

# Osborn Waves: Differential Diagnosis

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**A** 56-year-old man with schizoaffective disorder, type 2 diabetes mellitus, and no cardiac history was sent from a psychiatric facility for evaluation of a left foot wound. He was disoriented to time, place, and person. The patient's core body temperature was 87.4 °F, and his pupils were equally reactive to light. His left foot had an ulcer with a dirty base and much foreign material, and his 2nd and 3rd toes were black with clear demarcation. Laboratory results included a normal white blood cell count ( $8 \times 10^9/L$ , 23% band neutrophils), a hemoglobin level of 7.4 g/dL, normal electrolyte levels except for calcium elevation (11.8 mg/dL; 12.8 mg/dL after correction for albumin), and no detected cardiac troponin. Urine toxicology results were positive for tricyclic antidepressants (TCAs). An electrocardiogram (ECG) showed junctional rhythm with J waves (Osborn waves); a corrected QT interval (QTc) of 468 ms; a PR interval of 188 ms; and a heart rate of 60 beats/min (Fig. 1).

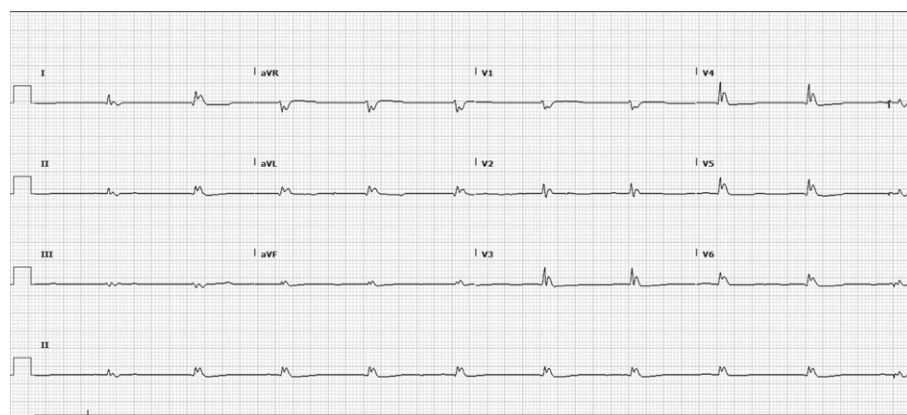


Fig. 1

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#### What abnormality is seen on the ECG?

- A) J-point elevation caused by hypothermia
- B) J-point elevation caused by hypercalcemia
- C) J-point elevation caused by combined hypothermia and hypercalcemia
- D) ST-segment-elevation myocardial infarction

See next page for the answer, as well as a link to the Focus on ECGs  
blog, where you can participate in a moderated discussion.

# FOCUS ON ECGs: ANSWER #19

## Answer

### C) J-point elevation caused by combined hypothermia and hypercalcemia

The ECG shows prominent Osborn waves, a heart rate of 60 beats/min, and prolonged QTc, PR, and QRS intervals. After differential diagnosis, the patient's hypothermia was thought to be caused by sepsis. Exposure to low temperature was ruled out because he had come from a healthcare facility. The facility reported that the patient was not taking TCAs; indeed, repeat urine screening revealed no antidepressants, so the first positive TCA result was deemed false. The patient was rewarmed with use of external techniques. Vancomycin and piperacillin-tazobactam were given. One day after admission, his temperature (99.5 °F) and calcium level were normal. An ECG showed sinus tachycardia (heart rate, 104 beats/min), no J-point elevation, a QTc interval of 362 ms, and a PR interval of 160 ms (Fig. 2).

J waves, also known as Osborn waves or the camel-hump sign, can be caused by hypercalcemia, brain injury, subarachnoid hemorrhage, and cardiopulmonary arrest from oversedation, vasospastic angina, or ventricular fibrillation.<sup>1</sup> However, the chief cause is hypothermia

(body temperature, <90 °F). Other ECG changes in hypothermia are bradyarrhythmias; junctional slow rhythms; prolonged PR, QRS, and QT intervals; shivering artifacts; ventricular ectopy; and cardiac arrest due to asystole or to ventricular tachycardia or fibrillation.<sup>2,3</sup> J waves occur when a heterogeneous distribution of potassium current increases the activity of a cardiac transient outward potassium current caused by low temperatures.

## References

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2. Nishi SP, Barbagelata NA, Atar S, Birnbaum Y, Tuero E. Hypercalcemia-induced ST-segment elevation mimicking acute myocardial infarction. *J Electrocardiol* 2006;39(3):298-300.
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*To participate in a moderated discussion of this case, go to [THIJournal.blogspot.com](http://THIJournal.blogspot.com). Two weeks from the original posting date, the discussion will close, but the comments will remain online for reference.*

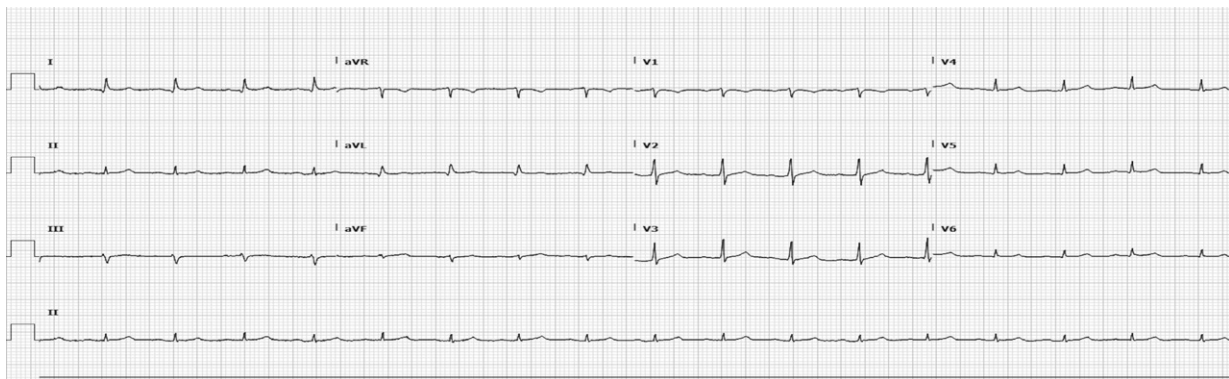


Fig. 2