ECG Findings You Do Not Want To Miss!

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Introduction

The electrocardiogram (ECG) remains the cornerstone for the diagnosis of many cardiac conditions [1]. While the ECG report usually provides a description of the recorded electrical findings, ECG interpretation requires a deeper analysis of such findings in relation to a patient's presentation [2]. The busy clinical schedules of many physicians have resulted in excess reliance on computer ECG interpretations, which may contain inaccuracies and require over-reading by an experienced electrocardiographer [3]. Improving ECG interpretation skills should be a priority in training [4], with application of competency-based approach at both the undergraduate and postgraduate levels [5].

Here, we present three ECGs with questions to illustrate the differential diagnosis and the potential pitfalls of computer interpretations. The reader may choose to systematically interpret the ECG tracings and entertain potential diagnoses [6].

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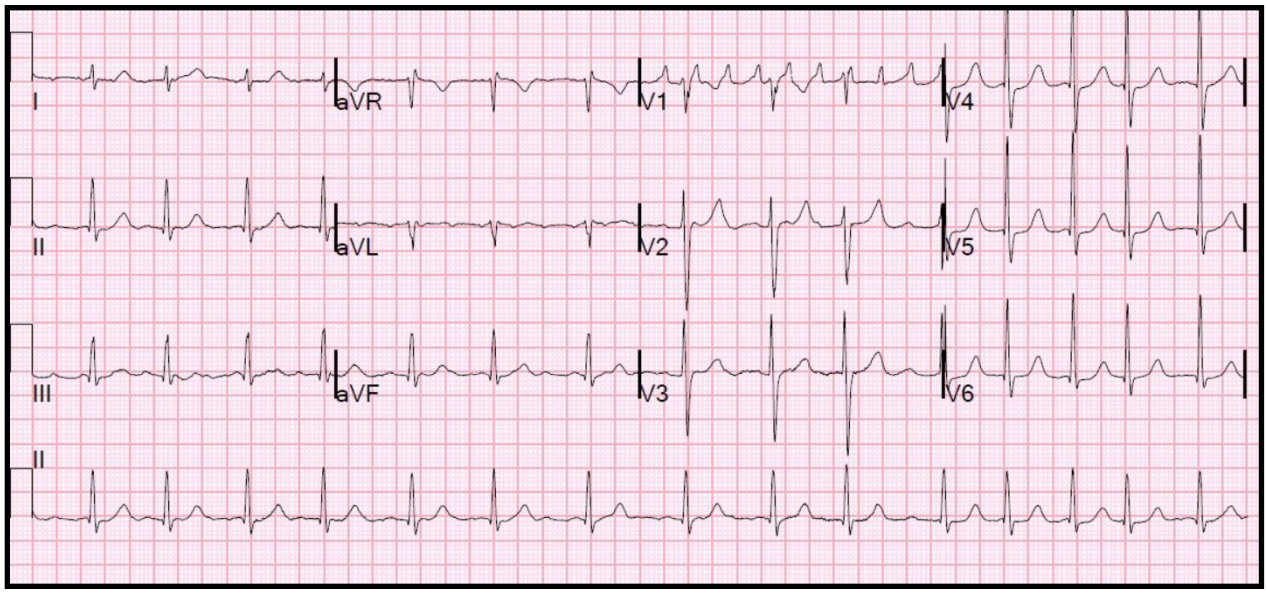

Figure 1A. What is the cause of the irregular rhythm?

A. Sinus rhythm with sinus arrhythmia.
B. Sinus rhythm with intraventricular conduction delay.
C. Atrial flutter with variable AV conduction.
D. Atrial fibrillation with rapid ventricular response.

