CASE REPORT

J Korean Neurosurg Soc 39 : 228-230, 2006

Severe Hypothermia Accompanying Acute Subdural Hemorrhage

Jung Goan Kim, M.D., Seok Won Kim, M.D.

Department of Neurosurgery, College of Medicine, Chosun University, Gwangju, Korea

Hypothermia is relatively a common condition and most cases involve mild hypothermia. But severe hypothermia below 30°C is medical an emergency condition. We report the case of a 41-year-old man who had been left in a manhole for more than 9 hours on a freezing cold water. He was transported to our emergency room in semicomatose state with a body temperature 26.5°C The patient was warmed with active rewarming. After initial stabilization, the patient was taken for a brain computed tomography and found to have large fronto-temporo-parietal(FTP) subdural hemorrhage. The patient underwent an emergent decompressive craniectomy and hematoma evacuation. After surgery, he recovered to drowsy mentation and vital signs were stable.

KEY WORDS : Severe hypothermia · Subdural hemorrhage.

Introduction

Hypothermia is a disease frequently encountered in emergency room and it refers to the case with the central body temperature decreased to lower than 35°C. In the cases with body temperature lower than 30°C, it is referred to as severe hypothermia, and it is a critical condition that the death rate only due to it is high, 30~80%[1], and thus it requires an aggressive diagnosis and treatments. We performed active rewarming and emergent craniotomy in an acute subdural hemorrhage(SDH) patient accompanied severe hypothermia of the rectum temperature 26.5°C and obtained a good result, hence, the case is reported here together with a review of the literature.

Case Report

A 41-year-old male patient was walking in the street under the drunken condition, fell to a manhole, discovered 9 hours later, and transferred to the emergency room at our hospital. On that day, the low temperature was -3.8°C, and the average temperature was 2.2°C.

The height of the patient was approximately 175cm, his weight was approximately 80kg, and at the time of admission, blood pressure was 100/60mmHg, pulse rate was 74 beats/min, body temperature measured by a rectum thermometer was 26.5°C, and by a tympanic membrane thermometer was 27.1°C. From now on, body temperature would be recorded by a rectum thermometer. The patient showed a semicomatose state, his entire body was cold, and the skin color was in various colors. His lip showed slight cyanosis, both breathing sound was rough, however, rale was not heard, and it expanded symmetrically. Heart sound was very irregular, but murmur was not detected. In neurological tests, the consciousness was at the level that the flexion of the arms under the semicomatose state, and in GCS, eye opening was 1 point, verbal command was 1 point, motor was 3 points. In regard to the pupils, the diameter of both eyes was 3mm/4mm, respectively, the direct as well as indirect light reflex and deep tendon reflex were not detected, and Barbinski's sign was negative.

In the peripheral blood test performed after admission, leukocytes were 17,580/mm^3 (polymorphonucleoleukocyte 90.7%) and in biochemical tests, Glucose was 322mg/dL, BUN was 25mg/dL, Creatine was 1.8mgdL, Amylase was 154U/L, and myoglobin was 1,151ng/ml and in blood coagulation test, PT was 80% (INR 1.09), aPTT was 25.2 sec (ref. 20~36sec). In arterial blood test, PH was 7.14, PCO2 was 50mmHg, PO2 was 171mmHg, Bicarbonate was 18.5mmol/L, and base ex-

• Received : July 28, 2005 • Accepted : October 10, 2005
• Address for reprints : Seok Won Kim, M.D., Department of Neurosurgery, College of Medicine, Chosun University, 588 Seoseok-dong, Dong-gu, Gwangju 501-717, Korea Tel : +82-62-220-3120, 3126, Fax : +82-62-227-4575, E-mail : chosunns@hanmail.net

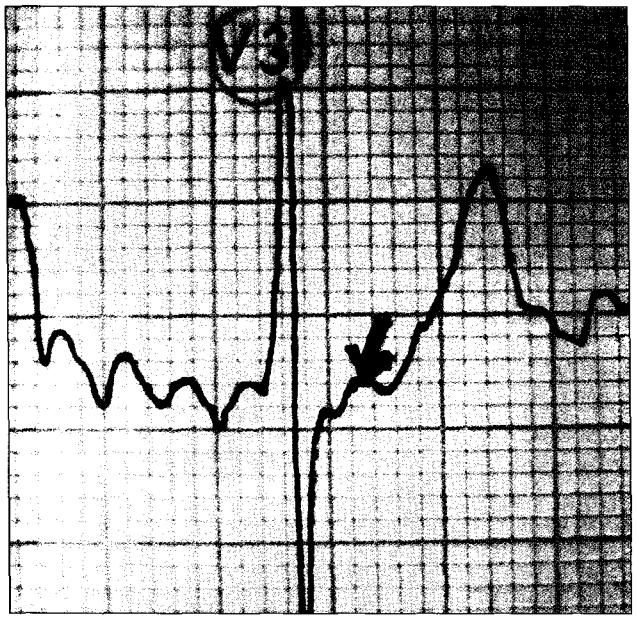

Fig. 1. EKG finding showing the Osborn-J wave which is a characteristic finding in hypothermia (black arrow).

