

## LETTER TO THE MJM

# SUCCESSFUL RESUSCITATION OF THE LONGEST REPORTED CASE OF SEVERE HYPOTHERMIA COMPLICATED BY CARDIAC ARREST

Dear *MJM*::

I wish to report a case of severe hypothermia of approximately 14 hours duration, complicated by the development of cardiac arrest, in which the patient was successfully resuscitated by prolonged cardiac massage for 3.5 hours and the use of closed thoracic cavity lavage (CTCL).

Accidental hypothermia occurs when an individual experiences a decrease in core temperature below 35°C as a result of exposure to the cold (1). In hypothermia complicated by arrest, passive rewarming--consisting of removal from the cold environment, the use of blankets, and reliance on endogenous heat production to restore normothermia (2)--will not suffice (3). Rather, active rewarming must be instituted, including external rewarming measures, such as fluid-circulating blankets and radiant heat shields, and core rewarming methods, such as airway rewarming, body cavity lavage, warm intravenous fluids, and cardiopulmonary bypass (CPB) (2). As evidenced by the present case, and others, CTCL can achieve success when CPB is not available (3-6).

The following report describes the case of a 19 year- old male found at 8:30 a.m. on December 19, 1995, submerged to his neck in a frozen creek. Shortly after 7:30 the previous evening, his vehicle had slid off the road into the creek. After cutting through the ice, rescuers reached the victim, who was making moaning sounds and feeble respiratory efforts, and whose pulse was faint at a rate of 12 beats per minute. By 9:20 a.m., a cervical collar had been applied, and he had been carried into the ambulance on a spinal board; by that time, his vital signs were absent. En route to the hospital, the patient received one-person CPR and a total of four unsuccessful shocks delivered by an attached automatic external defibrillator.

The young man arrived at the emergency department unconscious and pulseless with sluggish pupils. Rectal temperature was 22°C, and EKG showed fine ventricular fibrillation. Without delay, intravenous access was established and the patient was intubated. Defibrillation was again attempted without success, and external cardiac massage was continued while the patient was ventilated with humidified, warm oxygen. Active core rewarming procedures were rapidly initiated without the availability of CPB. Using warm, sterile saline, these included simultaneous nasogastric lavage, peritoneal lavage, bladder lavage, and CTCL, the latter via a straight chest tube inserted into the left pleural cavity.

Spontaneous respirations were observed shortly after the initiation of CTCL. Defibrillation was again attempted when the core temperature reached approximately 30°C, and the patient this time converted to sinus rhythm, at 75 beats per minute. Blood pressure was 82/60. However, because of persistent hypoperfusion, CPR was continued for 15 minutes subsequently, and ventilation with warm, humidified oxygen was maintained. One hour after successful defibrillation, the patient was still unconscious, but moving all limbs; his core temperature was 31.5°C, his blood pressure 107/70, and his pulse 91. He was monitored for rhabdomyolysis and myoglobinuria, but no dialysis or further critical care procedures were required.

Within 48 hours, the young man was walking and talking. He returned home after approximately 10 days. Follow-up neurological examination revealed relatively minor neurological sequelae. Two months after the accident, the victim complained only of some numbness principally in the feet, likely representing a cold-induced neuropathy expected to improve with time and physiotherapy.

This case emphasizes the importance of exhausting all measures toward resuscitation in the hypothermic patient. Many experts in hypothermia recommend that resuscitation efforts be suspended only after arrest persists above a core temperature of 35°C (3). The literature documents neurologically-intact survival despite documented cardiac arrests of 4.5 hours and 4.75 hours duration in two young adults with initial temperatures of 28°C and 17.5°C, respectively (3). While the arrest reported here did not persist as long as in these cases, the present case is unique for the duration of the severe hypothermia.

Case studies have shown that successful recovery from severe hypothermia is possible without CPB or extracorporeal warming (5,6,7). In particular, these cases show the success of CTCL. CTCL should be considered the treatment of choice when CPB is not available, because it is nearly universally available, is relatively easy to perform, and rapidly rewarms the heart (5,8). The case of this young man provides direct evidence of this, and substantiates the remarkable finding that, through active measures--even after prolonged arrest--the hypothermic patient may fully recover, neurologically intact.

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