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Case Study

Spontaneous, resolving S1Q3T3 in pulmonary embolism: A case report and literature review on prognostic value of electrocardiography score for pulmonary embolism

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ABSTRACT

Background: Electrocardiography findings in patients with pulmonary embolism have been investigated since 1935. As medicine has evolved, more effective modalities have surpassed the electrocardiogram in diagnostic utility. Despite the advent of these other modalities, the diagnosis of pulmonary embolism remains elusive and the prognosis is variable amongst each clinical presentation of its pathology.

Case report and literature review: After presenting a case of a resolving S1Q3T3 in subsequent electrocardiogram findings of a patient with pulmonary embolism, this literature review will provide information on a 21-point electrocardiogram scoring system that helps the emergency physician stratify the risk of a patient with an acute presentation of pulmonary embolism. *Why should emergency care staff be aware of this?* Given the time-sensitive nature of diagnosis and appropriate treatment, Electrocardiogram continues to be a tool in the assessment of patients with a clinical suspicion of pulmonary embolism. Based on the information provided, 21-point electrocardiogram score has been shown to have strong usefulness in assessing prognosis of patients presenting with acute pulmonary embolism.

1. Introduction

Pulmonary embolism (PE) refers to the occlusion of pulmonary vasculature which alters the intrapulmonary blood flow (Kline, 2011). The subsequent impairment of gas exchange can lead to significant morbidity and mortality. Roughly 200,000 new cases of venous thromboembolism are diagnosed each year with an approximately six percent 30-day fatality rate from PE (Freedman and Loscalzo, 2012). Prompt diagnosis and effective disposition and treatment are crucial in reducing the critical sequelae. As more advanced and accurate modalities have been developed, electrocardiography (ECG) has been deemed to have less diagnostic value. However, it should still maintain a role in the assessment of patients with a clinical suspicion of PE (Ullman et al., 2001). We present a case of a rapidly evolving ECG change in a patient with a stable PE and discuss the utility of ECG in the prognostic evaluation of PE in an acute setting.

1.1. Case report

A 42 year old male with no significant past medical history presented to the Emergency Department (ED) with left sided calf swelling and pain that started 5 days prior to presentation. The patient reported that the pain had progressed over the preceding 5 days and was exacerbated by exertion. He denied any recent trauma and immobilization, but reported a bilateral arthroscopic knee procedure 17 months prior. There was no personal or family history of venous thromboembolism (VTE). Review of systems was negative; including chest pain, shortness of breath and hemoptysis. Vital signs were normal and physical examination was only significant for left lower extremity tenderness and edema distal to the knee. Auscultation revealed clear lung sounds bilaterally and a normal S1 and S2 with no murmurs, gallops or rubs. Venous duplex showed thrombosis in the left popliteal, left gastrocnemius and left lesser saphenous veins. An ECG was performed and showed S wave in lead I, a Q wave in lead III, and an inverted T wave in lead III (also know as "S1Q3T3") with an incomplete right bundle branch block (Fig. 1). The patient was to be admitted for initiation of anticoagulation and further diagnostic testing; however, he chose to leave against medical advice for social reasons. The patient was prescribed enoxaparin and warfarin, as per the

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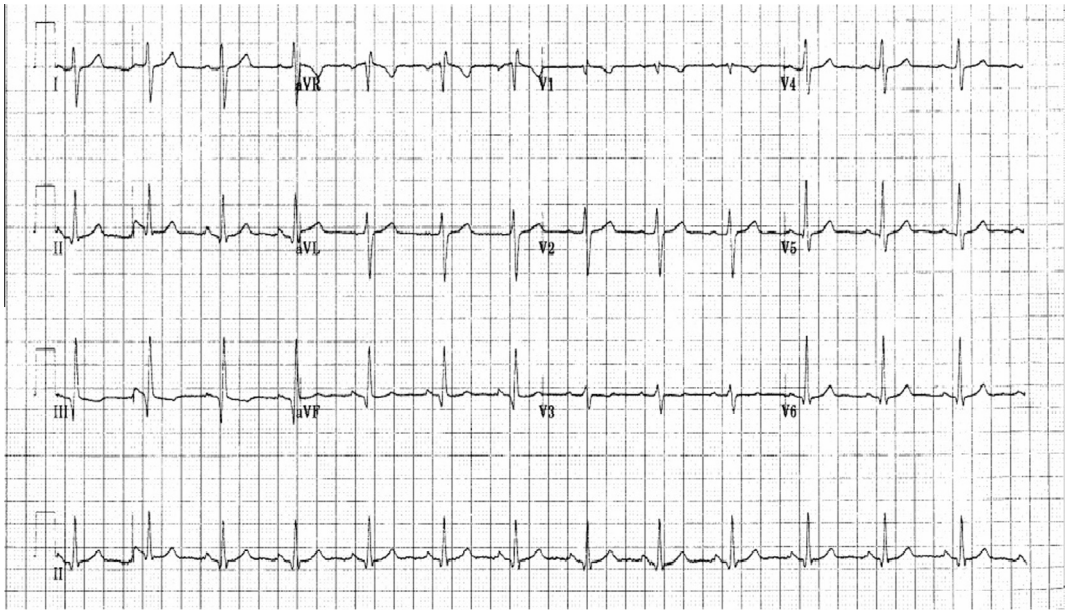