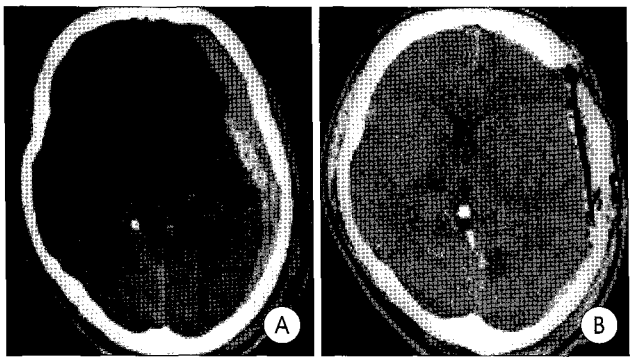

Fig. 2. Brain computed tomgraphy scans show a large left fronto-temporo-parietal subdural hemorrhage (A) and well evacuated hemorrhage after the operation (B).

cess was -10.3mmol/L. In chest x-ray, cardiomegaly or the abnormality in the lung parenchyme was not detected, and in electrocardiogram, atrial fibrillation, ventricular arrhythmia, and QT prolongation were detected, and together with the irregular rhythm of 74 times per minute, Osborn J wave finding was detected (Fig. 1).

A endotracheal tube was inserted to the bronchus, the patient was made to breath with the warm moisturized air, 43°C saline was injected intravenously, and the stomach and the bladder wash were performed. In addition, after the chest tube insertion, the left pleura was washed with warm saline. The pulse was still irregular, however, it showed the relatively more stable rhythm than at the time of admission. 2 hours 35 minutes after admission, body temperature became higher than 30°C, and thus to take brain computed tomography(CT), and in the brain CT, in the left FTP area, a large amount SDH was detected, emergent craniotomy and hematoma evacuation were performed (Fig. 2), and at the time of surgery, in regard to the vital signs of the patient, body temperature(BT) was 38°C and the heart rate(HR) was 58 beats/min. During the operation, the body temperature of the patient was raised rapidly to 40.0°C, and 48 hours after surgery, vital sign became stable, and thus he was transferred to a ward.

Discussion

Although the causality of hypothermia is diverse, it can be classified into 3 types : environmental factors, metabolic factors and drug or alcohol-induced factors[5,6]. Environmental factors include the cases about exposures to cold environment and loss of body heat due to inappropriate clothing and physical fatigue. The heat conduction of the water is high where the formation rate of cold water is rapid. Heat loss is determined by the temperature of water, yet when the temperature is lower than 10~19°C (50.8~59.8°F), hypothermia results almost all the time. Hypothermia is also caused metabolically due to the condition of the dysfunction of the release of diverse endocrine gland (hypothyroidism, adrenal insufficiency, and hypopituitarism). Hypoglycemia also induces hypothermia, which is speculated by the impairment of hypothalamic function.

The other causalities of the impairment of hypothalamic function and the central nervous system (head trauma, tumor, cerebral infarction) may interfere with the mechanism controlling body temperature. Hypothermia caused by alcohol and other drugs occurs most frequently, and it has been reported that in the cases of hypothermia related to drugs, 80% are closely related to the consumption of alcohol[2,4].

In the patient of our case, it is thought that the impairment of hypothalamic function due to the consumption of alcohol, the injury in the brain, and environmental factors was the main causality of hypothermia.

Clinical patterns manifested by hypothermia vary widely among individuals. In the mild hypothermia of 32~35°C, heart beat rate, blood pressure and cardiac output are all increased and decreased gradually as body temperature drops[7]. Osborn J-wave is a positive wave appeared at the end of QRS wave in electrocardiogram, which is a relatively characteristic finding shown in hypothermia. In the cases that body temperature was dropped to below 30°C, exposure to the risk of arrhythmia becomes more evident, and in most cases, it progresses from sinus bradycardia to atrial fibrillation, ventricular fibrillation eventually reaching the condition of asystole. Heart muscles under hypothermia are very unstable, and thus ventricular fibrillation can develop in response to a minute stimulation such as the change of posture, however, in most cases, the treatment of arrhythmia is not required since it can

return to normal upon rewarming in many cases[3]. Oxygen and intravenous fluid administered should be warm, and central body temperature, electrocardiogram and O_2 saturation must be monitored continuously.