Discussion:

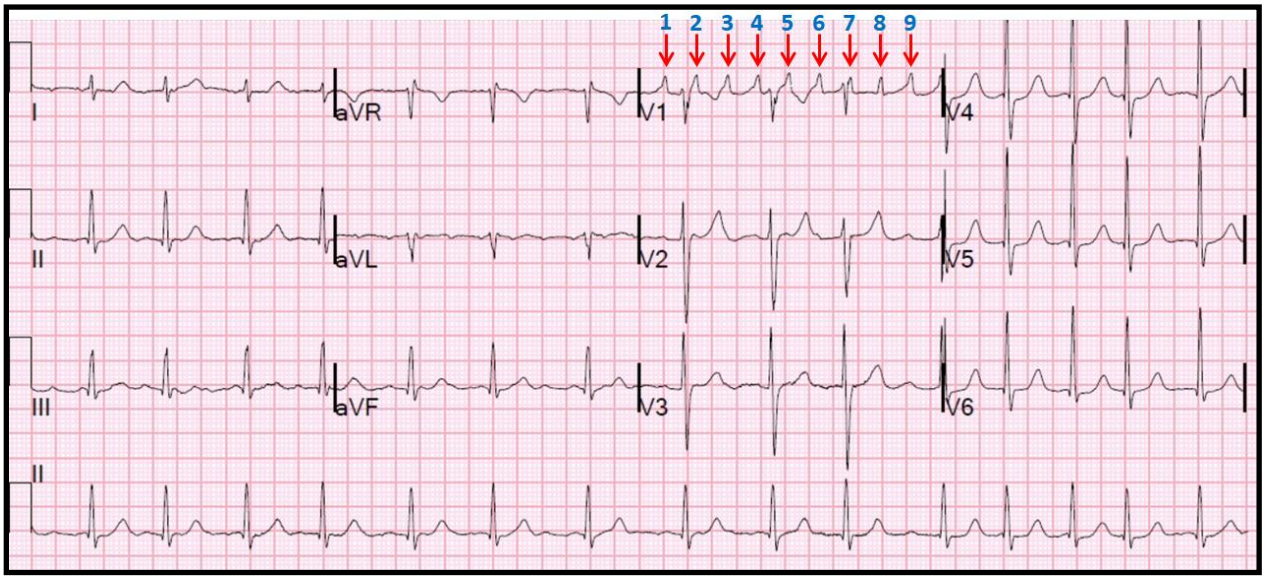

Figure 1B. Atrial flutter with variable AV conduction.

Examining the atrial activity, it is obvious that there are multiple P waves, or F (flutter) waves, seen best in lead V1, with an atrial rate of approximately 240/minute. Looking at Lead II rhythm strip, the irregularity and the inconspicuous P waves may cause a machine reading atrial fibrillation. The 1st and the 4th flutter waves, when viewed in Lead II rhythm strip, may also be misleading as sinus rhythm with sinus arrhythmia. Flutter waves which are adherent to the QRS complex (2nd and 7th) may form a pseudo r', with an erroneous interpretation of an intraventricular conduction delay. The absence of the typical saw tooth appearance in the inferior leads is suggestive of atypical atrial flutter [7].

