MECHANISM OF SEVERE HYPOTHERMIA INDUCED IN A COOL ENVIRONMENT IN A YOUNG FEMALE PATIENT

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A 17-year-old female patient (height 151.9 cm, body mass 52.3kg) suffering from severe hypothermia was admitted to the Pediatrics Department, Kanazawa University Hospital in winter (February) of 1998. Body temperature (axillary temperature), heart rate and systolic and diastolic arterial blood pressures at admission were 31.8°C, 40bpm and 84 and 42 mmHg, respectively. There were no particular abnormalities in the other routine physical examinations except for her slow body movement due to hypothermia. In subsequent studies, thermogenic hormone levels, such as plasma thyroid hormones and urinary catecholamines, were judged to be within normal ranges and brain MRI showed no specific changes in the hypothalamus and pituitary regions. According to a questionnaire, the patient had not noticed a fall in her core temperature during the episode of severe hypothermia, while, in a hot environment and during exercise, she could feel hot and perspire. We then investigated thermoregulatory function of the patient after obtaining informed consent of the patient and her parents in summer of the same year. The patient, wearing T-shirt and shorts, entered a climatic chamber and was seated on a chair at an ambient temperature (Ta) of 28°C and a relative humidity of 60%. Re tal and skin (7 sites) temperatures, heart rate and oxygen consumption were measured. After a 30-min rest, the Ta of the chamber was decreased to 24°C in 20 min and the new Ta was maintained for following 100min. The rectal temperature of the patent gradually decreased even at the Ta of 28°C and became 35.6°C at the end of the test. The fall in rectal temperature was associated with reductions in heart rate and skin temperatures. Clear vasoconstriction was seen only in the foot when rectal temperature reached ca. 36.0°C. Oxygen consumption of the patient did not increase regardless of the hypothermia, but slightly decreased. Indeed, no shivering was induced throughout the test. In a different series of studies, the patient's serum was intraperitoneally injected into rats, which were chronically implanted with a temperature transmitter for telemetry system. The serum produced a marked and short-lasting fall in core temperature. The fall in core temperature was consistent when dialyzed serum (69kD cutoff) was injected into rats. Taken together, it appears that the threshold core temperatures for thermogenesis and vasoconstriction of the patient shifted to extremely low levels, which then resulted in the severe hypothermia in a cool environment. We speculate that the patient may have produced unknown cryogenic substances with a large molecular size.

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