

Electro cardiographical changes of hypothermia/ osborn wave

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Mini review

This is the case of a 54-year-old woman without previous cardiac medical history who underwent a long (4hour) successful surgery due to a neoplastic pulmonary malignancy. Towards the end of the operation, the patient experienced a large drop in temperature (measured temperature 30oC in the rectum) with marked electrocardiographical alterations (ECG 1).

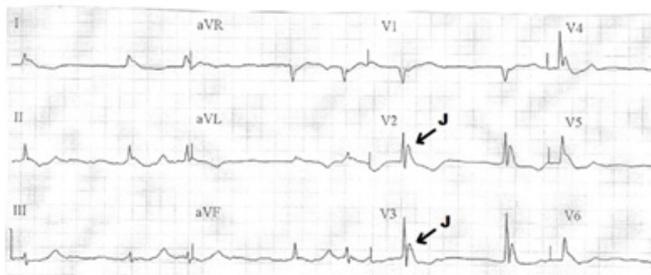


Figure 1 J or Osborn wave.

What is the diagnosis?

The main electrocardiographical findings is as follows:

1. The basal rate is atrial fibrillation with a frequency of about 50 beats per minute.
2. The ventricular complexes are prolonged (160ms), while in the lower third of the R-wave there is a positive deflection known as J or Osborn wave.^{1,2}

Diagnosis: ECG findings of hypothermia - Osborn Wave.

Comment: Hypothermia is defined as the body's central temperature drop below 35oC.

As central is defined the mean temperature of the viscera, especially of the thoracic cavity. It is distinguished in mild (32-35oC), moderate (30-32oC) and severe (less than 28oC). All organs of the human body are affected from its adverse effects, which are a result of the induced metabolic disorder. The fall in body temperature disrupts smooth cardiac function, which is outlined by the occurrence of various clinical manifestations and ECG changes reflecting the disorder in myocardial cell dynamics (Table 1).

The first clinical manifestations (temperature 33-35oC), vasoconstriction and shivering, affect the appearance of the ECG, which is full of artefacts. With further decrease in body temperature the shiver decreases and almost disappears when body temperature drops below 32oC. Subsequently, the metabolic cardiac processes are gradually slowed down resulting in a reduction in the functionality of the entire cardiac electrical leading system. Both the production and the transmission of the sinus stimuli is slowed down which results in the occurrence of bradycardia, atrioventricular and intraventricular blocks

(prolongation of PR, QT interval, QRS prolongation), ventricular repolarisation defects (negative T wave) and the presence of J or Osborn wave. The Osborn wave corresponds to a "notch" elevation of the lower part of the QRS wave which ranges between 1-10mm and is located in all leads, especially in the left precordial leads (V4-V6). Its size increases with the drop in temperature, but its appearance is also a poor prognostic point. It is basically an intraventricular disorder that is thought to be due to the difference in energy potential between phase 1 and 2 of ventricular repolarization.^{1,2}

Table 1 Hypothermia and electrocardiographical changes

Body temperature	Electrocardiographical findings
33-35°C	Artefacts
32°C	Bradycardia, prolongation of PR, QT, QRS, negative T, J or Osborn. Atrial Fibrillation.
30-32°C	Atrial Fibrillation.
28-30°C	"Nodular" tachycardias, ventricular tachycardia-fibrillation.
<27°C	Asystole

The first report of this ECG finding was made in 1938 by Tonpszewski³ in a man who had been exposed for many hours at low temperatures while the detailed description was made by Osborn⁴ in 1953. It is considered to be a pathognomonic ECG finding of hypothermia but can also rarely be seen in cases of hypercalcemia, severe subarachnoid haemorrhage, severe craniocerebral injury, in Brugada syndrome and vasoconstrictive coronary artery disease (Prinzmetal's angina).^{5,6} When the body temperature drops below 32oC, atrial fibrillation is often seen and with furthermore reduction (28-30oC) ventricular tachycardia and fibrillation occur. Finally, when the temperature drops below 27oC, cardiac asystole is observed.

Acknowledgments

None.

Conflicts of interest

Author declares there are no conflicts of interest.

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