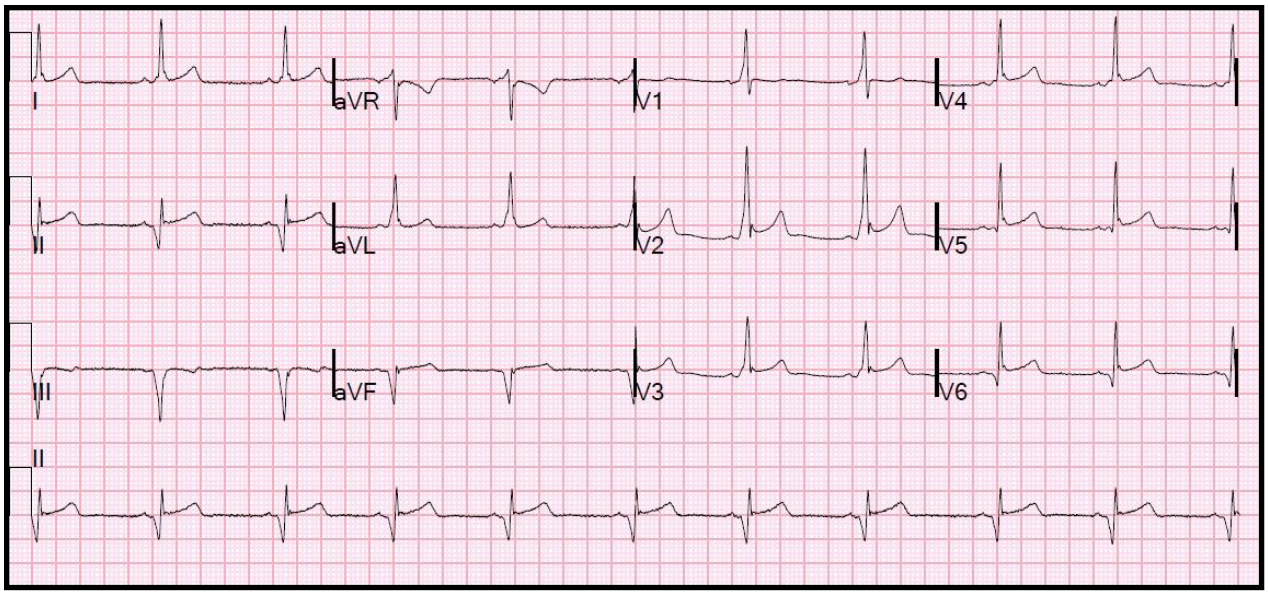

Figure 2A. What is the cause of abnormalities on this ECG?

A. Old inferior myocardial infarction.
B. Left-sided accessory pathway.
C. Precordial lead misplacement.
D. Right ventricular hypertrophy.

Discussion:

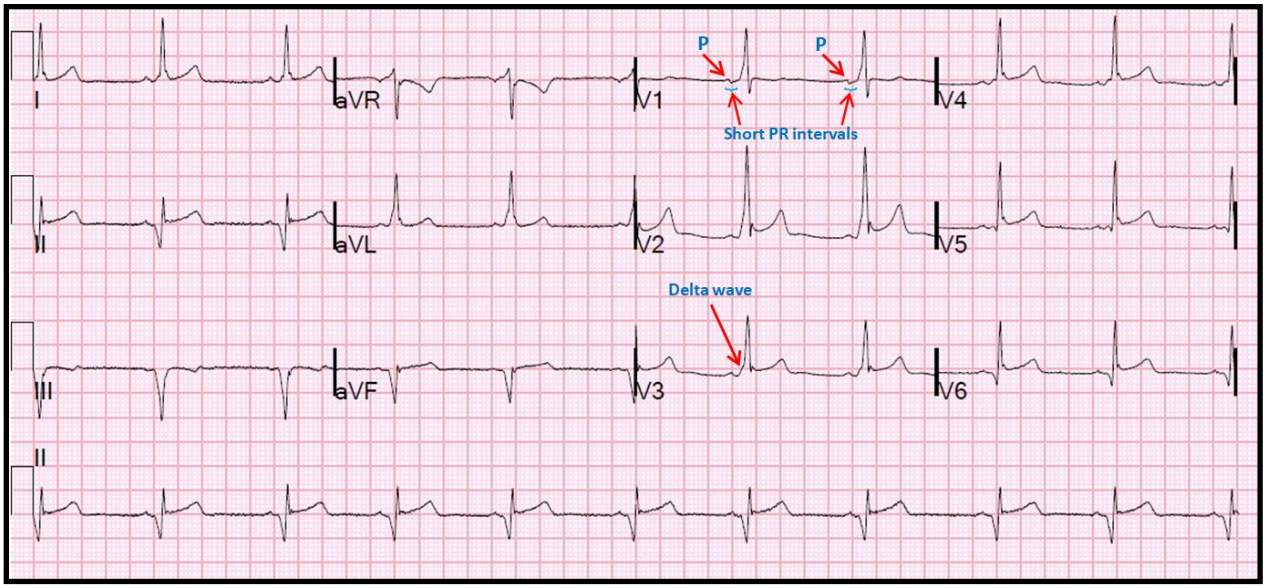

Figure 2B. Left-sided accessory pathway.