Rewarming methods can be classified into the passive rewarning method, the active external rewarming method, and the active internal rewarming method. The passive rewarming method is to rewarm by improving the metabolic rate of patient himself, which is least stimulatory to patients using natural response.

The active external rewarming method is very effective for the elevation of body temperature, and the reported research result using the method of delivering heated air through a blanket made of paper or vinyl was proven to be effective[2]. The shortcoming is that in the case of the poor peripheral blood circulation, active external rewarming method is less effective. Due to the expansion of the peripheral blood vessels and the induction of venous congestion in hypovolemia and rewarming shock, the influx of lactate from the peripheral area to the center may result in rewarming acidosis. This is because the exacerbation of the hypoxia and acidosis within tissues due to the increased requirement of energy in the peripheral area develops before the heart secures a sufficient supply.

The active internal rewarming method has several advantages for internal organs because the heart is heated first decreasing the instability of the heart thereby resulting in the fast normalization of functions. The expansion of the peripheral blood vessels or the influx of lactate to the center is low minimizing the events of accompanied complications. The inhalation of the warm air is simple, and it can suppress the loss of calories during respiration to 30% of the total metabolism. It has been reported that washing the gastro-intestinal tract or the bladder using warm saline, washing the peritoneum using the dilysate that is heated to 40~45°C without potassium , or washing by inserting a thoracic tube to the pleura have been effective[1].

Conclusion

We performed active warming and emergent craniotomy on a drunken patient with a head trauma accompanying severe hypothermia caused complexly by enviromental, metabolic and alcohol induced factors, and obtained a good result.

References

1. Barr GL, Halvorsen Lo, Donovan AJ : Correction of hypothermia by continuous pleural perfusion. **Surgery 103** : 553-557, 1988
2. Fitzgerald FL : Hypothermia and accidental hypothermia in an alcoholic population. **West J Med 133** : 105-107, 1980
3. Koller R, Schnider TW, Neidhart P : Deep accidental hypothermia and cardiac arrest-rewarming with forced air. **Acta Anaesthesiol Scand 41** : 1359-1364, 1997
4. Loppnow G, Wilson L : Effects of ethanol on systemic hemodynamics in a swine model of accidental hypothermia. **Ann Emerg Med 34** : 3-4, 1999
5. Sadikali F, Owor R : Hypothermia in the tropics. A review of 24 cases. **Trop Geogr Med 26** : 265-270, 1974
6. Tintinelli JE, Kelen GD, Stapczynski JS : **Emergency Medicine. A comprehensive study guide,** ed 5. McGraw-Hill, 2000, pp1231-1235
7. Tveita T, Traasdal E, Ytrehus K : Alteration of autonimous cardiovascular control after rewarming from experimental hypothermia in rat. **Acta Anaesthesiol Scand Suppl 43** : 104, 1999

Commentary

The authors reported an interesting case of severe hypothermia accompanying acute subdural hemorrhage. Body core temperature was 26.5C. Although this article quoted severe hypothermia is lower than 30C, recent reports define as followings; mild hypothermia(32~35C), moderate hypothermia(28~32C), severe hypothermia(below 28C). Major abnormal findings of the case were 322mg/dL of glucose, metabolic acidosis (pH=7.14) with high oxygen level (PO2= 171mmHg), characteristic J or Osborne wave of ECG. Hypothermic patients generally are volume contracted because of cold diuresis. As a result, hematocrit may be deceptively high. Hematocrit levels increase 2% for each 1C drop in core temperature. Acute hypothermia can result in hyperglycemia, while chronic hypothermia or secondary hypothermia may present with low blood glucose. The body's coagulation mechanism often fails in hypothermia, and a disseminated intervascular coagulationtype syndrome can be present. It would be better that authors should pay more attention to these laboratory findings.

In an older review, rewarming at rates faster than 2C/h was noted to reduce mortality when compared to slower rates. For simplicity, aggressive rewarming methods can be categorized as slow, moderate, or rapid. Rapid rewarming methods provide heat at levels higher than 100 kcal/h. Methods include thoracic lavage at 500mL/min (6.1C/h), cardiopulmonary bypass (400 kcal/h or 18.0C/h), thoracic lavage at 2 L/min (19.7C/h), and warm-water immersion (1500kcal/h). Although this case used gastric, bladder and thoracic lavages, the rate of thoracic lavage was not mentioned. Although many articles suggest that IV fluids be heated to 45C (43C in this case), this temperature choice is based on convenience of previous study designs rather than hard evidence. A trial using fluids heated to 65C demonstrated more efficacy in treating severe hypothermia in other report.

I think this case shows good model of severe hypothermia accompanying head injury .

Dong Ho Kim, M.D.
Department of Neurosurgery, Chungbuk National University