

CASE REPORT

A rare case of full neurological recovery from severe nonexertional heatstroke during a bedrock bath

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Abstract

We report a rare case of full neurological recovery in a 77-year-old woman with an initial Glasgow Coma Scale of 3 while taking a bedrock bath. Severe heatstroke was quickly diagnosed, and intensive treatment was immediately provided. Laboratory data showed multi-organ failure, and her electroencephalogram showed very low amplitude, indicating a poor prognosis; however, she gradually recovered consciousness, and her electroencephalogram normalized, showing a Glasgow Coma Scale of 15 at discharge. This case demonstrated that physicians should pay careful attention when withholding treatment from a patient with severe heatstroke accompanied by a poor initial electroencephalogram result and laboratory data.

KEYWORDS

bedrock bath, central sympathetic hyperactivity, electroencephalogram, heatstroke

1 | INTRODUCTION

Heatstroke is a series of systemic symptoms accompanied by hyperthermia caused by either exposure to heat or increase in body heat production because of body movement.¹ In general, the deeper the coma, the greater the likelihood of mortality.² Few studies were reported regarding heatstroke caused by bedrock bath compared to sauna. We report here a rare case of severe nonexertional heatstroke that initially showed an electroencephalogram (EEG) with very low amplitude (<10 μ V) indicating a poor prognosis, but eventuated in a full recovery.

2 | CASE REPORT

A 77-year-old woman with no declining of activities of daily living (ADL) was brought to the emergency department by ambulance

after being found with severe disturbance of consciousness and fecal incontinence while taking a bedrock bath for around 2 hours. On physical examination, she was in a deep coma with a Glasgow Coma Scale of 3, blood pressure of 93/67 mm Hg, heart rate of 175 beats per minute, regular respiratory rate of 24 breaths per minute, and a tympanic temperature of 40.1°. She had a history of untreated hypertension. A laboratory test revealed increased serum creatinine and creatine kinase at 1.38 mg/dL and 1545 IU/L, respectively. A head CT and MRI scan showed no significant lesion. All other examinations including abdominal ultrasonography, transthoracic echocardiography, lumbar puncture, and EEG disclosed no specific abnormalities. The possibility of epilepsy or encephalitis was negligible.

After detailed examination, we initiated immediate cooling and intensive care including a blood transfusion and mechanical ventilation in the intensive care unit for the treatment of severe heatstroke.

Shogo Sagisaka and Hidetaka Tamune equally contributed to this study.

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Tracheal intubation was performed and a sedative and analgesic were also administered. Despite intensive medical care, her clinical course was severe as shown in Figure 1A. Her initial SOFA score at hospitalization was 8 and reached a peak of 16 on hospital day 4.

On hospital day 4, severely fluctuating blood pressure was found without certain causes. Her vital signs showed hypertensive crisis without counter-regulation of heart rate, followed by the consecutive circulatory collapse every 2 hours, shown in Figure 1B. It was similar to "autonomic storm" found in amyotrophic lateral sclerosis, suggesting that limbic system may have been involved.³ The fluctuating blood pressure probably due to central sympathetic hyperactivity quitted on hospital day 5 without life-threatening events.

On hospital day 5, sedation using midazolam was discontinued. Despite the discontinuation, she remained unconscious for the following 2 days, and her EEG on the day 6 showed very low amplitude (<10 μ V, Figure 2), suggesting an unfavorable prognosis. (Over 98%

of the patients with this type of EEG died.⁴) As per her family's wishes, treatment was withheld and further attempts at resuscitation were discontinued.

However, contrary to our expectations, the patient responded to intensive supportive care. She gradually recovered consciousness on hospital day 8 and was extubated on hospital day 11 with a Glasgow Coma Scale of 15. Her EEG eventually normalized, and she was discharged. She had no significant neurological sequelae. Mini-Mental State Examination score was 29 at 2 years after discharge.

3 | DISCUSSION

A bedrock bath is similar to a sauna but differs in the way it heats the body. The bedrock bath does not use water; instead, the bather lies on a flat stone, which is heated to around 50°. The room temperature is maintained at 40–45°, and the humidity is maintained