The underlying rhythm in this EKG tracing is normal sinus rhythm. There is early transition of the QRS complexes in V1, which may be confused for right ventricular hypertrophy. Q waves in the inferior leads may also lead to an erroneous diagnosis of old inferior myocardial infarction. The precordial lead voltage is positive and concordant, not indicative of lead misplacement. Closer examination reveals a short PR interval and slurring of the initial portion of the QRS complexes due to delta waves. This is typical of left-sided, likely posteroseptal, accessory pathway. The inferior Q waves represent a pseudo-infarct pattern due to altered ventricular activation, a common finding in posteroseptal accessory pathways [8].

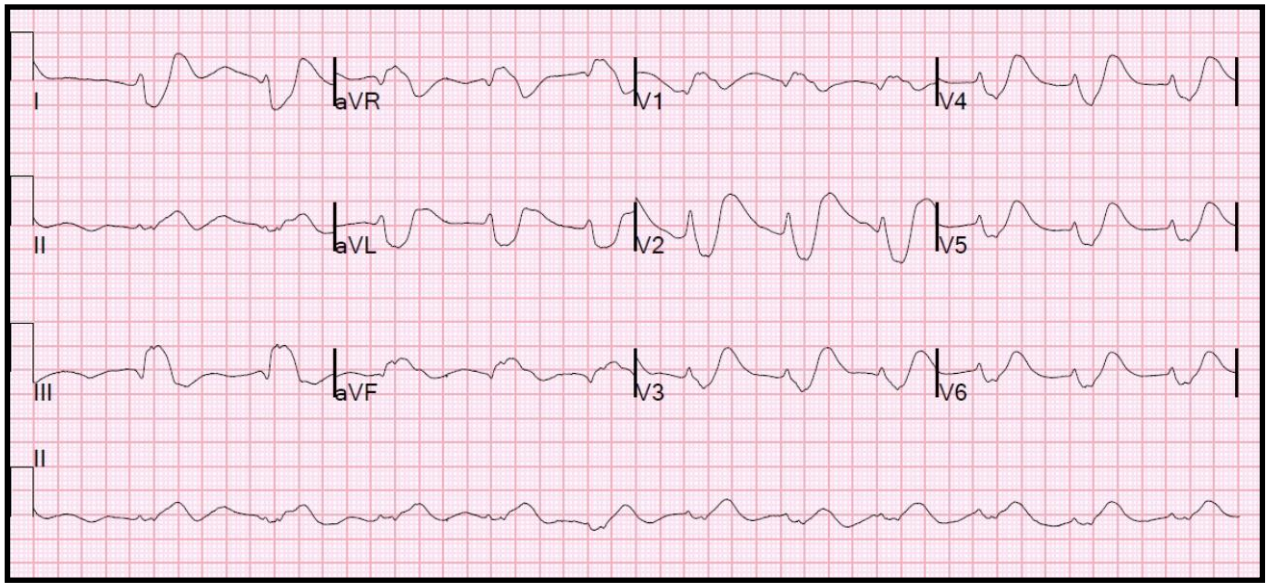

Figure 3A. What is the cause of the bizarre QRS complexes?

