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EP ROUNDS

An Abnormal Electrocardiogram in a Young Man: What Is the Etiology?

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A 23-year-old man with diabetes presented to the emergency department complaining of nausea, vomiting, and fatigue. The physical exam was notable only for a fever. A 12-lead electrocardiogram (ECG) was obtained (Fig. 1). A second ECG was recorded 5 minutes later and is shown in Figure 2. An echocardiogram revealed normal left ventricular function, with no wall-motion abnormalities or pericardial effusion. What is the cause of the abnormal ECG?

Discussion

The 12-lead ECG shown in Figure 1 shows normal sinus rhythm with a normal QRS duration. There is apparent J-point and ST-segment elevation in the inferior and lateral precordial leads, and apparent ST-segment depression in leads V_1–V_2. The P wave voltage undulates and appears abnormally large in the lateral precordial leads.

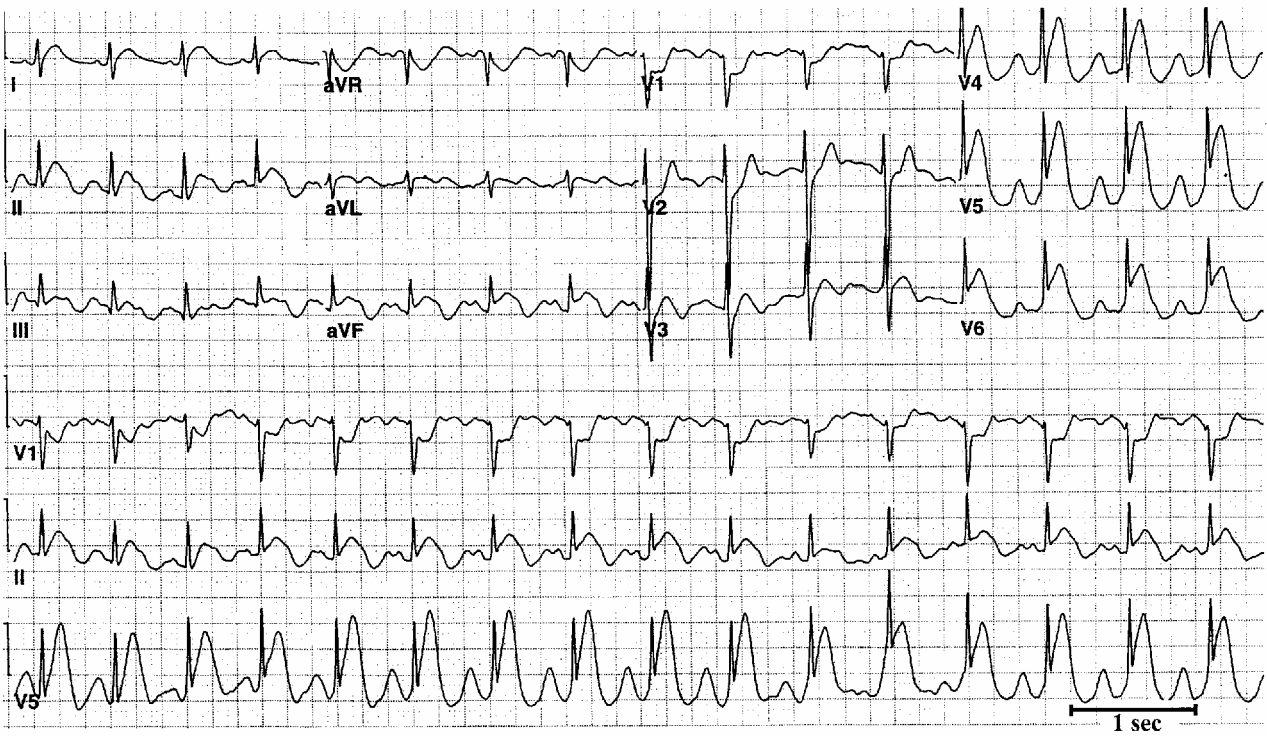

Figure 1. *Initial 12-lead electrocardiogram.*

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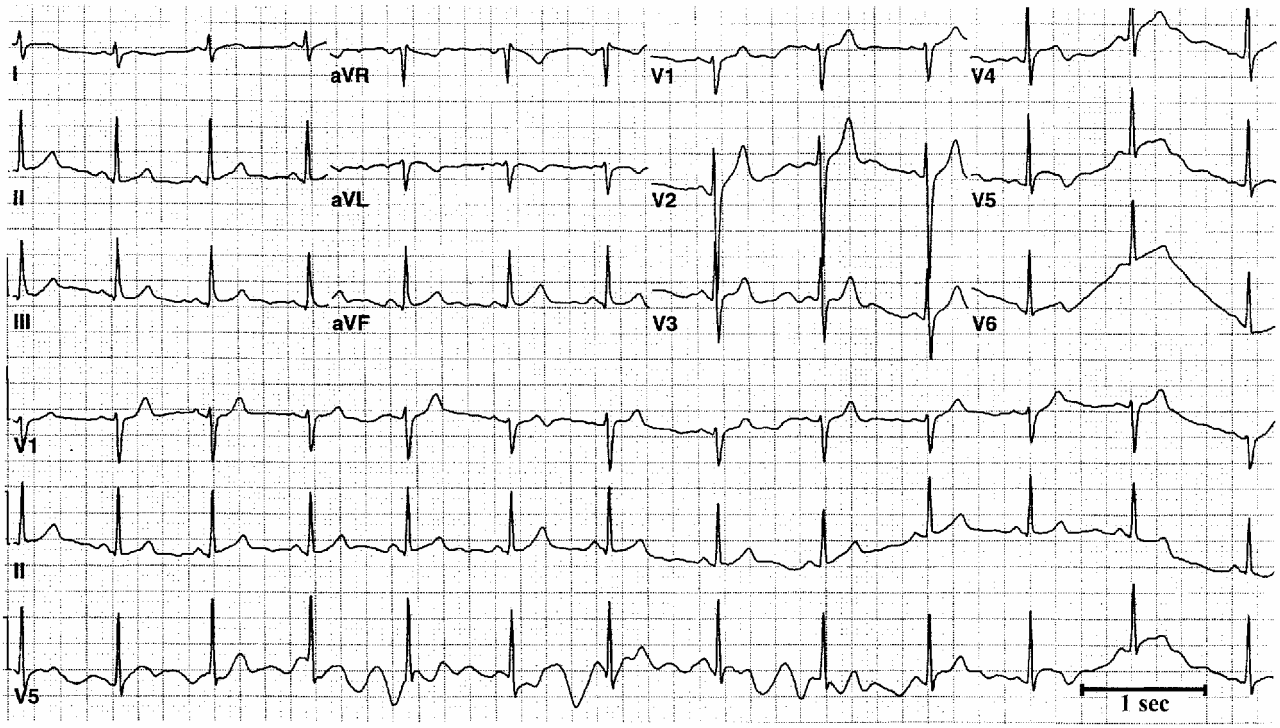

Figure 2. *Repeat 12-lead electrocardiogram (ECG) recorded 5-minutes after the initial ECG.*

