

# S1Q3T3 electrocardiographic pattern in saddle pulmonary embolism



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## Introduction

Acute pulmonary emboli (PEs) are often associated with electrocardiographic changes, and although predictive diagnostic criteria have been proposed, prognostication remains controversial. This case report highlights a patient with an acute “saddle” PE exhibiting a distinct pattern on electrocardiogram (ECG) associated with submassive PEs known as S1Q3T3. Although these and other electrocardiographic changes associated with PE have been well documented, corroboration in the clinical setting remains elusive.

## Case report

The patient is an 83-year-old man with a history of hypertension, diabetes, hyperlipidemia, and dementia who was admitted for weakness, hypotension, and tachycardia. Chest computed tomography showed bilateral PEs with right heart strain (RHS), resulting in initiation of a heparin infusion. Computed tomography angiogram showed bilateral extensive PEs with opacities in the main pulmonary artery and bilateral lobar arteries (saddle PE) with RHS. The patient underwent a pulmonary arteriogram with embolectomy for submassive PE with RHS.

Transthoracic echocardiography showed bicuspid aortic valve, no aortic stenosis, moderate right ventricular (RV) enlargement with normal systolic function, mild concentric left ventricular hypertrophy present, and left ventricular ejection fraction at 50%–54%. Ultrasound Doppler of lower extremities showed no deep vein thrombosis. Cardiac electrophysiology service was consulted for supraventricular tachycardia. ECGs revealed atrial tachycardia with a prominent S wave in lead I, Q wave in lead III, inverted T waves in lead III, and incomplete right bundle branch block (RBBB) (Figure 1). The patient’s hemodynamics improved

with resolution of atrial tachycardia and ultimate discharge from the hospital on apixaban.

## Discussion

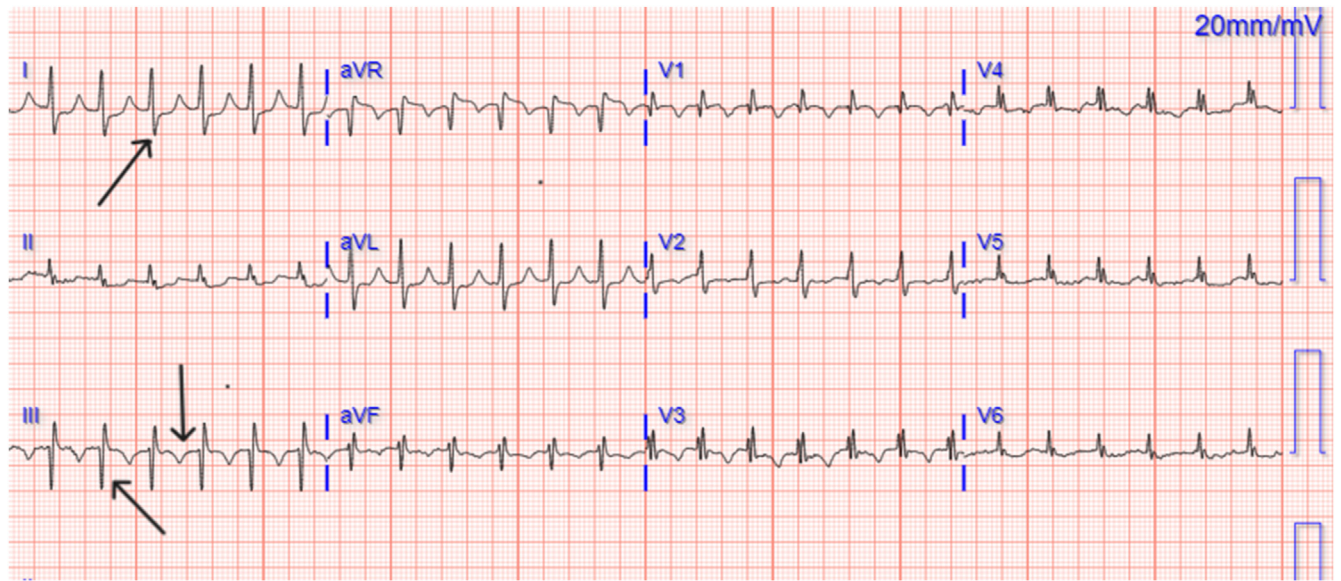
Pulmonary embolisms are the third-leading cause of cardiovascular mortality.<sup>1</sup> Although obtaining an ECG is inexpensive, quickly interpreted, and noninvasive, there remains a lack of consensus on prognostication for PEs based on the ECG. Though case reports are well documented, most studies have been limited in quality and retrospective in nature.<sup>2</sup> For more severe cases, electrocardiographic changes are thought to be the result of pulmonary artery obstruction with resultant RV strain, dilation, hypoxia, ischemia, and ventricular dyssynchrony manifested as repolarization abnormalities, ST-segment injury, conduction delays, and arrhythmias.<sup>3</sup> According to the “2019 ESC Guidelines for the Diagnosis and Management of Acute Pulmonary Embolism,”<sup>1</sup> electrocardiographic changes indicative of RV strain include precordial T-wave inversion (TWI), a QR pattern in lead V<sub>1</sub>, an S1Q3T3 pattern, and incomplete or complete RBBB. Forty percent of patients with PEs have sinus tachycardia, and the most common arrhythmias are atrial tachycardia and atrial fibrillation.<sup>1</sup> A systematic review and meta-analysis was performed based on 39 eligible studies that used the ECG to prognosticate for the main outcomes of death and clinical deterioration in patients with PEs. ECG signs that were statistically significant predictors for negative outcomes were S1Q3T3, complete RBBB, TWI, right axis deviation, and atrial fibrillation.<sup>2</sup> Weekes and colleagues<sup>3</sup> conducted a prospective, multisite study to determine associations of early ECG patterns with clinical deterioration for PE. The authors found supraventricular tachycardia was an independent predictor of clinical deterioration and that TWI in precordial leads, incomplete RBBB, ST elevation in aVR, sinus tachycardia, and S1Q3T3 were independent predictors of RV abnormalities.<sup>3</sup>

**KEYWORDS** S1Q3T3 ECG pattern; Pulmonary embolism; Right ventricular strain; Right bundle branch block; T-wave inversion; Atrial arrhythmias; Electrocardiogram  
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## Conclusion

This case report describes the ECG S1Q3T3 pattern in a patient with a submassive PE and related morphology. Although there are no current ECG diagnostic criteria for PE, there is increasing value in using the ECG for prognostication of acute PE.



**Figure 1** Twelve-lead electrocardiogram with SIQ3T3 pattern (negative S wave in lead I, deep Q wave in lead III, T-wave inversion [TWI] in lead III). Electrocardiogram also shows precordial TWI and incomplete right bundle branch block.

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## References

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