

Successful radiofrequency catheter ablation therapy of an adolescent with atrial ectopic tachycardia

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Atrial ectopic tachycardia is an incessant supraventricular tachycardia and is frequently refractory to medical treatment. Because it can cause tachycardia-induced cardiomyopathy, early diagnosis and treatment is important. We present a 16-year-old boy who was diagnosed as atrial ectopic tachycardia. The tachycardia, originating from the lower region of the right atrium along the crista terminalis was terminated by successful radiofrequency ablation treatment. The tachycardia did not recur in eight months of follow-up.

Key words: atrial ectopic tachycardia, radiofrequency ablation.

Atrial ectopic tachycardia (AET) is the most common cause of chronic supraventricular tachycardia in children and comprises approximately 10% of all pediatric supraventricular tachycardias. This arrhythmia is due to an atrial focus with abnormal automaticity outside the sinus node. It is usually incessant and can cause tachycardia-induced cardiomyopathy if not treated. However, the cardiomyopathy is potentially reversible upon control of the arrhythmia. AET frequently refractory to pharmacologic therapy. Radiofrequency (RF) catheter ablation has been reported to be successful in pediatric patients with single ectopic focus¹⁻³. We present an adolescent boy with an ectopic focus in the lower region of the right atrium along the crista terminalis who underwent successful RF catheter ablation therapy.

Case Report

A 16-year-old boy was admitted to the hospital with a history of palpitation and chest pain for three months. On his physical examination, heart rate was 150 beats/min and dysrhythmia was determined. His functional capacity was New York Heart Association class I. Respiratory and gastrointestinal systems were found to be normal. The 12-lead electrocardiogram (ECG) revealed a supraventricular tachycardia with a mean rate of 150 beats/min. The P wave was positive in leads I, II, aVL, aVF and all precordial leads, and negative in III and aVR. The P wave

morphology was slightly different from that of sinus rhythmia, and several episodes of Mobitz type I second-degree atrioventricular block were observed (Fig. 1). The diagnosis of AET with ectopic focus localized near the sinus node was made based on these findings and digoxin therapy was given to improve cardiac output. The echocardiographic examination and chest x-ray were normal. During 24-hour Holter monitoring, there were frequent AET attacks of 6-12 beats; the mean heart rate was 125 beats/min during daytime, with a maximum rate of 215 beats/min and a minimum rate of 65 beats/min. In addition, rare episodes of ventricular extra beats and couplet beats were determined. During the electrophysiologic procedure, programmed

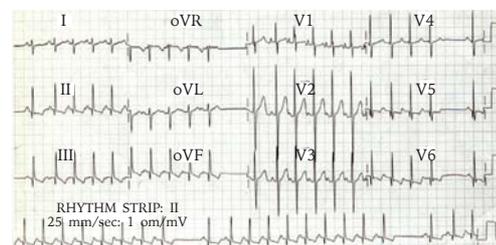


Fig. 1. Twelve-lead electrocardiogram (ECG) shows positive P waves in leads I, II, aVL, aVF and all precordial leads, and negative in III and aVR. The P wave morphology is slightly different from that of sinus rhythmia (the arrows indicate sinus P wave), and atrial ectopic rhythmia episode with Mobitz type I second-degree atrioventricular block after sinus P wave is observed (the PR interval becomes progressively prolonged until one QRS complex is dropped completely).

electrical stimulation failed to terminate and reset the ongoing tachycardia. The earliest local atrial activation potential during tachycardia was recorded from the mapping/ablation catheter in the lower region of the right atrium along the crista terminalis. The electrogram recorded at this ectopic focus preceded the upper region of the right atrium by 34 milliseconds (Fig. 2). Application of RF ablation at this site resulted in tachycardia termination. After RF ablation, the record of atrial activation at the region of the sinus node started earlier than of ectopic focus (Fig. 3). Procedure duration was two hours and radiation exposure 43 minutes. No complications were observed during or after the procedure. During a follow-up of eight months, the patient was asymptomatic and repeat control electrocardiograms revealed a sinus rhythm.

