ORIGINAL ARTICLE

"Keeping Them Warm"—A Randomized Controlled Trial of Two Passive Perioperative Warming Methods

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Purpose: *Inadvertent perioperative hypothermia is a common problem for patients undergoing surgery. Heat redistribution from the body's core to the periphery after induction of anesthesia is the major contributor.*
Design: *A prospective randomized controlled trial was conducted to determine if reflective blankets are more effective than cotton blankets in reducing the core-peripheral temperature gradient and increasing peripheral compartment heat content during the preoperative phase among adult patients undergoing elective surgery of less than 1 hour. About 328 adult patients undergoing general anesthesia were randomly allocated into two groups.*
Methods: *Data were analyzed using independent* t *tests for continuous variables and chi-square tests for categorical variables.*
Finding: *There was a significantly smaller reduction in temporal artery/foot temperature gradient (1.13 vs 1.64°C,* $P < .001$*) and a significant increase in foot temperature (0.64 vs 0.11°C,* $P < .001$*) in the reflective blanket group.*
Conclusions: *Reflective blankets are more effective than cotton blankets in warming patients' periphery and reducing core-peripheral temperature gradient preoperatively.*
Australian New Zealand Clinical Trials Registry Number: *ACTRN1261 4000931673 (retrospective registration).*

Keywords: *hypothermia, perioperative hypothermia, prewarming methods, inadvertent perioperative hypothermia, randomized controlled trial.*

INADVERTENT PERIOPERATIVE HYPOTHERMIA (IPH) is a well known and thoroughly costed complication of anesthesia and surgery.[1-4] Operating theaters are cold places, and the importance of keeping patients warm is often underestimated.[1] Hypothermia is defined as a body core temperature below 36°C. Mild hypothermia is classified as temperatures of 34 to

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36°C.[1,3] The UK National Institute for Health and Clinical Excellence describes IPH as a common but preventable complication of perioperative procedures that is associated with poor outcomes for patients.[1] These poor outcomes include surgical site infections, prolonged surgical wound healing,[5] reduced platelet functioning, increased intraoperative blood loss, and prolonged effects of general anesthesia.[1,3,4,6,7] In severe hypothermia, below 34°C, the incidence of ventricular tachycardia and morbid cardiac events triple.[1,4,6-8]

IPH also affects a patient's comfort and satisfaction. Patients frequently report feeling cold preoperatively, which can contribute to increased anxiety about various aspects of surgery.[2,3,6,9,10]

Factors Contributing to Perioperative Hypothermia

The administration of general and regional anesthesia compromises the patient's ability to regulate body temperature, even during short procedures.[1,6] During the first hour, the core temperature can decrease by 1.6°C, of which 81% is attributed to redistribution of body heat from the core to the periphery and only 19% to environmental factors.[2,8,11]

There are reported benefits from preoperative or pre-emptive warming.[2,3] By increasing energy content in the peripheral thermal compartment through prewarming, mean body temperature can be raised, and patients will maintain higher intraoperative temperatures.[3] Horn et al[12] found that the core temperature of patients who were not prewarmed declined more than with prewarming, despite active warming during the surgical procedure. Even 10 minutes of prewarming was sufficient to prevent hypothermia. Longer periods of 20 or 30 minutes of prewarming neither did changed the absolute core temperature profile nor did it significantly reduce the proportion of postoperatively hypothermic patients.

In awake individuals, preoperative skin warming minimally alters core temperature, but it does increase body heat content and peripheral tissue temperature. Such prewarming should minimize redistribution hypothermia during subsequent induction of anesthesia.[3,13] However, when the outer region of the body becomes warmer, vasodilation can lead to increased heat loss. To prevent this, adequate passive thermal care is necessary.[3]

Warming Mechanisms

Much research has focused on sophisticated active warming methods, such as forced air warming devices, circulating water garments, and energy-transfer pads.[1,6,7] Although active warming has proven benefits, many of these methods require long exposure times.[1,14] For shorter procedures, passive methods applied before anesthetic induction could provide an alternative by reducing the core to periphery temperature gradient and reducing heat redistribution.[2] However, there is little evidence comparing different passive warming methods.[1]

Passive Warming Methods

Many hospitals cover patients with warmed cotton blankets to provide thermal comfort once they change into a cotton gown.[3,4] However, as the warmth dissipates within 5 to 10 minutes, the blankets are frequently changed, with significant resourcing requirements in both nursing time and utilities to heat the blankets.[10,14,15]

Reflective blankets comprise metalized plastic sheeting, which acts primarily as insulation not only by reducing the heat loss caused by radiation but also by reducing convectional loss by minimizing draughts.[16]

A National Institute for Health and Clinical Excellence review of management of IPH found only weak evidence for the use of reflective modalities preoperatively and recommended that large randomized controlled trials be undertaken.[1] Here, we present results from a trial comparing reflective and cotton blankets.

Objectives

The primary objectives of this study were to determine if thermal insulation with reflective blankets would be more effective than cotton blankets in adult patients undergoing surgery of 1 hour or less in: