Scholars Journal of Medical Case Reports (SJMCR) **ISSN 2347-6559 (Online)**
Abbreviated Key Title: Sch. J. Med. Case Rep. **ISSN 2347-9507 (Print)**

A United of Scholars Academic and Scientific Society, India

A Patient with Cardiac Arrest Induced By Accidental Deep Hypothermia Who Required Percutaneous Cardiopulmonary Support

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Article History
Received: 03.04.2018
Accepted: 09.04.2018
Published:30.04.2018

DOI:
10.36347/sjmcr.2018.v06i04.004

Abstract: A 63-year-old man with alcoholism and liver dysfunction was found unconscious at home by his wife. The lowest temperature had been 0 °C on that day. On arrival, his radial artery showed no pulse, but his carotid artery did. His heart rate was 30 beats per minute. After tracheal intubation and securing a venous route, cardiac arrest occurred. The initial rhythm was ventricular fibrillation. He received basic life support, including one electrical shock, without return of circulation. He underwent percutaneous cardiopulmonary support (PCPS) for support of circulation, respiration and rewarming over the course of 40 minutes. The cause of the patient's accidental deep hypothermia was considered to be both difficulty moving due to alcoholic hypokalemia and the low cold temperature. On the second hospital day, rewarming was completed, and he was taken off of PCPS on the third hospital day. When arterial cannulation was removed, massive transfusion was required because massive hemorrhaging had occurred. Consequently, he became complicated with acute respiratory distress syndrome. He was extubated once on the seventh hospital day, but he was re-intubated due to complications of hypoxia induced by difficulty excreting sputum. Post-tracheostomy on the 10th hospital day was eventful. He retained his normal degree of intelligence and was transported to another medical facility for rehabilitation. We herein report a patient with cardiac arrest induced by accidental deep hypothermia who obtained a favorable outcome by PCPS for cardiac arrest and rewarming. PCPS was useful for treating accidental deep hypothermia with cardiac arrest.

Keywords: percutaneous cardiopulmonary support; cardiac arrest; accidental deep hypothermia.

INTRODUCTION

Primary hypothermia occurs when heat production in an otherwise healthy person is overcome by the stress of excessive cold, especially when the energy stores of the body are depleted. Secondary hypothermia can occur in ill persons with a wide variety of medical conditions [1]. The risk of cardiac arrest increases as the core temperature drops below 32 °C and increases substantially if the temperature is less than 28 °C [1]. Hypothermia can be staged clinically on the basis of vital signs with the use of the Swiss staging system of hypothermia (stages HT I to HT IV) [2]. When signs of life and vital signs are absent (stage HT IV), there is a consensus that treatment with percutaneous cardiopulmonary support (PCPS) is safe and efficient. Among patients treated with PCPS, the rate of surviving without neurologic impairment is 47%-63%. One advantage associated with PCPS is the safe establishment of blood flow during rewarming. In addition, PCPS has been shown to be useful for rescuing patients with cardiac arrest, even those not in a hypothermic state [3].

We herein report the successful treatment with PCPS for rewarming for a patient with cardiac arrest accompanied by accidental hypothermia.

CASE REPORT

A 63-year-old man with alcoholism and liver dysfunction was found unconscious at home by his wife. The lowest temperature had been 0 °C on that day. When medical technicians checked him, he was in a deep coma state in a state of shock with bradycardia and deep hypothermia. On arrival, his radial artery showed no pulse, but his carotid artery did. His heart rate was 30 beats per minute. After tracheal intubation and securing a venous route, cardiac arrest occurred. The initial rhythm was ventricular fibrillation. He received basic life support, including one electrical shock, without return of circulation. He underwent PCPS for support of circulation, respiration and rewarming over the course of40 minutes.

An arterial gas analysis on arrival revealed the following findings: pH, 7.334; PCO_2, 54.6 mmHg; PO_2, 139 mmHg, HCO_3^-, 29.6 mmol/l, and base excess, 3.9

mmol/l. Portable chest roentgenography revealed no significant lesions. The main results of a biochemical analysis of the blood were as follows: aspartate aminotransferase, 364 IU/L; alanine aminotransferase, 174 IU/L and potassium, 2.8 mEq/l. The findings on chest roentgen, electrocardiogram and whole-body computed tomography were all negative.

The cause of the patient's accidental deep hypothermia was considered to be both difficulty moving due to alcoholic hypokalemia and the low cold temperature [4]. On the second hospital day, rewarming was completed, and he was taken off of PCPS on the third hospital day. He became complicated with acute respiratory distress syndrome and received tracheostomy, but he retained his normal degree of intelligence and was transported to another medical facility for rehabilitation.

DISCUSSION

Farstad *et al*. reported their findings of twenty-six patients with accidental hypothermia combined with circulatory arrest or severe circulatory failure, which were rewarmed to normothermia using extracorporeal circulation (ECC) [5]. Nineteen of the 26 patients were weaned off ECC whereas seven died because of refractory respiratory and/or cardiac failure. Eight of the 19 successfully weaned patients were discharged from the hospital. Seven of the discharged survivors were not associated with asphyxia based on the reports from the site of accident, but one patient with a severe neurological deficit was identified to have asphyxia. The present case also did not demonstrate asphyxia and obtained favorable outcome.

In addition, Morita *et al*. reported the results of 24 patients with hemodynamically unstable accidental deep hypothermia (core body temperature is less than 28 degrees Celsius) without cardiopulmonary arrest, who were treated by PCPS for rewarming [6]. The mortality rate in their study was 12.5% (3/24). The Glasgow Outcome Scale of the patients who survived were as follows: no deficit, 17 cases; mild disability, 3 cases; and severe disability, 1 case. As a result, they supported the efficacy of PCPS for rewarming for patients with hemodynamically unstable accidental deep hypothermia. According to their theory, our case should therefore have undergone PCPS treatment from the start of treatment.

In a deep hypothermic state (*i.e.*, <20°C), the brain function can be preserved during cardiac arrest, even when the patient remains in cardiac arrest without chest compression for more than 1 hour [7]. Prolonged chest compression has been shown to increase the occurrence of complication [8, 9]. The present case, who was complicated with acute respiratory distress syndrome, also received chest compression for 40 minutes after falling into a state of cardiac arrest. Accordingly, a patient with cardiac arrest induced by accidental deep hypothermia who requires percutaneous cardiopulmonary support for the support of circulation and rewarming, may not require chest compression and rewarming.

CONCLUSION

We encountered a patient with cardiac arrest induced by accidental deep hypothermia who obtained a favorable outcome by PCPS for cardiac arrest and rewarming. PCPS was useful for treating accidental deep hypothermia with cardiac arrest.

Grant: This manuscript received financial support from the Ministry of Education, Culture, Sports, Science and Technology (MEXT)-Supported Program for the Strategic Research Foundation at Private Universities, 2015-2019 concerning [The constitution of total researching system for comprehensive disaster, medical management, corresponding to wide-scale disaster]. (No grant number)

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