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AN UNUSUAL CASE OF ALTERNATING VENTRICULAR MORPHOLOGY ON THE 12-LEAD ELECTROCARDIOGRAM

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Abstract—Background: One of the principal tasks of an emergency physician is identifying potentially life-threatening conditions in the undifferentiated patient; cardiac dysrhythmia is an example of such a condition. A systematic approach to a patient with atypical dysrhythmia enables proper identification of such life-threatening conditions. **Case Report:** We describe a 31-year-old man presenting to the emergency department with an undifferentiated dysrhythmia after naloxone reversal of an opiate overdose. A systematic approach to the electrocardiogram led to the rare diagnosis of Wolff-Parkinson-White (WPW) alternans. We review the differential diagnosis of this dysrhythmia and the initial evaluation of a patient with the WPW pattern present on their electrocardiogram. **Why Should an Emergency Physician Be Aware of This?:** Emergency physicians should be prepared to use a systematic approach to an undifferentiated dysrhythmia to identify potentially life-threatening conditions. © 2016 Elsevier Inc. All rights reserved.

Keywords—dysrhythmia; ECG; Wolff-Parkinson-White

INTRODUCTION

One of the principal tasks of an emergency physician is identifying potentially life-threatening conditions in the undifferentiated patient; cardiac dysrhythmia is an

example of such a condition. Patients with dysrhythmias may present to the emergency department (ED) atypically; a systematic approach to the dysrhythmia enables proper identification of such life-threatening conditions. We report a case of an unusual dysrhythmia presenting to the ED in an atypical fashion. We also include a review of this condition and the initial electrophysiologic approach to evaluation of this condition.

CASE REPORT

A 31-year-old man presented to the ED after receiving naloxone from prehospital personnel for altered sensorium caused by a presumed drug overdose. He was alert and oriented to person, place, and time, and admitted to heroin use before arrival. He denied intentional coingestion, but admitted that the heroin “might have been cut with something.” He also reported that he had fallen and struck his head earlier, with loss of consciousness. He denied chest pain, difficulty breathing, nausea, vomiting, or withdrawal symptoms. He reported no significant medical or family history. He was not taking any prescription medications. His vital signs were as follows: blood pressure of 147/96 mm Hg, heart rate of 125 beats/min, respiratory rate of 16 breaths/min, temperature of 99°F, and oxygen saturation 99% on ambient air. His bedside glucose measurement was within normal limits. The physical examination was unremarkable.

An electrocardiogram (ECG) was obtained ([Figure 1](#)).

