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Electrocardiographic landmarks of hypothermia

Elektrokardiografia w hipotermii

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Abstract

We present the cases of two patients with hypothermia, with a detailed description of electrocardiographic changes associated with hypothermia. In both cases, J wave was initially misdiagnosed as left bundle branch block (LBBB). We discuss the differentiation of J wave from LBBB.

Key words: left bundle branch block, J wave, hypothermia

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INTRODUCTION

Clinical severe hypothermia is an infrequent condition in daily practice. It is defined as a central temperature (rectal, oesophageal or tympanic) below 35°C. Hypothermia is associated mainly with cooling of the body and prolonged exposure to low temperatures. Hypothermia may be accidental, metabolic, or therapeutic There are some pathological conditions that can favour hypothermia [1, 2]. In a surface electrocardiogram (ECG), the characteristic sign of hypothermia is a J-wave, also known as an Osborn wave and referred to in the literature as the 'camel hump', 'hump-like deflection', and/or injury potential [2]. In recent years, an association between the presence of J-waves and life-threatening ventricular arrhythmias in patients with apparently normal structural hearts but also with structural heart disease, has been demonstrated [3–5]. In a typical ECG, a feature of hypothermal state is the appearance of a very characteristic extra wave called the J wave [2].

We present here two cases of hypothermia to highlight the ECG landmarks of this condition.

CASE REPORTS

We describe ECG of two patients with hypothermia.

Case 1. A 44-year-old man was found by his family unconscious and cooled. On admission, his body temperature was 28°C, blood pressure was undetectable, heart rate was slow and irregular at about 35 bpm, and he had atrial fibrillation (AF). Atropine and catecholamines were given intravenously. The procedure of re-warming was started, but many episodes of ventricular fibrillation (VF) occurred and after the last one a shock converted VF into asystole without response to atropine and adrenaline and continuous cardiopulmonary resuscitation. The patient died after this event.

The ECG on admission was interpreted as AF with very slow ventricular response of 30–35 bpm, with markedly prolonged QRS duration up to 240 ms in leads V_2–V_3 prolonged QT interval at 600 ms in leads V_2, V_3 and 560 ms in leads V_5, V_6. Negative T-waves in leads I, II, III, aVF and V_4–V_6 as the secondary changes related to depolarisation disturbances (Fig. 1). Can we diagnose a distal conduction disorder in the setting of this clinical scenario?

Case 2. A 45-year-old man was found on the street in cold weather by an emergency team. His body temperature was 30°C. ECG showed: regular sinus rhythm 42 bpm, PQ interval 240 ms, left bundle branch block (LBBB), QRS duration time up to 200–240 ms. QT interval 680 ms, QTc interval 574 ms. ST segment depression in leads: I, II, III, aVF and V_4–V_6 (Fig. 2).

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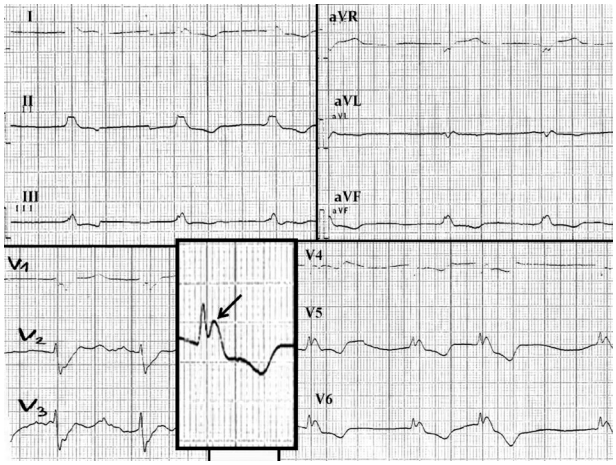

Figure 1. Electrocardiogram of patient 1 on admission, with a paper speed of 25 mm/s

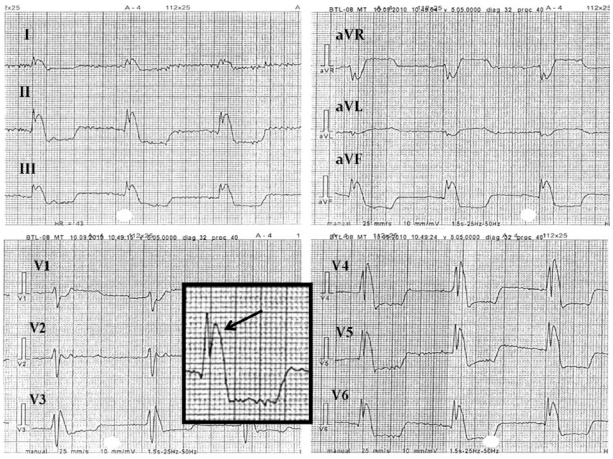

Figure 2. Electrocardiogram of patient 2 on admission, with a paper speed of 25 mm/s

DISCUSSION

In the ECGs described above of two patients admitted with hypothermia, one should pay attention to the characteristic Osborn wave (J-wave) (Figs. 1, 2). In cases 1 and 2, the J-wave was interpreted as an integral part of the QRS and was mistaken as prolonged QRS, leading to the wrong diagnosis of LBBB. In fact, the late component of the QRS interval is a pronounced J-wave associated with hypothermia.

In severe hypothermia, as in the cases described above, the J-wave presents as a huge wave placed between the end of QRS and the beginning of the ST-segment. The amplitude of the Osborn wave is directly associated with the body temperature. The lower the body temperature, the higher is the J-wave amplitude [1]. The J-wave often follows the ST segment depression and the negative T-wave. The ECG features of hypothermia can be summed up as:

- sinus bradycardia or slow conducted AF;
- widening of the P-wave (reflecting intra-atrial conduction delay);
- widening of QRS (decreased velocity of the intraventricular conduction);
- widening and flattening of T-waves;
- prolongation of the PQ interval;
- prolongation of the QT interval;
- J-wave (Osborn`s wave).

The most common arrhythmias are: AF and VF, as presented in our case (Fig. 1).

A number of non-environmental conditions (other than exposure to cold) may produce hypothermia. They can provoke the same ECG changes as true cold-induced hypothermia. Other conditions that may cause hypothermia are: 1) hypothyroidism, 2) hypopituitarism, 3) hypoglycaemia, 4) diabetes ketoacidosis, 5) cerebrovascular accidents, 6) antipsychotic drugs, 7) alcohol, 8) surgical procedures in hypothermia, 9) infections [2].

Conflict of interest: *none declared*

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