Rewarming a Patient With Accidental Hypothermia and Cardiac Arrest Using Thoracic Lavage

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The optimal treatment for severe accidental hypothermia is cardiopulmonary bypass because this offers the most rapid rate of rewarming. However, cardiopulmonary bypass therapy is not available in every hospital. In these circumstances, rewarming has to be achieved with other methods. We present a patient who was successfully rewarmed with thoracic lavage after he had been found with a core temperature of 21°C and asystole.


Accidental hypothermia is an unintentional fall in core temperature to less than 35°C. It is classified as mild (32–35°C), moderate (28–32°C), and severe (20–28°C). Advanced age, mental impairment, substance abuse, and injury are the most common risk factors for accidental hypothermia [1]. In the United States, the annual incidence of hypothermia-related deaths is 0.2 per 100,000 population [1]. A multicenter review of 428 cases reported an overall mortality rate from accidental hypothermia of 17% [2].

Hypothermia has profound effects across multiple organ systems. With the exception of ischemic tissue complications, hypothermia-induced changes are mostly reversible by rewarming. One of the most severe complications of accidental hypothermia is cardiac arrest. A body temperature less than 30°C is associated with arrhythmias, and asystole occurs at temperatures less than 25°C [3].

For patients with hypothermia who are in cardiac arrest, an active extracorporeal blood warming approach is recommended by cardiopulmonary bypass, which maintains perfusion and oxygenation to vital organs [4]. A Finnish report with 23 patients documented a 61% survival for adults undergoing cardiopulmonary bypass after a mean 70 minutes of cardiopulmonary resuscitation after accidental hypothermic arrest [5].

When cardiopulmonary bypass is not available, other rewarming techniques have to be taken into consideration. These methods include thoracic and peritoneal lavage, thoracotomy with internal cardiac massage, hemofiltration, and conservative management with forced air rewarming. In this article, we report a case of a patient with asystole and a core temperature of 21°C who was rewarmed by thoracic lavage.

A 60-year-old man was brought to the hospital by the emergency medical services after being found lying in the snow. The outside temperature was −10°C (14°F). A passer-by found the patient unconscious with a decreased respiratory rate and started resuscitation. By the time the patient had been admitted to the hospital, he had received cardiopulmonary resuscitation for 13 minutes from the passer-by and for a further 50 minutes by the emergency medical help. The patient’s core temperature as measured from the nasopharynx was 21°C, and he had asystole. The blood alcohol level was 3.5 mL.

The patient was taken to the operating theater, which is located next to the emergency department. An emergency left thoracotomy was performed to start open chest compressions and mediastinal rewarming with warm sterile saline and warm water. Continuous nasopharyngeal temperature monitoring was used to measure the patient’s core temperature during the procedure. A warming catheter was inserted into the femoral vein (ICY Intravascular Heat Exchange Catheter Kit, Zoll Circulation, Inc, Sunnyvale, CA). In addition, warm saline was infused through a drain that was inserted through a minilaparotomy incision and through a urinary catheter. First, we used all available warm (37°C) sterile normal saline, and after that thoracic lavage was continued with clean tap water. The temperature of the water (37°C) was estimated with the palm of the hand. After 100 minutes of cardiac massage and rewarming with 70 L of warm liquids, mostly intrathoracically, the patient’s core temperature had reached 28°C. Sinus rhythm returned after intravenous administration of amiodarone and epinephrine plus two electric shocks delivered by defibrillator. Thoracic lavage with warm liquids was continued for 1 hour.

The thoracotomy was then closed and the patient was transferred to the intensive care unit. The patient’s core temperature was kept at 36°C for 24 hours, and he was successfully extubated on the seventh day. Our patient made an almost complete neurologic recovery with only a minor visual defect. However, multisystem complications of hypothermia developed, including pancreatitis, thrombocytopenia, gastrointestinal ulcers, and hepatic impairment. Several laparotomies were performed for bowel resections and pancreatic necrosectomies. The patient died on the 39th day after hospital admission; the cause of death was pancreatitis as a consequence of hypothermia and alcohol abuse.

Comment

Cardiac arrest is the most profound manifestation of severe hypothermia. There is a high risk of asystole at a core temperature less than 25°C [3]. Furthermore, it has been reported that 85% of the patients who have died from accidental hypothermia had an initial core temperature of...
these patients, 4 (29%) died within 2 weeks of hospital admission. The core temperature was 22°C or less in 3 patients (21%). Nine patients (64%) presented with ventricular fibrillation, and the remaining 5 (36%) presented with asystole. Of the 5 patients with asystole, 3 died and only 1 made a full recovery [6].

We describe a successful resuscitation of a patient with deep accidental hypothermia (core temperature of 22°C) and asystole. This was achieved by internal cardiac massage and thoracic lavage. Unfortunately, after successful rewarming and almost complete neurologic recovery, the patient died of pancreatitis 39 days after his hospital admission. Hypothermia has been documented as a precipitating factor for pancreatitis. About half of patients with hypothermia have elevated serum amylase levels, and postmortem studies of patients with accidental hypothermia have shown evidence of acute pancreatitis in 20% to 30% of cases [7]. Our patient most probably also had a history of alcohol abuse, which is a well-known risk factor for the development of acute pancreatitis.

In conclusion, victims of severe hypothermia with cardiac arrest can be effectively treated using prolonged cardiopulmonary bypass and thoracic lavage in hospitals that are not suitably equipped for cardiopulmonary bypass procedures.

References

Chest Tube Entrapment: A Simple Solution for Technical Error

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Unrecognized chest tube entrapment by surgical closure is a technical error. We present a rare case of chest tube entrapment that was successfully treated with a simple and safe solution in an elderly man after coronary artery bypass grafting (CABG). We visualized the suture using a small endoscope through the chest tube and incised it with the help of thoracoscopic scissors. The tube was then removed without the need for surgical exploration.


Chest tube placement is a requirement after coronary artery bypass grafting (CABG) to drain the mediastinal and pleural spaces. Although rare, this routine part of the operation is not without its own complications. For instance, simple yet devastating chest tube entrapment by means of suture does occur. It is an avoidable complication with diligent suture technique. Once it occurs, it poses a therapeutic dilemma to the attending surgeon. We present a simple and safe solution to this problem.

A 64-year-old man with known 3-vessel coronary artery disease underwent CABG. Before sternotomy closure, 2 standard 32F chest tubes were inserted into the mediastinal and left pleural spaces. In an attempt to remove the mediastinal tube on postoperative day 2, we encountered significant resistance, which led us to suspect chest tube entrapment. We inserted a small laparoscopic scissors (5 mm), together with a flexible pediatric 3-mm endoscope through the lumen (Fig. 1), and the culprit (Fig. 2) was identified and released (Fig. 3). The mediastinal tube was then removed in the usual manner without any complication. Our patient had an uneventful recovery and he was discharged home on day 6 postoperatively.

Comment

Unintentional sutured chest tube is a rare iatrogenic complication, with an incidence of 0.6% after median sternotomy [1]. Such an error is a dilemma to the attending surgeon because reopening the wound is a concern to both patient and surgeon. This minor but unforgiving mistake...