



## Case report

# Deep accidental hypothermia accompanied with cardiac arrest after alcohol and drug poisoning treated with extracorporeal life support

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## ARTICLE INFO

## Keywords:

Hypothermia

Resuscitation

ECMO

Cardiac arrest

## ABSTRACT

Deep accidental hypothermia is an unusual clinical entity in developed countries. We report a case of a 30 year old male Caucasian patient with accidental severe hypothermia who was transferred to the emergency department of our hospital after prolonged exposure in the urban city's night environment cold as a result of alcohol and drugs abuse. The patient was found unconscious in the first early hours from onlookers. The time that the patient remained unconscious is unknown. During the transfer to the hospital because of cardiac arrest cardiopulmonary resuscitation began. In the emergency department an extracorporeal life support system (ECLS) was implanted under cardiopulmonary resuscitation in order to achieve hemodynamic stabilization and rapid and safe rewarming. The patient's rewarming lasted 6 hours. The patient was extubated the next day.

## 1. Background

Deep accidental hypothermia (DAH) is an unusual emergency clinical emergency with a possible high mortality. The exposure to the cold environment could be caused from an intoxication of alcohol or drugs or from other diseases by elder people [1–4]. The use of extracorporeal circulation (ECC) can provide a fast and safe body rewarming with good results [2,4]. In patients with cardiac arrest and DAH the use of ECC can be a life-saving treatment [1]. The application of these techniques should be performed by skilled staff and are therefore mostly performed in specialized cardiothoracic clinics [2]. Here we report a case of a patient who was transferred to the emergency department of the Westpfalz Klinikum in Kaiserslautern, Germany with DAH and cardiac arrest and was successfully treated with rewarming

using ECLS.

## 2. Case presentation

A 30-year-old male patient with unknown former clinical history and identity was found unconscious from passing people early in the morning (06:30 local time). The city's first aid service was alerted and the patient was transferred to the hospital's emergency department. The city environment's temperature during that night was  $-5^{\circ}\text{C}$ .

During his transfer the patient had a blood pressure from 50 mmHg and because of cardiac collapse cardiopulmonary resuscitation (CPR) followed. Due to ventricular fibrillation episodes, he needed to receive three electric defibrillations. CPR was continued in the emergency department, while the patient was intubated. The patient had dilated eye

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<https://doi.org/10.1016/j.rmcr.2018.06.011>

Received 27 May 2018; Received in revised form 18 June 2018; Accepted 18 June 2018

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pupils and the body's temperature was 25 °C.

The cardiothoracic surgical department was called and a veno-arterial extracorporeal life support (va-ECLS) was placed through percutaneous approach under CPR. The ECLS system was implanted 45 minutes after the start of CPR. At the time of the ECLS installation the patient had a rhythm atrial fibrillation. After the ECLS implantation the patient was transferred to the cardiothoracic intensive care unit in a stable hemodynamic and respiratory condition. At the point of the patient's entry at the intensive care unit the blood gas analysis showed normal values. After 6 hours of rewarming and after the patient's temperature reached 36,8 °C the ECLS was successfully removed. After the patient's rewarming and at the time of the ECLS explantation the patient had a sinus rhythm. Weaning from ventilator followed and the patient was successfully extubated on the next day. After the extubation the patient showed a clinically normal condition. He remained cardiopulmonary stable without any neurological deficits. In the next days the patient showed drug and alcohol withdrawal symptoms (anxiety, anger, aggression, excitability and restlessness). Because of the unknown medical history and his former neurological condition a computer tomography (CT) scan of the brain was decided. No signs of hypoxia or any other pathological findings were demonstrated. The toxicological tests which were additionally carried out confirmed the drug intoxication. Except the drug and alcohol withdrawal symptoms the further clinical course was uneventful. The 7th day after the ECLS explantation the patient was transferred in the department of neurology for further treatment.

### 3. Discussion

The current advances made in the field of prehospital treatment have improved the patients' survival. DAH is characterized from drop of the core temperature < 28 °C. This clinical entity is an unusual case in the emergency department and a high mortality rate can occur [1,2,4]. However, with the use of ECLS the survival rates of a DAH with a cardiac arrest can reach 100% [5].

DAH should not be confused with the technically induced hypothermia during for example for cardiovascular surgery. DAH occurs unexpectedly and uncontrolled. DAH is triggered after the exposure in cold environments. The cause of the exposure to a cold environment may be related to the consumption of alcohol, drugs, trauma or other diseases mainly in elderly people. In our case hypothermia occurred due to exposure to cold environment due to alcohol and drug consumption and a CPR began due to lack of vital signs already on a pre-hospital basis.

In the diagnosis of DAH and specifying its severity the measurement of the patient's core temperature is crucial.

An appropriate staging system is a valuable for an effective triage and a suitable emergency treatment. A classification based on the Swiss system (Hypothermia I–IV) is commonly used on the prehospital basis. The level of consciousness, vital signs, and core temperature are the parameters used to indicate hypothermia severity. Stage I refers to a mild hypothermia of 35–32 °C with normal level of consciousness and shivering. A moderate Hypothermia (Stage II) is described with a body temperature of < 32–28 °C and an impaired consciousness with or without shivering. In Stage III (severe hypothermia) the body temperature is below 28 °C and clinically presents with unconsciousness with present vital signs. Stage IV is used to denote death due to

irreversible hypothermia [5].

Our patient was found unconscious with a body core temperature lower than 28 °C. For this reason hypothermia was classified as severe (Stage III). The ventricular tachycardia in our case was attributed to the DAH. While rewarming the patient's electrocardiogram showed a stable sinus rhythm. If the cardiac arrest is a result of DAH the survival rate reaches 25–100%.

ECLS appeared as the evolution of the ECC. The ECC is the choice treatment for patients with DAH and cardiac arrest [5]. For patients with DAH and cardiac arrest the only reason for not performing an ECC is the lack of the device from the hospital. A veno-arterial ECLS or cardiopulmonary bypass are the rewarming treatments of choice. A veno-venous extracorporeal membrane oxygenation (vv-ECMO) rewarming is not commonly used as it provides no circulatory or ventilatory support in case of cardiac arrest. On the other hand, the veno-arterial (va-) ECMO is generally preferred as it can increase the cardiac output and circuit perfusion. In addition, the use of va-ECMO can provide a life-saving rewarming using a femoral vascular access and thus avoiding the performance of a sternotomy [5]. However, veno-venous extracorporeal membrane oxygenation (vv-ECMO) has also been used in other cases of accidental hypothermia. Tiruvoipati et al. report the successful use of a vv-ECMO for the treatment of DAH [6]. ECLS in the presence of primary hypothermic cardiac arrest or severe circulatory instability because of Hypothermia III–IV gives the possibility to immediately restore the circulation through cardiovascular support. It provides also a quick core rewarming and better tissue oxygenation through CO<sub>2</sub> removal [1–3]. First the body core is rewarmed. In this way in this way the vital organs are protected and a peripheral vasoconstriction is not allowed. In addition, through the ECLS the metabolic disorders that have been caused through the exposure to the cold environment can also be effectively restored [1].

### Conflict of interest

None to declare.

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