A. Hypothermia.
B. Left bundle branch block (LBBB).
C. Anterior ST elevation MI (STEMI).
D. Electrolyte abnormality.

Discussion:

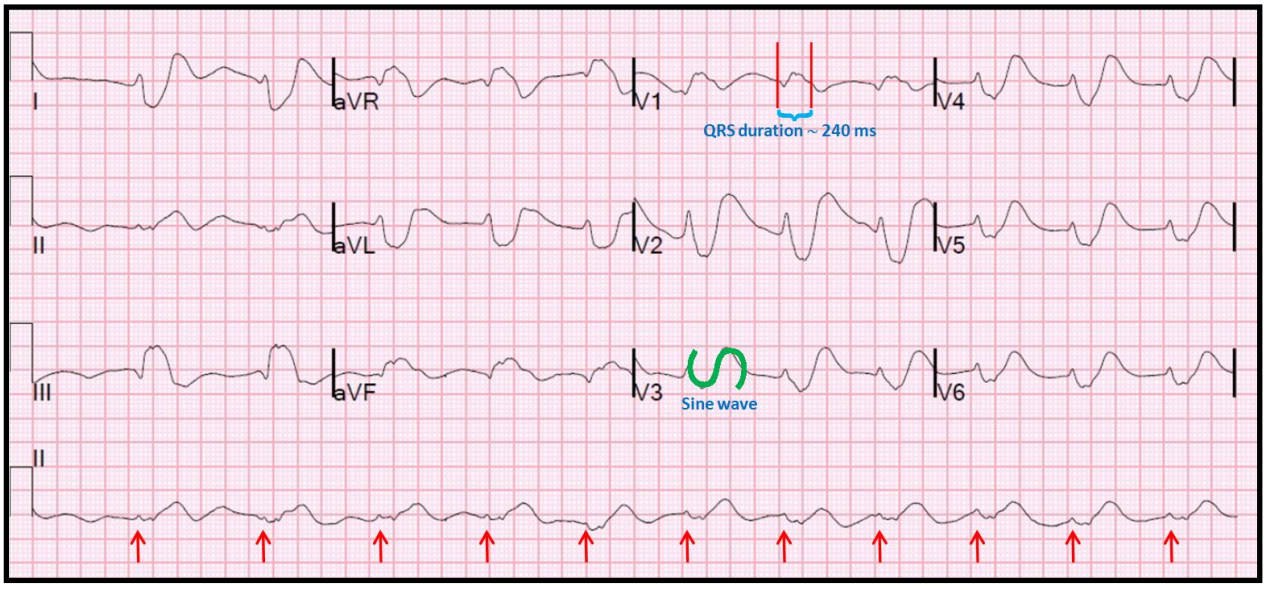

Figure 3B. Electrolyte abnormality (severe hyperkalemia; potassium level > 10 mmol/L).

The QRS complexes in this tracing are very wide, unlikely from isolated LBBB. Hypothermia is associated with a terminal positive deflection of the QRS complex, the Osborne (J) wave, not seen here. The QRS widening is causing the QRS to fuse with the T wave, obliterating the ST segment, which is not suggestive of an anterior STEMI. This QRS-T fusion is pathognomonic of the sine wave of severe hyperkalemia [9]. The underlying rhythm is suggestive of sinus arrhythmia but without conspicuous P waves. This may be due to sinoventricular conduction with loss of atrial capture seen in severe hyperkalemia [10]. Resolution of these changes and return of sinus rhythm is seen on repeat ECG with K ~ 4 (Figure 4).

