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ECG TEACHING COMPETITION

ADVANCED

IMAGING VIGNETTE: ECG CHALLENGE

Focal Atrial Tachycardia Originating From the Right Atrial Appendage Masquerading as Inappropriate Sinus Tachycardia

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ABSTRACT

Focal atrial tachycardia arising from the right atrial appendage (RAAT) may be misdiagnosed as sinus tachycardia. The electrocardiogram from this case demonstrates a negative notched P-wave in leads V_1 and V_2 during RAAT compared with a beat of sinus rhythm. RAAT was confirmed and eliminated with mapping and ablation. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:1379–1381) Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

CASE

A 23-year-old woman presented with palpitations that began at age 17 years. They occurred intermittently, lasted up to 30 minutes several times throughout the day and night, were worse with activity, and also woke her up at night. Her pulse would go up to 150 beats/min on her watch, sometimes with associated dizziness. Echocardiography revealed a structurally normal heart (ejection fraction: 57%). Her resting electrocardiogram (ECG) is shown in **Figure 1**.

WHAT IS THE DIAGNOSIS?

A. Premature atrial complexes
B. Right atrial appendage atrial tachycardia (RAAT)
C. Postural orthostatic tachycardia syndrome
D. Inappropriate sinus tachycardia

The correct answer is B.

EXPLANATION

This ECG demonstrates focal RAAT, with spontaneous termination and a single sinus beat (Supplemental Figure 1, dot), followed by resumption of RAAT (Supplemental Figure 1, arrow). The 12-lead ECG can provide accurate localization of focal atrial tachycardias (ATs) with high sensitivity and specificity (1). However, the ECG of RAAT often appears similar to sinus rhythm because of the close proximity of the RAA and the sinus

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ABBREVIATIONS AND ACRONYMS

AT = atrial tachycardia

ECG = electrocardiogram

IEGM = intracardiac electrogram

RA = right atrium

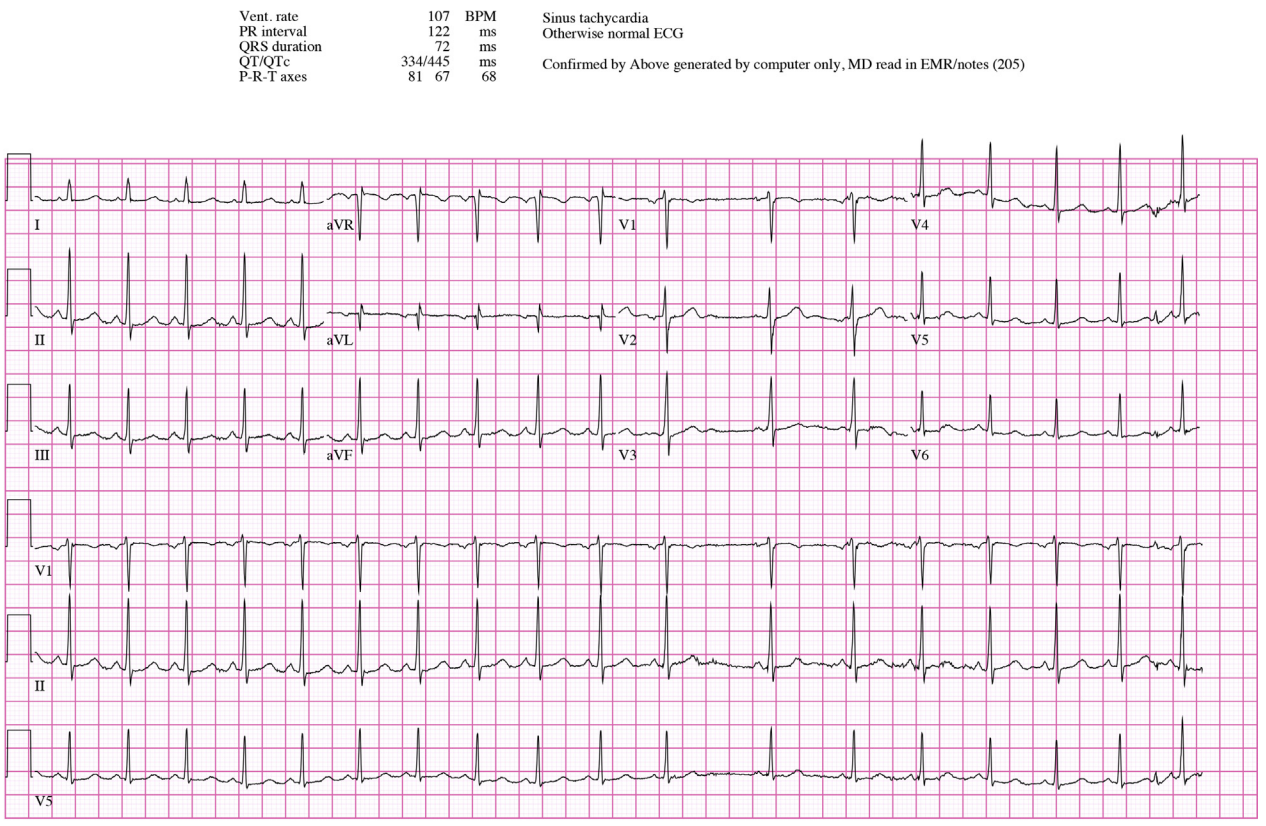
RAAT = right atrial appendage atrial tachycardia

node in the high right atrium (RA). Both RAAT and sinus rhythm typically have positive P waves in the inferior leads and a positive precordial transition by lead V_3. During RAAT, the P waves in leads V_1 and V_2 are often negative with notching (Supplemental Figure 1, arrows), compared with a biphasic P-wave in lead V_1 and biphasic and/or positive P waves in lead V_2 during sinus rhythm (Supplemental Figure 1, dot).

The negative P waves during RAAT occur because the RAA is located anterior to the sinus node, with activation moving away from the electrodes of leads V_1 and V_2. Supplemental Figure 2 and Video 1 compare the anterior location of the RAAT with the sinus node, recorded from a multipolar catheter during this patient's catheter ablation. To avoid misinterpretation of the rhythm, it is important to compare the presenting ECG with sinus rhythm to evaluate proper precordial lead placement. Improper positioning of the precordial leads can create biphasic and/or negative P waves in leads V_1 and V_2 during sinus rhythm (2).

Focal RAAT is a rare focal AT (3). When recognized, catheter ablation is effective, with a low incidence of recurrence reported in these patients. This patient initially was misdiagnosed with inappropriate sinus tachycardia and referred for a tilt-table test. It is important to have a high suspicion of focal AT in patients with inappropriate sinus tachycardia, because untreated AT has been associated with the development of tachycardia-mediated cardiomyopathy in up to 37% of patients (1). In this patient, successful ablation eliminated her RAAT. The patient's palpitations resolved, and her quality of life significantly improved after ablation.

FIGURE 1 Electrocardiogram



Patient's resting electrocardiogram in clinic.

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KEY WORDS ablation, P-wave morphology, right atrial appendage tachycardia

APPENDIX For a supplemental figure and video, please see the online version of this paper.