



Atrial Ectopic Tachycardia-Induced Cardiomyopathy Requiring ECMO Supported Catheter Ablation

Ziv Beckerman^{1,2}; Michelle Mizrahi^{1,2}; Charles D Fraser^{1,2}; Lok Sinha^{1,2}; Arnold L Fenrich^{1,3}

¹Texas Center for Pediatric and Congenital Heart Disease, UT Health Austin/Dell Children's Medical Center, Austin, TX, USA.

²Department of Surgery and Perioperative Care, University of Texas Dell Medical School, Austin, TX, USA.

³Department of Pediatric Cardiology, University of Texas Dell Medical School, Austin, TX, USA.

*Corresponding Author(s): Ziv Beckerman

Dell Children's Medical Center, Texas Center for Pediatric and Congenital Heart Disease, 4900 Mueller Blvd, Suite 3S.003, Austin, TX 78723, USA.

Email: zbeckerman@austin.utexas.edu

Abstract

Atrial Ectopic Tachycardia (AET) may lead to Tachycardia-Induced Cardiomyopathy (TIC) and severe hemodynamic instability. This case report describes a patient presenting with AET and severe myocardial dysfunction. The arrhythmia resulted in cardiorespiratory collapse, requiring mechanical circulatory support. The patient was managed with catheter ablation of the atrial ectopic focus with dramatic fast improvement in function to follow.

Received: Dec 15, 2020

Accepted: Jan 28, 2021

Published Online: Feb 03, 2021

Journal: Annals of Pediatrics

Publisher: MedDocs Publishers LLC

Online edition: <http://meddocsonline.org/>

Copyright: © Beckerman Z (2021). *This Article is distributed under the terms of Creative Commons Attribution 4.0 International License*

Keywords: Atrial ectopic tachycardia; Catheter ablation; Tachycardia-induced cardiomyopathy; Pediatric arrhythmias; AET.

Introduction

Prolonged periods of supraventricular tachycardia can lead to Tachycardia-Induced Cardiomyopathy (TIC) [1], and hemodynamic instability. Atrial Ectopic Tachycardia (AET) is the most common cause of TIC in the pediatric population, and it may remain deceptively asymptomatic until severe myocardial impairment presents [2]. While treatment for AET varies depending

on the patient's condition, catheter ablation is recommended for patients with evidence of TIC, as soon as hemodynamic stability is achieved [3]. Here we present a patient with AET-induced cardiomyopathy, requiring radiofrequency catheter ablation of the ectopic focus, under mechanical circulatory support.



Cite this article: Beckerman Z, Mizrahi M, Fraser CD, Sinha L, Fenrich AL. Atrial Ectopic Tachycardia-Induced Cardiomyopathy Requiring ECMO Supported Catheter Ablation. *Ann Pediatr.* 2021; 4(1): 1055.

Case report

A previously healthy 6-year-old (23kg) female presented to an outside facility complaining of nausea and vomiting for 2 days. She was diagnosed with supraventricular tachycardia; and after Adenosine administration, Atrial Ectopic Tachycardia (AET) was confirmed, prompting her transfer to our institution. Upon arrival, she presented with severe Heart Failure (HF) and AET at 200 Beats Per Minute (bpm). An echocardiogram showed severely depressed biventricular function with an ejection fraction of 37%, and severe Mitral Regurgitation (MR). Flecainide and Propranolol were started. Due to increased work of breathing, inotropic support (Milrinone and Calcium) was started and the patient required mechanical ventilatory support. The HF and AET persisted for 3 days, albeit at a slower rate (160bpm). Work-up for myocarditis was negative. Due to the persistence of the arrhythmia, Amiodarone continuous infusion (20mg/kg/day) was started in attempt to achieve rhythm control.

Twelve hours after initiating the Amiodarone infusion, her hemodynamic status deteriorated abruptly, requiring 5 minutes of CPR. The patient was successfully resuscitated, and immediately cannulated for cervical venoarterial Extracorporeal Membrane Oxygenator (ECMO). Under ECMO support, the left ventricle continued to eject and decompress, with no signs of atrial hypertension. The following day, with continuing AET, the patient was taken to the Catheterization laboratory for an electrophysiology study and potential catheter ablation. Through a femoral vein approach, mapping was performed using the Abbott Ensite-Precision 3D mapping and GE-Marquette-Pruka recording systems. Both atria were mapped, with the left atrium accessed through an existing Patent Foramen Ovale (PFO).

The ectopic focus was mapped to the right upper pulmonary vein, and ablated (Figure 1). Sinus rhythm resumed within 2.8 seconds of the first radiofrequency lesion using a Boston Scientific Blazer 4mm tip ablation catheter (Figure 2). Four additional ablation lesions were delivered, and the PFO was enlarged, to allow complete decompression of the left heart.

After the intervention, all antiarrhythmic medications were discontinued. An echocardiogram the following day demonstrated dramatic ventricular function improvement (EF of 40-45%) and improvement in the MR. Two days post-ablation, the patient was successfully decannulated from ECMO and extubated. Her echocardiogram on discharge (5 days later) demonstrated a left ventricular EF of 50-55% with trivial MR.

