Japanese study abstract

Relative clinical heat transfer effectiveness: Forced-air warming vs. Conductive fabric electric warming

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Background:
The heat transfer capability for patient warming technologies under clinical conditions is largely determined by two factors: 1.) Conductive vs convective; and 2.) The amount of body surface area in contact with the heat. Forced-air warming (FAW) relies on convection and is limited to the area under a single blanket. Recent study by Sessler et al, showed that FAW is at best, minimally effective; with 50% of patients experiencing hypothermia for 2 hours after induction.[1]
A new warming technology, conductive fabric electric warming (CFW) relies on conductive heat transfer and roughly doubles the body surface area in contact with the heat by using both a blanket over the patent and a heated mattress under the patient. In this study we are comparing the relative clinical heat transfer by holding all of the other relevant variables constant, including: warming temperature set point, warming duration, surgical exposure and patient demographics.

Methods:
We prospectively randomized 41 patients undergoing GI surgical procedures lasting more than 2 hours into 2 groups: 1.) FAW Group (n=20); treated with a WarmTouch™ (Covidien) upper or lower body blanket. 2.) CFW Group (n=21); treated with a HotDog™ (ATM) upper or lower body blanket plus an underbody heated mattress. Both warming technologies were set at 39°C, we relied on the manufacturer for the accuracy of that delivered temperature. The warming mattress in the CFW Group was energized when the patient entered the OR. The warming blankets in both groups were energized when the patient was "draped."

Tympanic temperatures (CE Thermo™, Nipro) were recorded starting when the blankets were energized. All patients received an anesthetic that included: propofol, fentanyl, an inhalation agent and Remifentanil. Statistical significance was determined by the Friedman test. Exclusion criteria were: ASA 3 and 4, BMI (kg/m^2) <17 and >30.

Results:
The FAW Group started at 36.53±0.36°C and ended at 36.57±0.49°C after 120 min. of warming—a warming rate of 0.01°C/hr. The CFW Group started at 36.51±0.39°C and ended at 37.20±0.49°C after 120 min. of warming—a warming rate of 0.35°C/hr. The temperature difference between the two groups was statistically significant at each data point after 30 min. ($p<0.05$).

Conclusions:
In this small study, CFW showed significantly higher patient warming rates than FAW (0.35°C/hr vs 0.01°C/hr), when all other relevant variables were held constant. We conclude from these data that the clinical heat transfer effectiveness of CFW (HotDog™) is significantly greater than FAW convection (WarmTouch™). This is due to the combination of conductive heat transfer and the larger surface area of simultaneously heating from above and below the patient.

References:
1. Sun Z et al. Intraoperative Core Temperature Patterns, Transfusion Requirement, and Hospital Duration in Patients Warmed with Forced Air. Anesthesiology 2015;122:276-85.

All authors have no competing interests.

Summary

We compared heat transfer of forced-air warming(FAW) with conductive fabric electric warming(CFW) in patients undergoing GI surgery under general anesthesia. CFW transferred more heat than did FAW,during the first hour of warming. Recovery from redistribution hypothermia after anesthesia induction was faster in the CFW group. CFW may be an alternative to FAW.

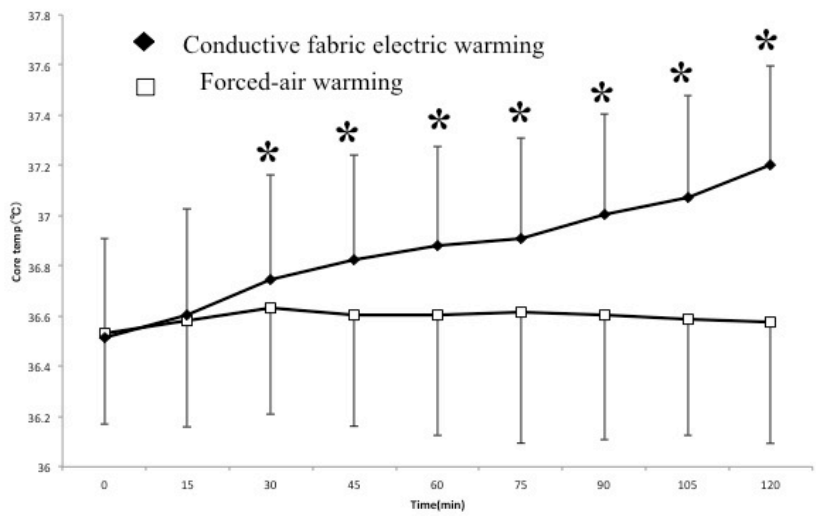

Fig.1 Core temperatures after warming. Temperatures were recorded at 15-minute intervals. Results are shown as means ±SD. The temperature difference between the two groups was statistically significant at each data point after 30 min. ($p<0.05$).