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# The Clinical Picture

## Osborn waves: An inverse correlation with core body temperature

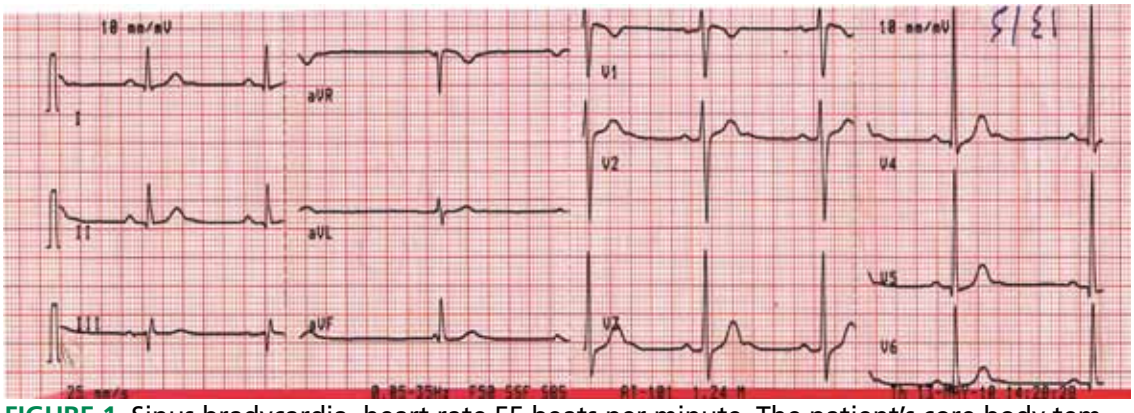


**FIGURE 1.** Sinus bradycardia, heart rate 55 beats per minute. The patient's core body temperature was 36°C (96.8°F). There are no evident J waves.

**Although Osborn waves are a marker of hypothermia, they also occur in nonhypothermic conditions**

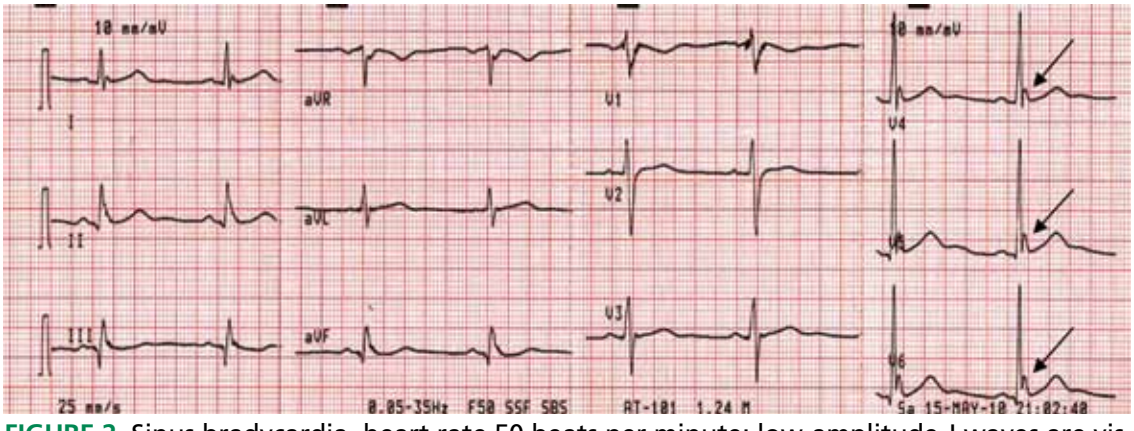


**FIGURE 2.** Sinus bradycardia, heart rate 50 beats per minute; low-amplitude J waves are visible in leads $V_4$, $V_5$, and $V_6$ (arrows). The patient's core body temperature was 31°C (87.8°F).

A 22-year-old man was brought to the emergency room after a motor vehicle accident. He was in a deep coma, with a Glasgow coma score of 4 out of 15 (3 being the worst score) and a core body temperature of 36°C (96.8°F). The next day, clinical evidence of brain death was noted, and his core body temperature dropped as low as 29.6°C (85.3°F). At that time, his electrocardiogram revealed sinus bradycardia, with a rate of 48 beats per minute, PR interval 0.24 second,

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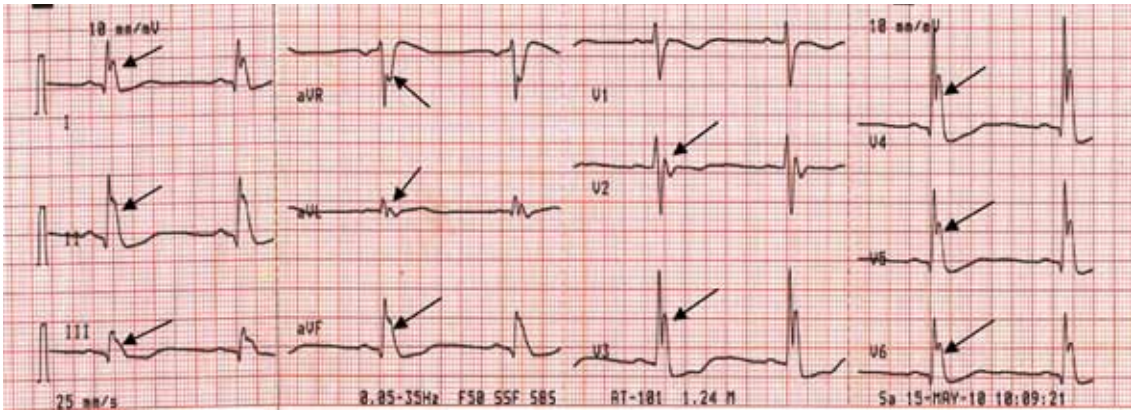


**FIGURE 3.** Sinus bradycardia, 48 beats per minute; the PR interval is prolonged at 0.24 second, the QRS interval is prolonged at 0.16 second, the corrected QT interval is 0.5 second, and classic high-amplitude J waves are visible in all leads (arrows). Core body temperature was 29.6°C (85.3°F).

QRS interval 0.16 second, corrected QT duration 0.5 second, and classic high-amplitude Osborn waves (J waves) that were evident in all leads. **FIGURES 1, 2, AND 3** show the effect of various degrees of hypothermia on the electrocardiogram.

The Osborn wave[1] (J wave) is the result of a transient, outward, potassium-mediated current in the ventricular epicardium but not the endocardium, corresponding to a notch in the action potential. This gives rise to a transmural voltage gradient during early repolarization, which appears as the J wave on electrocardiography. It is more pronounced in hypothermia, disappears after normalization of the body temperature, and is usually evident in the inferolateral leads.

Although Osborn waves are a marker of hypothermia, they also occur in nonhypothermic conditions. Brainstem death is a precursor of the J wave, and this is explained by impaired thermoregulatory ability resulting from hypothalamic dysfunction and subsequent hypothermia.

The three electrocardiograms presented here illustrate several points:

- Classic findings in hypothermia include J waves, sinus bradycardia, prolongation of the PR interval, widening of the QRS complex, and prolongation of the QT interval.
- The lower the core body temperature, the higher the amplitude of the J wave.
- The J wave in brain death (unlike hypothermic causes of the J wave) is not associated with the characteristic signs of shivering in the surface electrocardiogram.
- As hypothermia becomes more profound, the J wave becomes evident in all leads, not only the inferolateral leads.

## REFERENCES

1. **Osborn JJ**. Experimental hypothermia; respiratory and blood pH changes in relation to cardiac function. Am J Physiol 1953; 175:389–398.

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