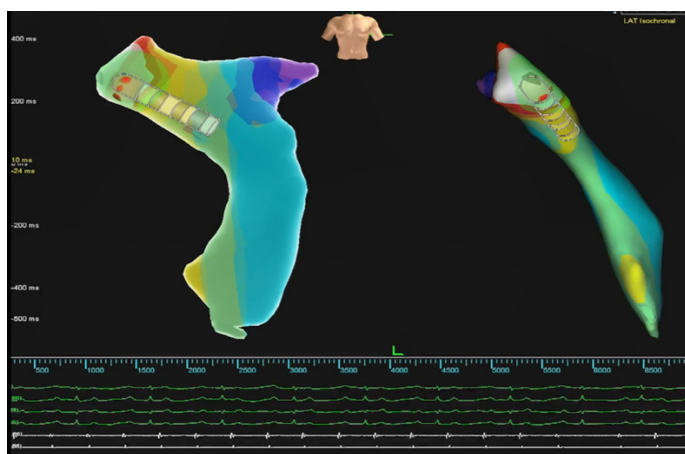


Figure 1: Mapping and radiofrequency ablation of atrial ectopic focus.

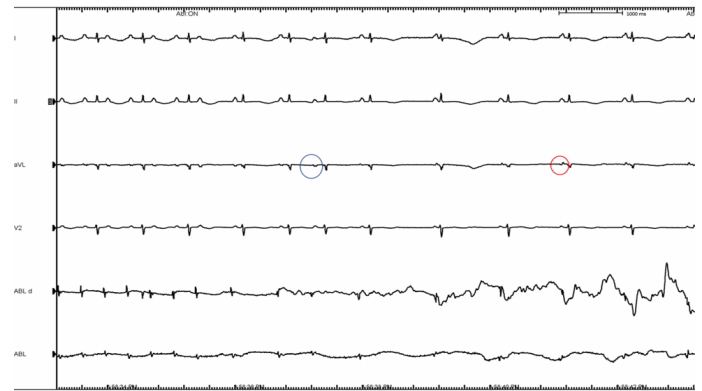


Figure 2: Electrocardiography tracing showing Atrial Ectopic Tachycardia (AET) converting to sinus rhythm. Negative P wave in a VL (blue circle) suggesting its origin from the left atrium. Less than 2.8 sec after Radiofrequency energy initiation, AET terminated and the P wave becomes positive (red circle).

Discussion

This case presents a patient with TIC secondary to incessant and medically resistant AET. TIC presents without underlying structural heart disease, with an incidence of 28% in children with AET [4].

Children are often unaware of symptoms, and with time, the underlying mechanism associated with rapid heart rate leads to calcium mishandling, neurohormonal activation, and eventually, LV dilation with severe contractile dysfunction [5].

Following initial stabilization, radiofrequency ablation (RFA) of AET is the preferred treatment approach for children ≥ 15 kg, particularly when evidence of TIC is present [3]. In our case, the AET did not respond to 3 antiarrhythmic medications in combination, requiring ECMO-supported catheter ablation for treatment. Whether the result of the acute hemodynamic collapse of the patient was secondary to the marginal cardiac function, or worsened by the antiarrhythmics, is hard to say.

As seen in this patient, after radiofrequency ablation of an AET focus, the cardiomyopathy tends to reverse [5]. Following reinstitution of sinus rhythm, the patient's cardiac function began to recover rapidly, allowing weaning of hemodynamic support shortly after the procedure.

The management of this patient exemplifies the necessity and crucial importance of a multidisciplinary team approach. The patient was managed in the cardiac intensive care unit, and followed by cardiology, electrophysiology, intensive care, and cardiac surgery (among other specialties). The immediate availability of ECMO support was key in supporting the hemodynamics of the patient, allowing both the option of medical management of the arrhythmia, and supporting the catheter procedure. Furthermore, this case demonstrates that electrophysiological studies and catheter ablation procedures, can be safely performed under ECMO support in case the need arise. ECMO support should not be considered a contraindication for catheter-based procedures.

Conclusion

Since most children are unaware of tachycardia-related symptoms, a high index of suspicion for TIC should be held for any presenting case of supraventricular tachycardia in a pedi-

ric patient. Particularly in patients with a rapidly deteriorating hemodynamic stability after presentation, with no known pre-existing cardiac conditions.

Since AET is frequently resistant to pharmacological treatment, radiofrequency catheter ablation of the ectopic focus, should not be delayed. Recovery of ventricular function should be expected after successful conversion to sinus rhythm.

Disclosures

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

References

1. Toyohara K, Fukuhara H, Yashimoto J, Ozaki N, Nakamura Y. Electrophysiologic Studies and Radiofrequency Catheter Ablation of Ectopic Atrial Tachycardia in Children. *Pediatr Cardiol.* 2011; 32: 40-46.
2. Moore JP, Patel PA, Shannon KM, Albers EL, Salerno JC, et al. Predictors of myocardial recovery in pediatric tachycardia-induced cardiomyopathy. *Heart Rhythm.* 2014; 11: 1163-1169.
3. Walsh EP, Saul JP, Hulse JE, Rhodes LA, Hordof AJ, et al. Transcatheter ablation of ectopic atrial tachycardia in young patients using radiofrequency current. *Circulation* 1992; 86: 1138-1146.
4. Kang KT, Etheridge SP, Kantoch MJ, Tisma-Dupanovic S, Bradley DJ, et al. Current management of focal atrial tachycardia in children: A multicenter experience. *Circ Arrhythm Electrophysiol.* 2014; 7: 664-670.
5. Spinale FG, Hendrick DA, Crawford FA, Smith AC, Hamada Y, et al. Chronic supraventricular tachycardia causes ventricular dysfunction and subendocardial injury in swine. *Am J Physiol.* 1990; 259: H218-H229.