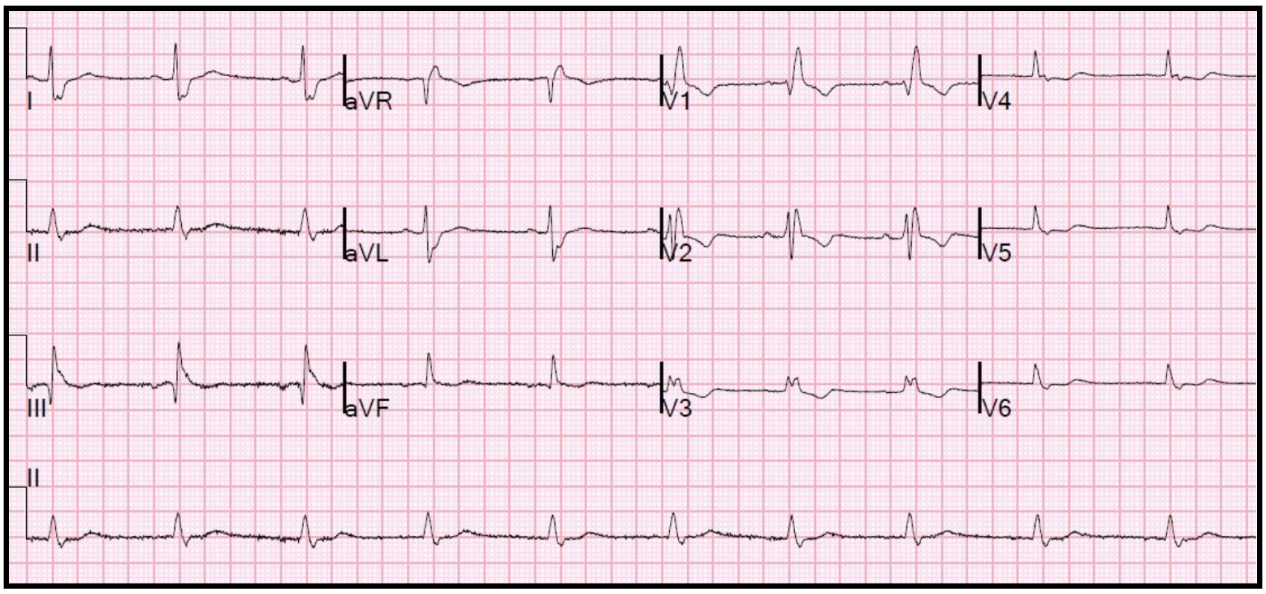

Figure 4. Normalization of ECG changes of severe hyperkalemia shown in figure 3.

References:

1. Noble RJ, Hillis JS, Rothbaum DA. Electrocardiography. In: Walker HK, Hall WD, Hurst JW, eds. *Clinical Methods: The History, Physical, and Laboratory Examinations*. 3rd ed. Boston: Butterworths; 1990.
2. Hurst JW. There is more in the ECG than is reported. *Am J Med*. 2005;118(12):1453.
3. Schläpfer J, Wellens HJ. Computer-Interpreted Electrocardiograms: Benefits and Limitations. *J Am Coll Cardiol*. 2017;70(9):1183-1192.
4. Hurst JW. Current status of clinical electrocardiography with suggestions for the improvement of the interpretive process. *Am J Cardiol*. 2003;92(9):1072-1079.
5. Antiperovitch P, Zareba W, Steinberg JS, et al. Proposed In-Training Electrocardiogram Interpretation Competencies for Undergraduate and Postgraduate Trainees. *J Hosp Med*.
6. Hutton D. A novel systematic approach to ECG interpretation. *Dynamics*. 2005;16(4): 19-21.
7. Cosío FG. Atrial Flutter, Typical and Atypical: A Review. *Arrhythm Electrophysiol Rev*. 2017;6(2):55-62.
8. Goldberger AL. Pseudo-infarct patterns in the Wolff-Parkinson-White syndrome: importance of Q wave-T wave vector discordance. *J Electrocardiol*. 1980;13(2):115-118.
9. Petrov DB. Images in clinical medicine. An electrocardiographic sine wave in hyperkalemia [published correction appears in N Engl J Med. 2012 Nov 8;367(19):1868]. *N Engl J Med*. 2012;366(19):1824.
10. Maradey J, Bhave P. Sinoventricular Conduction in the Setting of Severe Hyperkalemia. *JACC Clin Electrophysiol*. 2018;4(5):701-70.

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Reference this article as:

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