Case Report

Severe hypothermia secondary to spinal cord injury without radiographic abnormality

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Case: A 64-year-old female was found lying by a river. She was unconscious and her lower body was under water. The patient was transported to the emergency room of our hospital. On arrival, her rectal temperature was 24.6°C. We immediately started rewarming and artificial respiration. Five days after admission, rewarming was completed and she became conscious and could communicate. Initially, she had been injured and examination showed paraplegia. Magnetic resonance imaging of her cervical spine showed no findings indicating bony or ligament injury, but there was a T2 high intensity area at C5/6 and C6/7 levels. The patient was diagnosed with spinal cord injury without radiological abnormality.

Outcome: At 5 months post-injury, the patient was able to walk without crutches.

Conclusion: Spinal cord injury might be missed if there are no radiographic abnormalities. Spinal cord injury without radiological abnormality should be considered as a differential diagnosis of accidental hypothermia.

Key words: Accidental hypothermia, severe hypothermia, spinal cord injury without radiological abnormality, spinal cord injury, trauma

INTRODUCTION

PRIMARY HYPOTHERMIA OCCURS when heat production in a healthy person is overcome by the stress of excessive cold. Alternatively, secondary hypothermia can occur in ill persons with a wide variety of medical conditions, including spinal cord injury (SCI).¹

Although spinal cord injury without radiographic abnormalities (SCIWORA) is thought to be rare in adults,² it has been recognized as a common cause of cervical cord injury (CCI) in Japan.³

We report a case of severe accidental hypothermia secondary to SCIWORA.

CASE REPORT

A 64-YEAR-OLD FEMALE WAS found unconscious and was transported to our hospital in an ambulance in early October 2014. She had a history of diabetes mellitus,

hypertension, and angina pectoris. She began cutting bamboo at 7:00 am. She was found by local police officers lying by a river at 10:00 pm. Her lower body was immersed in the river water. The average temperature of that day was 21.4°C.

On arrival at the emergency room of our hospital, her Glasgow Coma Scale was 9 (E2V3M4). Her vital signs showed hypotension (systolic blood pressure of 60 mmHg), bradycardia at a rate of 36 bpm., and hypothermia (rectal temperature of 24.6°C). There was an abraded wound on her forehead, but there were no other obvious signs of abnormalities. Her breath was slow and shallow. In response to pain stimulation on her chest, she could flex her elbow and shoulder only slightly but there was no movement in her lower extremities. Because of her unconscious state, no meticulous neurological examination was carried out.

Laboratory data showed slight anemia (hematocrit 33%), elevation of creatine kinase (250 IU/L), and hyperglycemia (314 mg/dL). A chest X-ray showed slight cardiac expansion. Head and whole body plain computed tomography (CT) scans showed the dilation of bilateral pulmonary vessels but no head injuries or cervical spine fractures. Because of the patient's shallow breathing and low Glasgow Coma Scale score, we immediately intubated her. In

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addition, we administered dopamine at 5 µg/kg/min as a vasopressor against her low blood pressure. We diagnosed the primary accidental hypothermia from her low core temperature and absence of any CT findings that could indicate the cause of unconsciousness.

Active external warming using a heating pad (Arctic Sun, Medivance, Inc. Louisville, Kentucky) was begun soon after diagnosis in addition to the administration of warm i.v. fluids and passive external warming. Body temperature was rapidly rewarmed to 33°C and subsequently rewarmed by 1°C per day. Mechanical ventilation was carried out and a muscle relaxant was used for preventing shivering during rewarming of her body temperature from 33°C to 35°C. Rewarming was finished 4 days after admission. The patient wore a soft collar on her neck during rewarming.

At 5 days after admission, the patient was extubated and she became conscious. It was then discovered that she was paraplegic and had disturbances of motor activities in both her hands and fingers. She could talk about the accident. She had fallen, hit her forehead, and lost consciousness. However, her unconscious state was transient and she realized she had fallen into a small river. She tried to crawl out of the river but could not because of paraplegia. Then she gradually lost consciousness.