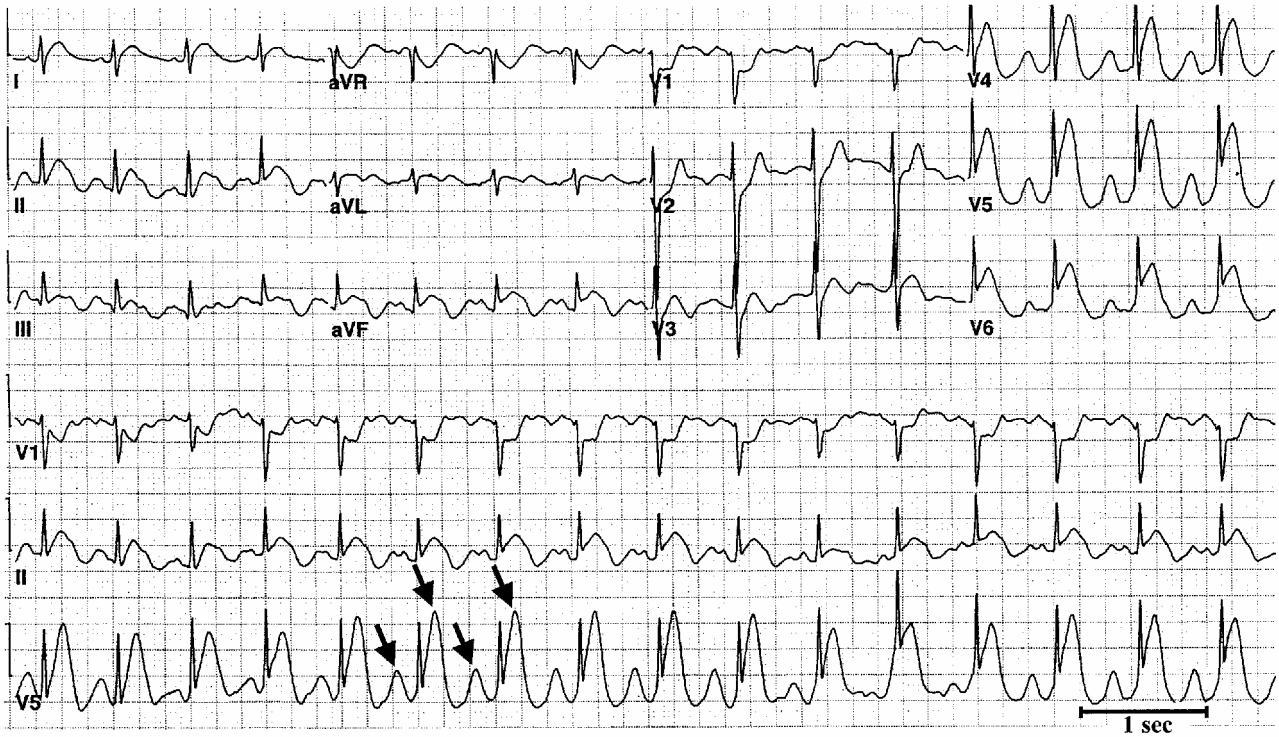

Figure 3. *The initial 12-lead electrocardiogram (ECG) shown in Figure 1 with arrows added to highlight the undulating artifact evident throughout the V_5 rhythm strip.*

At first glance, the ECG changes in this case appear to reflect myocardial injury. However, there are three observations that support a diagnosis of electrocardiographic artifact. First, there is a waveform recorded before the QRS at the same timing as the P wave that has a similar appearance as the waveform recorded after the QRS, although it is smaller in amplitude (Fig. 3). This pre-QRS waveform is too large and variable in amplitude to be physiological and, therefore, must represent electrocardiographic artifact. Second, the pre-QRS waveform occurs exactly midway between two consecutive post-QRS waveforms. This second observation suggests that the post-QRS and pre-QRS waveforms must arise from the same source and that the rate of the artifact is twice the ventricular rate. Third, although the artifact seems gated to the QRS, it is in fact not. The lead V_5 rhythm strip in Figure 1 shows that the relationship of the QRS complex relative to the artifact changes over time. The interval between the peak of the QRS complex and the peak of the artifact is 140 ms at the beginning of the lead V_5 rhythm strip and decreases to 120 ms at the end of the recording. Note that the artifact can also be seen in Figure 2, in the lead V_5 rhythm strip, but is less prominent.

Physician misinterpretation of electrocardiographic artifact may be widespread[1] and can result in a broad range of unnecessary interventions.[2] Electrocardiographic artifact can be the result of body movement, poor skin to electrode contact, recorder malfunction, or electromagnetic interference. The cause of the artifact in this case could not be determined. Electrocardiographic artifacts have been classified as pseudoarrhythmic and nonarrhythmic.[3] The present case demonstrates that artifact also may result in a pseudoinfarction pattern.

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