HYPOTHERMIA – WHEN THE TEMPERATURE IS „MEASURED” WITH AN ELECTROCARDIOGRAM

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Introduction. Osborn wave represents a positive deflection of J point (2 mm), negative in aVR and V1, with a configuration of hump/dome occurring at the R-ST junction that can be frequently observed in hypothermic patients.

Short case presentation. A 38-years old unresponsive male patient was transported to the Emergency Department (ED) by the paramedics. The patient was located by the police outdoors in the urban area. During this time the outdoors temperatures ranged from – 14 to 10 Celsius degree.

Upon arrival the patient had a Glasgow Coma Scale (GCS) of 5, miotic pupils, barely responsive on luminous stimuli, severely hypothermic with a core (rectal) temperature of 28.5 degrees Celsius, a heart rate (HR) of 46 beats per minute, respiratory rate of 9 breaths per minute, blood pressure 80/45 mmHg.

An **ECG** (Figure 1) showed sinus bradycardia, HR 46/min, type I atrioventricular block (PR 220 msec), QRS axis + 65 grade, corrected QT of 560 msec, Osborn wave/J wave in DII, DIII, aVL, aVF, V4-V6 and negative in aVR.

After the patient was rewarmed for 24 hours, the J waves disappeared, and the QT interval and QRS duration normalized.

His blood tests showed mild hyperkalemia (5.4 mEq/L), mild hyperlactacidemia (2 mmol/L), a 10 fold increase in creatine kinase and a normal calcium level.

Osborn wave/J wave represents a positive deflection of J point (2 mm), negative in aVR and V1, with a configuration of hump/dome occurring at the R-ST junction. In hypothermia, these waves are more prominent in the inferior and lateral leads and the magnitude is generally proportional with the degree of hypothermia⁽¹⁾.

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J wave (Osborne wave) appearance on the ECG of the hypothermic patient results from a heterogeneous distribution of potassium currents within the myocardium. Hypothermia determines a more prominent epicardial than endocardial increase in the activity of the cardiac transient outward potassium current (I_{to}).

It can be frequently observed in hypothermic patients, however, other conditions have been report to cause Osborn wave, such as hypercalcemia, brain injury, subarachnoid haemorrhage, cardiorespiratory arrest from oversedation, vasospastic angina, idiopathic ventricular fibrillation^(1,3,4,5). The link between the Osborn wave and arrhythmia and the arrhythmogenic potential is not fully understood^(1,2).

Figure 1. 12-Lead Electrocardiogram showing sinus bradycardia, 46/min, type I atrioventricular block (PR 220 msec), QRS axis + 65 grade, corrected QT of 560 msec, Osborn wave/J wave in DII, DIII, aVL, aVF, V4-V6 and negative in aVR

References:

1. Gussak I, Bjerregaard P, Egan TM, et al. ECG phenomenon called the J wave: history, pathophysiology, and clinical significance. *J Electrocardiol.* 1995;28:49-58.
2. Alhaddad IA, Khalil M, Brown EJ. Osborn Waves of Hypothermia. *Circulation.* 2000;101(25):e233-e44. doi:doi:10.1161/01.CIR.101.25.e233.
3. Thompson R, Rich J, Chmelik F, et al. Evolutionary changes in the electrocardiogram of severe progressive hypothermia. *J Electrocardiol.* 1977;10:67-70.
4. Okada M, Nishimura F, Yoshino H, et al. The J wave in accidental hypothermia. *J Electrocardiol.* 1983;16:23-28.
5. Patel A, Getsos J. Osborn waves of hypothermia. *N Engl J Med.* 1994;330:68