

Pre-clinical demonstration of a portable intranasal brain cooling device for rapid traumatic brain injury treatment

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Background

- Therapeutic hypothermia (TH) can reduce cerebral edema and prevent encephalopathy during traumatic brain injury
- The systemic side effects of TH are a significant barrier to implementation
- **Intranasal brain cooling:** a minimally invasive technique to reduce brain temperature in a targeted, localized manner

Approach

ICEPICC (Intranasal Cooling for Encephalopathy Prevention in Combat Casualties): a portable system for providing cooled airflow to lower brain temperature to normothermic and therapeutic hypothermic ranges.



Figure 1: ICEPICC system with tympanic membrane temperature probe and cannula connection.

Methods

As part of preclinical experimentation, ICEPICC was tested in an animal (porcine) model.

1. Pigs were sedated for the duration of the experiment, then intubated and instrumented.
2. Baseline temperatures and relevant physiological parameters were recorded prior to initiating cooling, and continuously throughout the experiment.
3. Cooling was initiated for a period of 4 hours – air temperature 5-10° C, flow rate 25 L/min.
4. Cooling was halted and rewarming was initiated until the pigs returned to baseline brain temperature.

Effects on porcine model

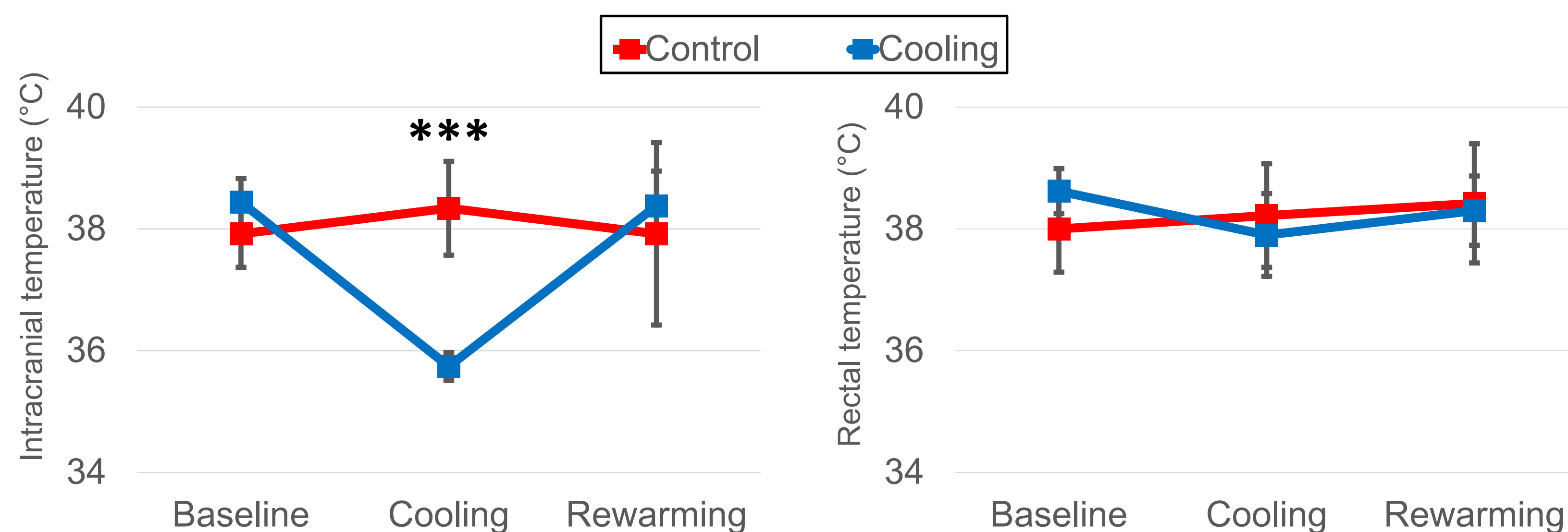


Figure 2: Recordings of intracranial (left) vs. rectal (right) temperature throughout cooling and rewarming process. Mean (n = 5) ± SD; ***: p < 0.001

- Cooling was rapid, with 50% (1.4°C) of total temperature change within 14 minutes.
- Laser Doppler perfusion and cerebral blood flow were not significantly different.

Conclusions and future directions

This animal study demonstrate the safety and effectiveness of targeted brain cooling in a healthy porcine model.

Next steps:

- Evaluating the device in humans in a hospital setting (Pilot Study)
- Developing a platform to correct brain temperature in febrile patients within the clinic as well as at point of injury outside of the clinic for fast, focal, brain cooling

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