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Case report

Severe Accidental Hypothermia: A Crucial Impact of the Prehospital Orientation

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Abstract

The incidence of accidental hypothermia in adults is estimated to be around 1.1 per 100,000 inhabitants per year, with major variations in a etiologies and risk factors depending on demographic data and countries [1,2]. The associated mortality rate varies from 12% to 38% and is mainly explained by the initial an etiology [3,4].

The main risk of hypothermia is the occurrence of cardiovascular inefficacy - i.e., cardiac arrest - resulting from Ventricular Fibrillation (VF). The incidence of VF's occurrence is correlated with the depth of hypothermia [5]. VF is preceded in 35% to 50% [5] of cases by a Path gnomonic Electro Cardio Graphic (ECG) abnormality known as an Osborn wave or J wave. An Osborn wave is a positive deflection at the J point, which is usually most prominent in the pericardial leads. Its amplitude increases with the depth of hypothermia but might not be associated with fatal arrhythmic events [6].

Hypothermia treatment is based on external and/or internal progressive rewarming [7]. External rewarming methods include active and passive options. Internal rewarming can be achieved by minimally invasive active core rewarming, invasive active core rewarming by Extra Corporeal Blood Warming (ECMO) and non-ECMO methods, including body cavity rewarming, closed thoracic ravage and an endovascular temperature control device. To date, no recommendation exists on the order of implementing therapeutic methods.

Case History

We report the case of a 43-year-old man (100 kg) who was admitted to the Intensive Care Unit (ICU) for severe accidental hypothermia after a seizure. His past history was marked by chronic alcoholism and depressive manic psychosis without treatment but no epilepsy or seizures. The last contact was 7 hours prior to admittance. The patient was found next to his brother on the ground. His brother called the Emergency Dispatch Centre (EDC) and explained the apparent comatose status. The EDC immediately dispatched a mobile intensive care unit to the scene. The outside temperature was +3 degrees Celsius.

During the prehospital setting, blood pressure was initially stable at around 80/45 mmHg, including a heart rate of 30 beats per minute, a respiratory rate of 10/min, a pulse oximetry without oxygen supplementation of 88%, blood capillary of 12.6 mmol.l-1 and lactatemia of 4.2 mmol.l-1. The patient's body temperature was 27°C (tympanic measure). As the patient was comatose with a Glasgow coma scale of 8 (E2V1M5), he was sedated (midazolam 5 mg.h-1 and sufentanyl 10 microg.h-1), and mechanical ventilation was in statured after the prehospital emergency physician provided an or tracheal intubation. The ECG reported a third-degree atrioventricular block and Osborn J waves. During the prehospital stage, he ultimately received 2000 ml of isotonic serum saline and 2 boil of 9 mg ephedrine to restore blood pressure.

Upon ICU arrival, fluid expansion was continued up to 40 ml.kg-1, and nor epinephrine was instituted up to 8 µg.kg-1.min-1 during the first 12 hours and then progressively decreased at 96 hours. Tran thoracic echocardiography found a normal systolic function, a left ventricular fraction ejection of 55%, no diastolic dysfunction (E/A ratio was 1) and no hypovolemia, with an inferior vena cava diameter of 18 mm. The ECG was similar to the prehospital setting. Progressive external rewarming was immediately performed using passive (simple blanket) and active methods (electric blanket), allowing a +0.5degree Celsius increase in the first hour. The rewarming was stopped when body temperature reached 37°C. During the rewarming process, we observed the regression of the initial ECG abnormalities. A septic shock consecutive to a pneumonia related to the inhalation of the

patient's or pharyngeal flora (Klebsiella pneumonia, staphylococcus aurous and Enterobacter cloacae) was documented on day 2. Its treatment consisted of administering an association of metronidazole with ceftriaxone over the course of 7 days. Mechanical ventilation removal was possible on day 10. Acute renal failure occurred with consecutive acute tubular necrosis resulting from shock since day 1, but did not require dialysis. The patient left the ICU at day 13 and left the hospital at day 25 for a psychiatric health disease centre.

Discussion

In this case report, we explore the favorable evolution of a patient who suffered deep accidental hypothermia and who's an etiology remains unknown, without requiring internal rewarming or Extra Corporeal Life Support (ECLS) treatment. The strategy for rewarming remains under debate [7]. To summarize, it first seems reasonable to use active external and minimally invasive rewarming [8]. Some authors recommend that ECLS should be considered for patients with hypothermia and cardiac instability with unfavorable response to the initial medical management without stating the catecholamine level (which defines the cardiac instability) [7]. Physicians should consider catecholamine kinetics instead of a threshold to decide which rewarming method to use. The prehospital setting strategy includes careful handling to avoid FV occurrence, passive and active external rewarming and transferring the patient to the appropriate facility [7]. In the case of cardiac arrest, ECLS implementation should be discussed, since recent developments in ECLS technology (miniaturized ECLS device, heparin-coated circuits and percutaneous cannulation techniques) allow its implementation in the prehospital setting. To date, despite case series [9] suggesting the efficacy of ECLS in the prehospital setting, its indication should be limited to patients with hemodynamic failure - i.e., cardiac arrest -due to the lack of evidence [10,11].

Transportation towards the appropriate hospital is a crucial decision that should be made between and agreed upon by the prehospital emergency physician and the EDC as soon as possible. Nevertheless, the patient being sent to a facility capable of providing ECLS is advocated in the case of cardiac instability, when cardiac arrest is more frequent and the core temperature is lower than 28°C [7,12]. In hospital treatment that is based on rewarming, the method chosen and used depends on the hypothermia level [7].

Conclusion

No clear recommendation exists on the order in which therapeutic methods should be implemented in case of hypothermia. The choice between external non invasive or internal invasive methods depends on the depth of hypothermia on one side and the hemodynamic impact on the other side. Beyond this choice, low rewarming must be started as soon as possible in the prehospital setting to decrease complications and improve survival. As the evaluation of the response to the initial treatment requires time, early transport to facilities able to provide different levels of care depending on the response should be the rule.

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