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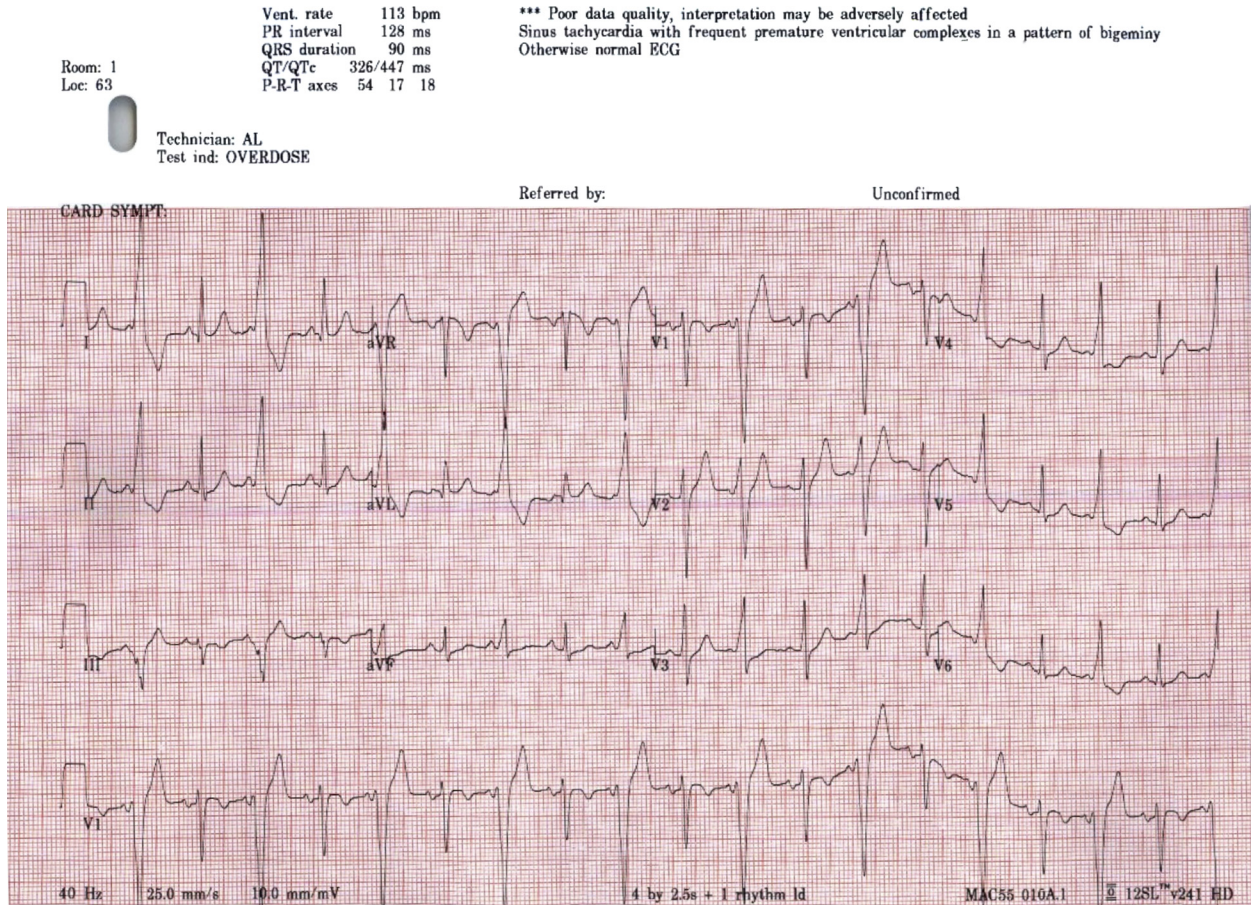


Figure 1. 12-Lead electrocardiogram on case presentation. The initial tracing, recorded shortly after presentation to the emergency department, was remarkable for an underlying sinus rhythm with alternating ventricular morphology. Every other complex featured a wider QRS complex, but each QRS complex was preceded by a P wave. The computer-generated interpretation was as follows: “sinus tachycardia with frequent premature ventricular complexes in a pattern of bigeminy; otherwise normal ECG.”

DISCUSSION

An ECG with alternating QRS complex morphologies has numerous potential etiologies and invokes an electrocardiographic differential diagnosis (Table 1). As with most differential diagnoses in emergency medicine, some entities are common while others are distinctly unusual. Correct interpretation of the ECG in this case allowed the emergency physician to distinguish the potentially serious underlying cardiac disorders from those that typically feature a more benign prognosis.

Table 1. Electrocardiographic Differential Diagnosis: Alternating QRS Complex Morphology

Ventricular bigeminy
Electrical alternans
Atrial bigeminy with aberrant conduction
Bidirectional ventricular tachycardia
Sinus rhythm with alternating bundle branch block
Wolff-Parkinson-White alternans

Sinus Rhythm with Ventricular Bigeminy

This is the most frequently encountered rhythm in this differential diagnosis; it features alternating QRS morphologies, narrow complex/wide complex, in apparent pairs (Figure 2). It was the computer-generated interpretation of the rhythm in this case. This rhythm is characterized by a normal-appearing PQRST sequence that emanates from the sinus node, followed by a ventricular beat (i.e., widened QRS complex) that arrives earlier than the next expected sinus beat. There is a discordance in the ventricular complex between the major vector of the QRS complex and the major vector of the ST-T wave complex (i.e., if the former is positive, the latter is negative, and vice versa). This rhythm demonstrates a “compensatory” pause following the premature ventricular complex (PVC) with the subsequent sinus beat following as if the PVC had not occurred, thereby compensating for the early arrival of the PVC (1). In this case (Figure 1), the rhythm had P waves preceding

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