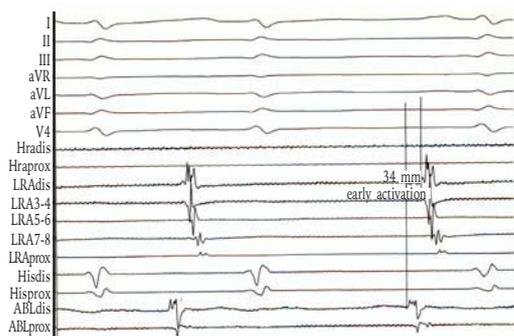


Fig. 2. Intracardiac electrocardiogram recordings from high right atrium (HRA proximal and distal), low right atrium (LRA proximal, distal, 3-4, 5-6, 7-8) and radiofrequency ablation catheter. The earliest local atrial activation potential was recorded from the mapping catheter in the lower region of the right atrium along the crista terminalis. The electrogram recorded at this ectopic focus preceded the upper region of the right atrium by 34 milliseconds.

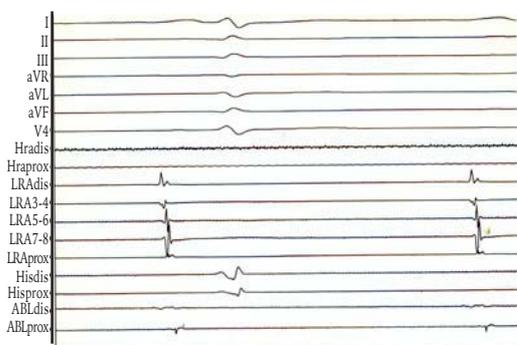


Fig. 3. Application of radiofrequency ablation at this site resulted in tachycardia termination. After RF ablation, the record of atrial activation at the region of sinus node started earlier than that of ectopic focus.

Discussion

Atrial ectopic tachycardia is insidious and symptoms may be absent or minimal until findings of congestive heart failure due to secondary cardiomyopathy appear. Complaints related to dilated cardiomyopathy are observed in over 50% of cases. Tachycardia rates are usually between 120-300 bpm¹⁻⁴. Our patient had only symptoms of palpitation and chest pain, but not cardiomyopathy. In children, abnormal focus is more frequently located near the pulmonary veins or the right atrium appendage. The ectopic focus in our patient was determined in the lower region of the right atrium along the crista terminalis.

P-wave axis and morphology of AET is different from sinus P waves. However, differentiating a high right atrial AET from a sinus tachycardia secondary to idiopathic cardiomyopathy is difficult. Electrocardiographic records of AET often show warming-up (the rate increasing gradually) on initiation and cooling-down on termination. The rate of AET is faster than of sinus tachycardia. The presence of intermittent first or second degree atrioventricular (AV) block is more frequent in AET due to the PR interval of ectopic beats lengthening at faster atrial rates^{1,5,6}. We distinguished sinus tachycardia in our patient by these findings (Fig. 1). Also, the permanent form of junctional reciprocating tachycardia (PJRT) which is an incessant form of supraventricular tachycardia and may produce cardiomyopathy if unrecognized, can be confused with an ectopic focus originating in the lower right atrium⁷. Both conditions may have negative P waves in II, III and aVF and be incessant. During invasive electrophysiologic evaluation, PJRT can be initiated and terminated with atrial pacing or premature atrial extrastimuli. AET may only be transiently suppressed (overdrive suppression) with rapid atrial pacing and also warms-up on initiation^{1,2}. We did not consider PJRT in our patient because of positive P waves in II and aVF, and given the electrophysiologic properties.

If AET is detected without developing ventricular dysfunction, medical therapy may be preferred. Although digoxin, β blocker and verapamil are unsuccessful in control of AET, they decrease ventricular speed and improve hemodynamics. Recently moricizine (Class IB antiarrhythmic agent), flecainide (Class IC), amiodarone and sotalol (Class III agents) have been found to be

effective in adults and children. However, success of medical therapy is lower (33%) and long-term use of drugs can cause dangerous side effects^{5,8,9}. Radiofrequency catheter ablations are now reported to be successful in 73-100% of the patients with AET^{1,10}. At ideal sites for ablation, ectopic P wave precedes sinus P wave by 20-60 milliseconds, and when the mapping catheter is properly positioned, abrupt tachycardia termination within five seconds is observed. The acute success of RF ablation exceeds 90% especially in the patients with single ectopic focus, and recurrence rates are less than 10%⁵. Surgical ablation has also been reserved for the patients with multiple ectopic foci^{2,11}. We preferred RF ablation method without attempting any antiarrhythmic agent in our patient, because our patient had frequent AET attacks resulting from single ectopic focus and his long-term control was difficult. No electrocardiographic or clinical evidence of tachycardia recurrence has been documented during eight months of follow-up.

Consequently; RF ablation is a reliable and effective treatment method in AET. This treatment method may be preferred in the young patients instead of medical therapy.

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