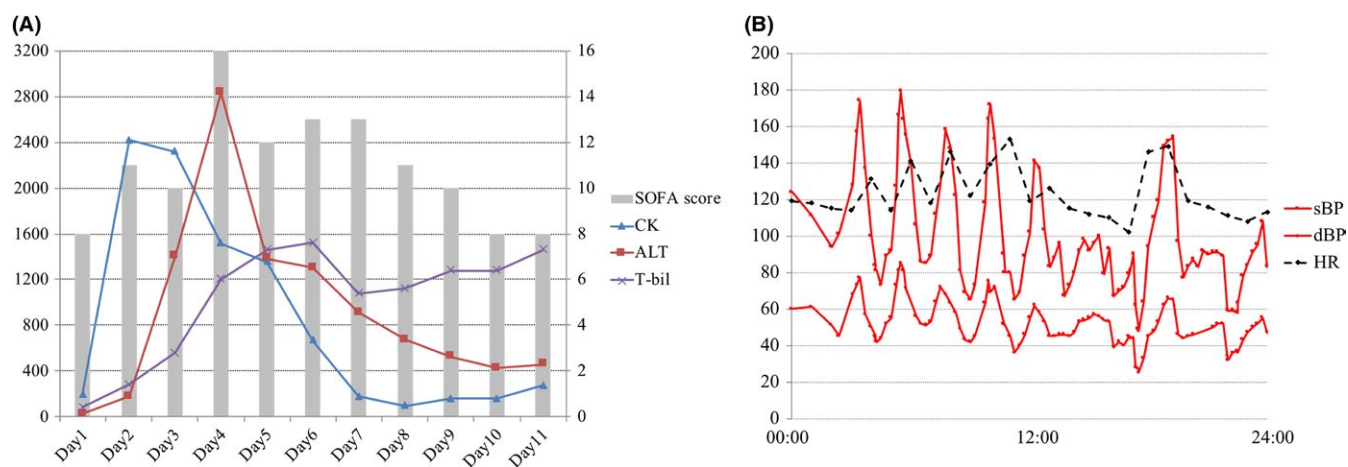


FIGURE 1 Clinical course. A, Successful extubation on day 11 after peak SOFA score of 16. B, Severely fluctuating blood pressure, hypertensive crisis without counter-regulation of heart rate followed by consecutive circulatory collapse every 2 h, was observed on day 4. ALT, alanine aminotransferase (IU/L, left axis); CK, creatine kinase (IU/L, left axis); dBP, diastolic blood pressure (mm Hg); HR, heart rate (/min); sBP, systolic blood pressure (mm Hg); SOFA score (right axis); T-bil, total bilirubin (mg/dL, right axis)

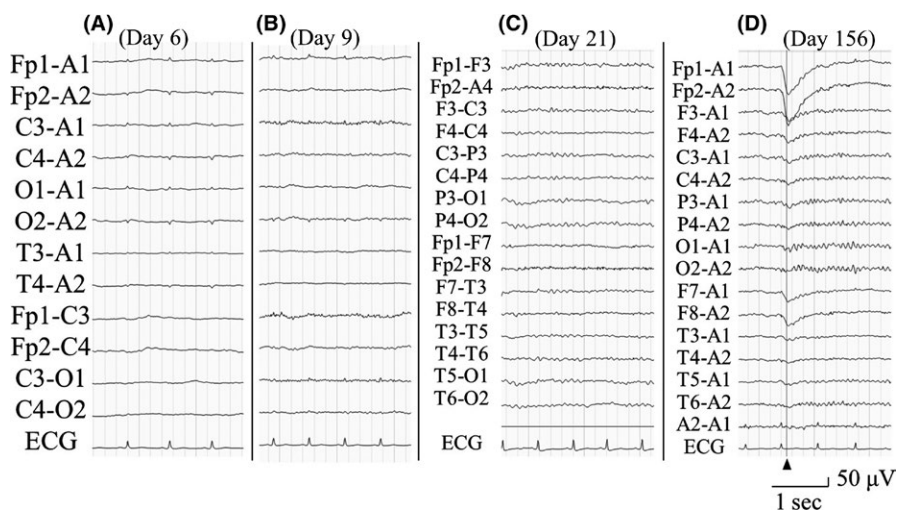


FIGURE 2 Recovery course of electroencephalograms. A, The amplitude was lower than 10 μ V. B,C, Gradual recovery. D, Alpha attenuation got fully revived (arrowhead, eye-opening). Filters: time constant, 0.1 s; high-cut filter, 70 Hz

at about 40%, creating what is believed to be a more comfortable environment than a sauna. During a bedrock bath, the heated stone emits far-infrared rays, which warm the body without steam or water. Although Hannuksela et al⁵ have reported the risks of sauna bathing, only one case report in Japanese on nonexertional heatstroke during a bedrock bath exists.⁶ Our case demonstrated that falling asleep in a bedrock bath might cause central sympathetic hyperactivity, which sometimes results in sudden death as a result of circulatory collapse.³

Furthermore, there are few studies focusing on the relationship between heatstroke and EEG. In this case, the duration of the sedation-free time was almost 36 hours on hospital day 6. We could have used flumazenil to reverse the sedation, and discontinuation period of midazolam injection was sufficient not to affect EEG regardless of the liver dysfunction.⁷ Although further studies are needed, our case demonstrated that the prognosis of patients with heatstroke may be unrelated to poor EEG findings, laboratory data, unknown causes of sympathetic hyperactivity, or poor state of consciousness. Careful attention should therefore be paid even after withholding treatment.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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