Cerebral regional oxygen saturation does not change according to body temperature during the rewarming phase after accidental hypothermia

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Purpose of this study:

Previous studies have shown that hypothermia reduces the cerebral metabolic rate of oxygen. If cerebral regional saturation of oxygen (rSO_2) accurately reflects the oxygen balance in the cerebrum, **the value of rSO_2 would decrease during the rewarming process**. The objective of this study was to evaluate the change of rSO_2 during rewarming in patients with accidental hypothermia.

Material and methods:

This study was conducted at a single emergency and critical care center in Japan from October 2017 to March 2018. We included adult hypothermia patients aged ≥ 16 years. Hypothermia was defined as a core temperature of less than 32°C . After hospital arrival, patients were rewarmed at $+1$ to 2°C per hour, and rSO_2 was prospectively monitored throughout rewarming with a TOS-OR device (FUJITA MEDICAL INSTRUMENTS CO., LTD., Tokyo, Japan). We did not use any anesthetics (sedatives or analgesics) and catecholamine at all.

Results:

Table 1. Patient characteristics (n=5)

Variables	
Age (years)	70.6 ± 14.2
Sex (male/female)	4/1
Initial core temperature ($^\circ\text{C}$)	26.8 ± 1.1
Hemoglobin (mg/dl)	11.2 ± 2.6
Lactate (mmol/l)	5.0 ± 4.1
PaO_2 (mmHg)	178 ± 103

Data are shown as mean $\pm$ SD or number.

Figure 1. The serial change of cerebral rSO_2 during the rewarming process in representative case. HR, heart rate; MAP, mean arterial pressure.

Figure 2. Serial changes in cerebral rSO_2 , heart rate (HR) and mean arterial pressure (MAP) during the rewarming process in five patients.

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We could measure serial changes in cerebral rSO_2 in five patients with moderate to severe hypothermia. The mean age of the patients was 70.6 years, and the mean initial core temperature was 26.8°C . In all cases, rSO_2 remained within almost normal range and did not change according to changes in body temperature. SpO_2 and PaO_2 did not change at all during the rewarming phase.

Discussions:

Our data suggests that higher temperatures (34 – 36°C) such as those of mild therapeutic hypothermia may have less of an influence on rSO_2 .

CBF, Cerebral blood flow; $CMRO_2$, Cerebral metabolic rate of oxygen

Figure 3. Schema of the change in oxygen supply and demand according to body temperature.

Conclusions:

Contrary to our expectations, body temperature (28 – 37°C) did not affect cerebral rSO_2 during the rewarming process in the patients with hypothermia.

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