We examined the MRI of the cervical spine (Fig. 1) 5 days after admission. Although it showed no findings indicating bony or ligament injury, there was a high intensity area at C5/6 and C6/7 levels, indicating SCI. Finally, we diagnosed SCIWORA. Three weeks after admission, the patient was transferred to a rehabilitation facility for further care.

At 5 months after the injury, the patient could walk without crutches while having residual disturbances of skilled motor activities in both of her upper extremities.

DISCUSSION

PATIENTS WITH MODERATE or severe hypothermia show various neurological manifestations, including central nervous depression and areflexia. When a patient with SCI becomes severely hypothermic, abnormal neurological signs may be masked by disturbed consciousness. With some radiological abnormalities, it is easy for us to make a diagnosis of SCI because the sensitivity of CT for detecting bone injuries is very high and CT is available in almost all modern facilities. Several authors have already reported hypothermia patients with SCI.^{1,4} In this modern era, SCI in severe hypothermic patients would only be difficult to diagnose if there was no evidence of radiological abnormality.

Two similar cases of accidental hypothermia secondary to SCIWORA have been reported. Smith *et al.* reported a case

Fig. 1. Magnetic resonance imaging of the cervical spine of a 64-year-old female with severe hypothermia, showing a T2 high intensity area at C5/6 and C6/7 levels of the spinal cord. No findings indicate bony or ligamentous injury.

of a 64-year-old male.⁵ The patient was found to be severely hypothermic with a rectal temperature of 24.9°C. He was unconscious, and his initial cardiac electrogram showed ventricular fibrillation. After regaining consciousness, he was found to be paralyzed from the neck down. Subsequent CT scans revealed no radiological abnormality and he was diagnosed with SCIWORA. Arai *et al.* reported a case of a 70-year-old female with severe hypothermia.⁶ At the time of arrival at hospital, her rectal temperature was 26.2°C. She was unconscious and rewarming was promptly carried out. Three hours after admission, her consciousness level became clear, but she was paralyzed below the C5 domain. She underwent MRI and was diagnosed with SCIWORA.

In our report, the patient was diagnosed with SCIWORA on the fifth day after undergoing MRI. Because the patient had an abrasion on her head, we should have suspected SCIWORA secondary to the hyperextension injury of the cervical spine, and we could have taken an MRI of the cervical spine and made an earlier diagnosis.

Spinal cord injury without radiographic abnormalities is thought to represent mainly a pediatric entity and its inci-

dence in adults is relatively rare. Kasimatis *et al.* reported that 7 of 166 patients (4.2%) had a radiological–clinical mismatch.² Nonetheless, in Japan, SCI without fractures and dislocations has been recognized as a common cause of CCI, especially in geriatric patients. In other words, these are equivalent to SCIWORA in the setting of cervical spondylosis or cervical canal stenosis.

Kato *et al.* reported that among 127 patients with CCI without bony injury treated at 11 institutions in Japan, the prevalence of CCI without bony injury was 32.3% among all CCIs and 0.81% among all blunt traumas. Degenerative changes and spinal canal stenosis represented important risk factors for developing CCI without bony injury. Guo *et al.* reported that there were 203 cases of SCIWORA among 869 cases of traumatic cervical spine injury in China.⁷ The morbidity rate was relatively low compared with the report from Japan.

Although not to the extent of Japan, the prevalence of SCIWORA might increase in number among countries with aging populations over the coming years. We consider SCIWORA an indispensable diagnosis of accidental hypothermia, especially in elderly patients.

If SCI is initially undiagnosed, the cervical spine would be at risk of additional damage during orotracheal intubation.⁶ Even during rewarming, protection of the cervical spine is mandatory until SCI is ruled out.

CONCLUSION

THE CAUSE OF hypothermia was initially unknown because of the patient's disturbance of consciousness. Five days after admission, the patient was diagnosed with

SCIWORA by examination of cervical MRI. We should consider SCIWORA as a differential diagnosis of accidental hypothermia.

CONFLICT OF INTEREST

NONE.

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