A 12-lead ECG was obtained from a 72-year-old man with a core body temperature of 85°F (Figure 1). The ECG shows severe sinus bradycardia with prolonged PR, prolonged QRS complex, prolonged QT interval, and an extra deflection at the end of the QRS complex (Osborn waves) (arrows). A second 12-lead ECG obtained 24 hours later, after the patient had been rewarmed to 98°F, was normal (Figure 2).

Hypothermia, defined as core body temperature <95°F, is associated with ECG changes of diagnostic and prognostic importance. In the initial stages of hypothermia, a sinus tachycardia develops as part of the general stress reaction. As the temperature drops below 90°F, a sinus bradycardia supervenes, associated with progressive prolongation of the PR interval, QRS complex, and QT interval. With temperature approaching 86°F, atrial ectopic activity is often noted and can progress to atrial fibrillation. At this level of hypothermia, 80% of patients have Osborn waves that consist of an extra deflection at the end of the QRS complex.

Osborn waves, also known as J waves, camel-hump waves, and hypothermic waves, are best seen the inferior and lateral precordial leads. They become more prominent as the body temperature drops, and they regress gradually with rewarming.

With temperature <86°F, a progressive widening of the QRS complex increases the risk of ventricular fibrillation. When the temperature drops to ~60°F, asystole supervenes.
Figure 1. A 12-lead ECG obtained at core body temperature of 85°F. Note Osborn waves, an extra deflection at end of QRS complex (arrows).

Figure 2. A 12-lead ECG obtained 24 hours later, after patient had been rewarmed to 98°F, was normal.
Osborn Waves of Hypothermia
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