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ECG TEACHING COMPETITION

INTERMEDIATE

IMAGING VIGNETTE: ECG CHALLENGE

This Can Be as Easy as 1-2-3

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ABSTRACT

The S1S2S3 pattern, in conjunction with right-dominant forces on a 12-lead electrocardiogram including a tall R-wave in lead V_1 (R:S >1), deep S waves in the left precordial leads V_5 and V_6 (R:S <1), QRS interval <120 ms, and right atrial enlargement (P-wave in lead II >2.5 mm), is highly specific for right ventricular dysfunction with pulmonary hypertension. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2021;3:1382–1383) 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 66-year-old African American woman with a 10-year history of sarcoidosis and hypertension presented with progressively worsening exertional dyspnea and fatigue for the past 1 month (**Figure 1**).

WHAT IS THE DIAGNOSIS?

Which clinical diagnosis is most closely represented in this electrocardiogram?

A. Anterolateral coronary ischemia
B. Pulmonary heart disease
C. Arrhythmogenic right ventricular (RV) cardiomyopathy
D. Apical hypertrophic cardiomyopathy
E. Septal infarction

The correct answer is B.

EXPLANATION

The S1S2S3 pattern has had variable criteria for identifying RV dysfunction and pulmonary disease since its initial description in 1960 by Burch and De Pasquale in association with ventricular septal defect (1) and shortly thereafter in adults with chronic obstructive pulmonary disease (2). General criteria for this pattern is a predominant S-wave deflection in leads I to III usually with right-axis deviation. RV hypertrophy with pulmonary hypertension produces right-dominant forces on a 12-lead electrocardiogram (ECG): a tall R-wave in lead V_1 (R:S >1); deep S waves in the left precordial leads V_5 and V_6 (R:S <1); QRS interval <120 ms; right atrial enlargement (P-wave in lead II >2.5 mm); and in our case, extreme right-axis deviation. The RV strain pattern, seen here as T-wave inversion (TWI) in the anterior and inferior leads, can be mistaken for coronary disease. Apical hypertrophic cardiomyopathy can manifest as deep precordial and high-lateral TWI, high precordial voltages, and left atrial enlargement. Arrhythmogenic RV

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cardiomyopathy can show ε waves, QRS fragmentation, and right precordial lead QRS prolongation with a delayed S-wave terminal deflection. Various constellations of these criteria for RV hypertrophy and pulmonary heart disease, which typically include S1S2S3, and have shown a diagnostic sensitivity of <50% and specificity of >95%, suggesting ECG to be a powerful modality in patients with an elevated clinical suspicion for pulmonary pathology (3).

ABBREVIATIONS AND ACRONYMS

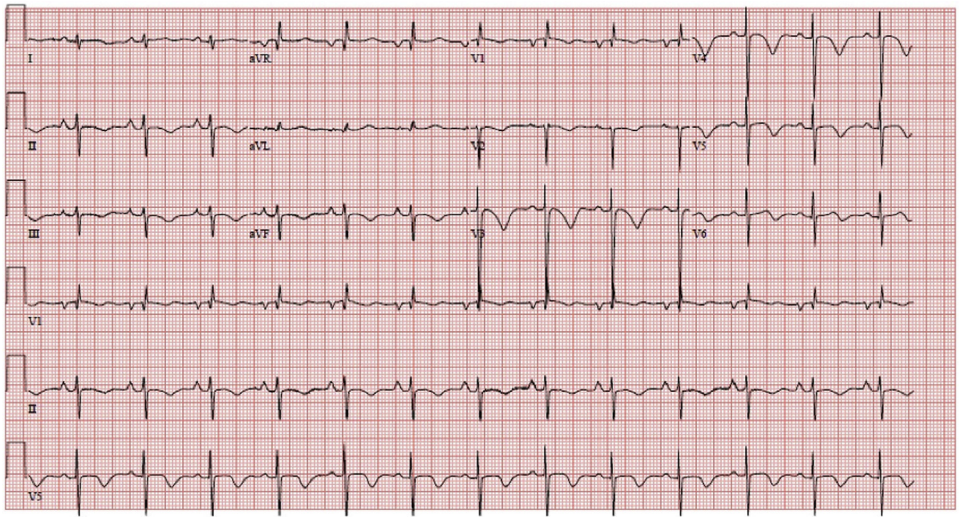
ECG = electrocardiographic

RV = right ventricle

TWI = T-wave inversion

This patient's subsequent echocardiogram (Supplemental Figure 1A) showing RV hypertrophy and dilatation, and the chest x-ray (Supplemental Figure 1B) shows stage 4 sarcoidosis with lung fibrosis, which supports the ECG findings.

FIGURE 1 Diagnostic Electrocardiogram



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KEY WORDS electrocardiogram, pulmonary hypertension, right ventricular dysfunction

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