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ECG TEACHING COMPETITION

INTERMEDIATE

IMAGING VIGNETTE: ECG CHALLENGE

Supraventricular Tachycardia

In Search of an Underlying Mechanism

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ABSTRACT

A 12-lead electrocardiogram of a regular narrow complex tachycardia with electrocardiographic characteristics used to help elucidate the arrhythmia mechanism. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2021;3:1354–1356) © 2021 The Authors. 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 63-year-old woman with a past medical history of hypertension presented to the emergency department with three months of recurrent palpitations. A 12-lead electrocardiogram (ECG) was obtained demonstrating a narrow complex tachycardia (**Figure 1A**).

WHAT IS THE DIAGNOSIS?

A. Sinus tachycardia
B. Atrioventricular nodal re-entrant tachycardia (AVNRT)
C. Atrioventricular re-entrant tachycardia (AVRT)
D. Atrial tachycardia (AT)

The correct answer is B.

EXPLANATION

The differential diagnosis for a regular narrow complex tachycardia is broad (1), and it may not be feasible to definitively exclude any of the above choices. However, often subtle findings on the ECG can help guide one to the correct diagnosis. This is a short R-P tachycardia as shown by P waves at the tail end of the QRS complexes. This is most apparent in lead V_1, where the P-wave can mimic an R′ component of the QRS complex, occasionally referred to as a pseudo-R′. Interestingly, detailed inspection of the ECG reveals that the P-waves are intermittently absent (**Figure 1B**).

The absence of P waves without interruption or perturbation of the tachycardia concludes that the atrium is not a critical component of the tachycardia circuitry. This simple observation excludes sinus tachycardia, AVRT, and AT (wrong answers are A, C, and D) from the differential diagnosis.

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The author attests they are in compliance with human studies committees and animal welfare regulations of the author's institution and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

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The mechanism for typical AVNRT involves dual-AV nodal physiology with antegrade conduction down the slow pathway and retrograde conduction up the fast pathway. Atrial activation is passive, and block to the atrium will not affect the tachycardia and leaves the arrhythmia unperturbed (Figures 1C and 1D).

In contrast, with AVRT, the atrium is a component of the macro-re-entrant circuit, and the absence of atrial activation would result in tachycardia termination (Figure 1E). Sinus tachycardia or AT, in the absence of a P-wave would not be accompanied by a subsequent QRS.

Alternatively, this ECG could be consistent with a junctional tachycardia or a concealed nodofascicular re-entrant tachycardia. These were not answer choices, and although important, are much less common entities. The patient underwent an electrophysiology study which confirmed the presence