Fig. 1. ECG demonstrating S wave in lead I, a Q wave in lead III, and an inverted T wave in lead III (also know as "S1Q3T3") with an incomplete right bundle branch block.

vascular surgery consultant's recommendation, and was instructed to return the following morning to continue treatment.

The patient returned the following morning and was amenable to admission and further treatment. He continued to deny symptoms of chest pain, shortness of breath and hemoptysis. Another ECG was performed which revealed a normal sinus rhythm with normal axis and normal intervals with no signs of acute ischemia, along with the absence of S1Q3T3 (Fig. 2). Given the initial ECG finding, the emergency physician decided to exclude the presence of PE, despite the patient continuing to deny any suggestive symptoms. The subsequent computed tomography scan showed filling defects of segmental and sub-segmental branches of the right lower lobe pulmonary artery, compatible with pulmonary embolism. The patient was admitted to the hospital for anticoagulation and further evaluation and management. The etiology of the PE was not definitively discovered. The patient was discharged in good condition after three days of treatment. Discharge instructions included taking warfarin until follow up with pulmonologist for continued monitoring and treatment.

2. Discussion

ECG findings in patients with PE have been described since 1935. McGinn and White (1935) studied postoperative patients that had signs suggestive of acute cor pulmonale. They found that a significant number of patients shared the similar constellation of findings of an S wave in lead I, Q wave in lead III, each with amplitudes of $\geqslant$1.5 mm, and an inverted T wave in lead III. It was extrapolated that "S1Q3T3" was a sign of right ventricular change secondary to occlusion of the pulmonary vascular system. This

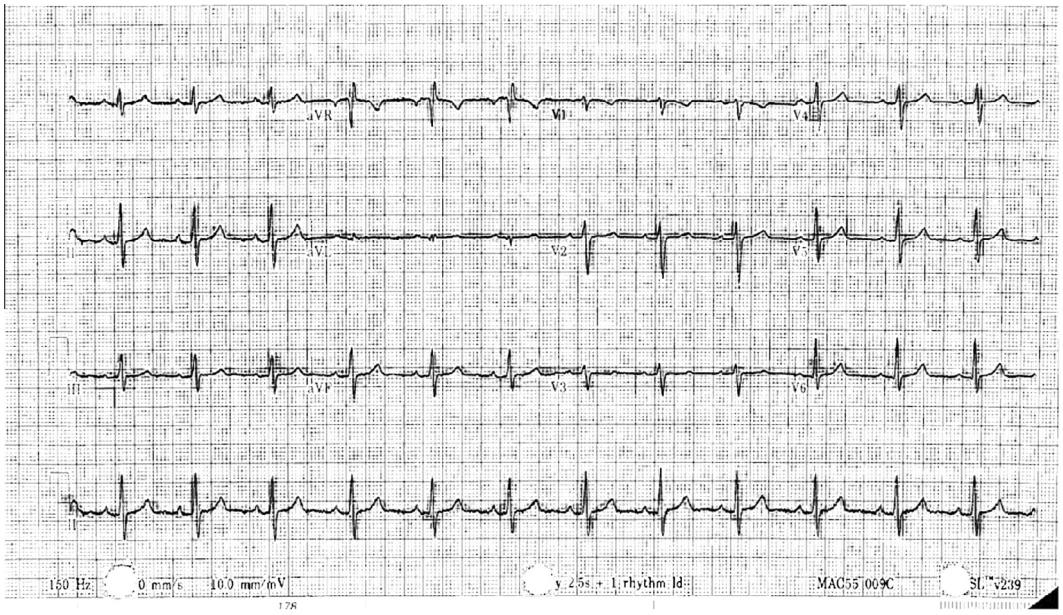

Fig. 2. ECG demonstrating a normal sinus rhythm with normal axis and normal intervals with no signs of acute ischemia, along with the absence of.