ECG Diagnosis: Pulmonary Embolism

Joel T Levis, MD, PhD, FACEP, FAAEM

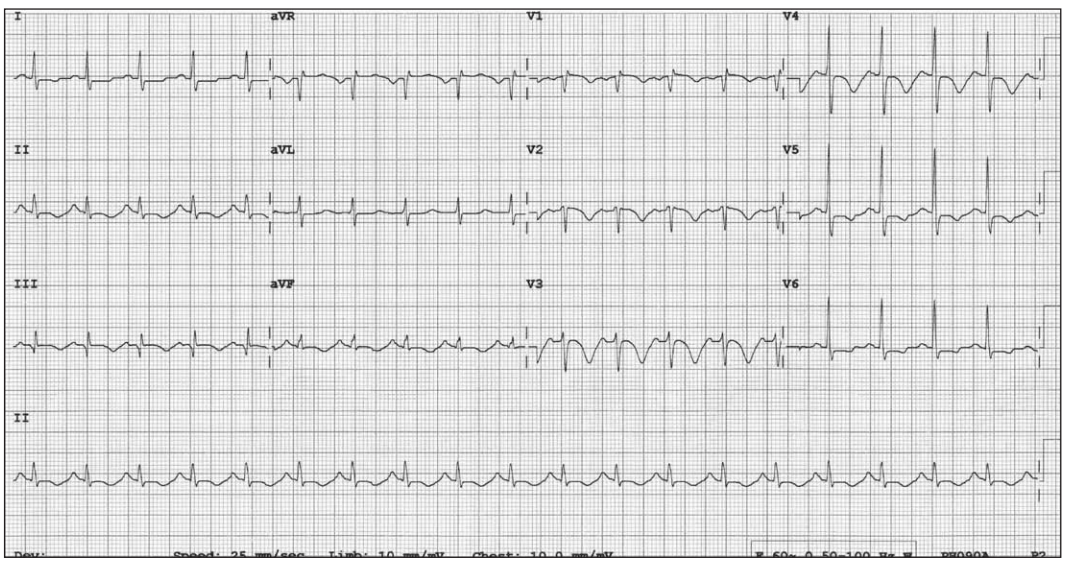

Figure 1. 12-lead ECG from a 68-year-old woman with new onset dyspnea on exertion.

Demonstrates sinus tachycardia, prominent S wave in lead I, with Q wave and T wave inversion in lead III ($S_1Q_3T_3$ sign), with inverted T waves in leads V_1-V_6. ST-segment elevation in leads aVR and V_1 is also present. A computed tomography angiogram of the chest was performed, which demonstrated multiple, bilateral pulmonary emboli (PE).

The $S_1Q_3T_3$ sign (prominent S wave in lead I, Q wave and inverted T wave in lead III) is a sign of *acute cor pulmonale* (acute pressure and volume overload of the right ventricle because of pulmonary hypertension) and reflects right ventricular strain.[1] This electrocardiogram (ECG) finding is present in 15% to 25% of patients ultimately diagnosed with pulmonary emboli (PE).[2] Any cause of *acute cor pulmonale* can result in the $S_1Q_3T_3$ findings on ECG, including PE, acute bronchospasms, pneumothorax, and other acute lung disorders. Other ECG findings noted during the acute phase of a PE include new right bundle branch block (complete or incomplete), rightward shift of the QRS axis, ST-segment elevation in V_1 and aVR, generalized low amplitude QRS complexes, atrial premature contractions, sinus tachycardia, atrial fibrillation/flutter, and T wave inversions in leads V_1-V_4.[2] The ECG is often abnormal in PE, but findings are neither sensitive nor specific for the diagnosis of PE.[3] The greatest utility of the ECG in a patient with suspected PE is ruling out other life-threatening diagnoses (eg, acute myocardial infarction). ❖

References

1. Chan TC, Vilke GM, Pollack M, Brady WJ. Electrocardiographic manifestations: pulmonary embolism. J Emerg Med 2001 Oct;21(3):263-70.
2. Ullman E, Brady WJ, Perron AD, Chan T, Mattu A. Electrocardiographic manifestations of pulmonary embolism. Am J Emerg Med 2001 Oct;19(6):514-9.
3. Rodger M, Makropoulos D, Turek M, et al. Diagnostic value of the electrocardiogram in suspected pulmonary embolism. Am J Cardiol 2000 Oct 1;86(7):807-9, A10.

Joel T Levis, MD, PhD, FACEP, FAAEM, is a Senior Emergency Medicine Physician at the Santa Clara Medical Center, and Clinical Instructor of Emergency Medicine (Surgery) at Stanford University. He is the Medical Director for the Foothill College Paramedic Program in Los Altos, CA. E-mail: joel.levis@kp.org.