ABBREVIATIONS AND ACRONYMS

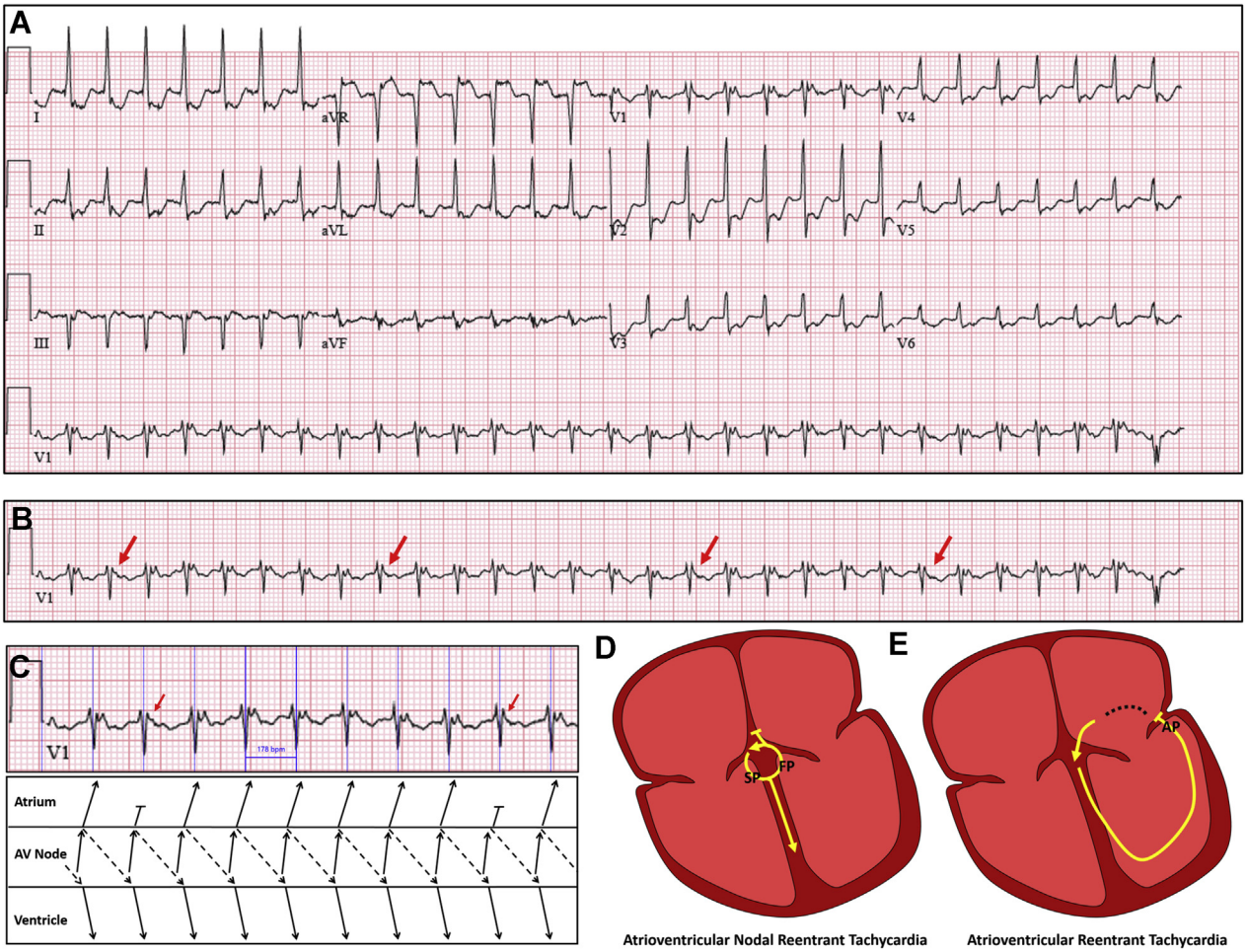
AT = atrial tachycardia

AVRT = atrioventricular re-entrant tachycardia

AVNRT = atrioventricular nodal re-entrant tachycardia

ECG = electrocardiogram

FIGURE 1 12-Lead Electrocardiogram Demonstrates a Narrow Complex Tachycardia



(A) 12-lead electrocardiogram demonstrates a narrow complex tachycardia. **(B)** The P waves, which are evident at the terminal end of the QRS complex, are intermittently absent **(red arrows)**. **(C)** A ladder diagram illustrates the re-entrant mechanism of typical atrioventricular nodal re-entrant tachycardia (AVNRT) with antegrade conduction down the slow pathway **(dotted arrow)** and retrograde conduction up the fast pathway. Atrial activation is passive, and the tachycardia is unperturbed with intermittent block to the atrium. **(D)** A graphic representation shows AVNRT with a block to the atrium without interrupting the tachycardia, as the atrium is not a critical component of the circuitry. **(E)** A graphic representation of atrioventricular re-entrant tachycardia (AVRT) with block to the atrium results in tachycardia termination as the atrium is a critical component **(dotted black line)** of the tachycardia circuitry. AP = accessory pathway; FP = fast pathway; SP = slow pathway.

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of dual-AV nodal physiology. The arrhythmia was induced, and diagnostic maneuvers were consistent with a diagnosis of AVNRT. A slow pathway modification was successfully performed, and the patient was non-inducible at conclusion of the case. Detailed inspection of the 12-lead ECG can offer subtle clues to the underlying mechanism of supraventricular tachycardia.

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