Comparing New-Technology Passive Warming Versus Traditional Passive Warming Methods for Optimizing Perioperative Body Core Temperature

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ABSTRACT

Hypothermia puts surgical patients at risk for adverse outcomes. Traditional passive warming methods are mostly ineffective in reducing hypothermia. New-technology passive warming holds promise as an effective method for promoting and sustaining normothermia throughout surgery. The purpose of this retrospective cohort study was to compare the effectiveness of new-technology passive warming with traditional methods. We measured core body temperature at anesthesia induction and at the end of surgery for patients undergoing robotic-assisted prostatectomy/hysterectomy in the lithotomy position who received either new-technology passive warming (n = 30) or traditional linens and gel pads (n = 35). The traditionally warmed cohort had no change in temperature (35.9° C ± 0.6° C presurgery vs 35.9° C ± 0.7° C postsurgery; $t = 0.47$; $P = .66$). The intervention cohort showed a significant increase in temperature (35.75° C ± 0.52° C presurgery vs 36.30° C ± 0.53° C postsurgery; $t = 4.64$; $P < .001$). A repeated-measure analysis of variance adjusting for surgery duration and fluid administration confirmed the significance ($F = 17.254$; $P < .001$), suggesting that new-technology passive warming may effectively complement active warming to reduce perioperative hypothermia. *AORN J* 102 *(August 2015) 183.e1–183.e8. © AORN, Inc, 2015. http://dx.doi.org/10.1016/j.aorn.2015.06.005*

Key words: *hypothermia, perioperative, passive warming, lithotomy position, prostatectomy, hysterectomy.*

The OR environment has been considered an extreme environment for patients because of its cold temperature that contributes to patient heat loss and hypothermia.[1,2] Hypothermia puts patients at risk for many adverse outcomes.[3,4] Passive warming methods are used concomitantly with active warming methods to promote normothermia in patients during surgery.[5] Passive warming methods traditionally involve wrapping patient extremities with blankets, linens, and gel pads. However, these passive methods are mostly ineffective in reducing heat loss.[6] Technological advances in passive warming materials and devices may improve their effectiveness in keeping patients warm and reducing the risk for hypothermia.

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STATEMENT OF PURPOSE

While technologically advanced warming devices show promise as an effective method for passive warming, limited evidence exists on which to base practice. The purpose of this study was to compare one new-technology passive warming device with traditional passive warming, consisting of gel pads and linens, for maintaining optimal core body temperature in the OR.

RESEARCH HYPOTHESIS

We hypothesized that patients with new-technology passive warming would have higher core body temperatures by the end of surgery than patients with traditional passive warming methods.

STATEMENT OF SIGNIFICANCE TO NURSING

Perioperative nurses are critical to promoting best practices for keeping patients safe during surgery.[7] AORN has developed recommended practices for perioperative nurses to prevent unplanned hypothermia. These include the selection of appropriate equipment, appropriate uses of warming devices, and use of evidence in determining best practice.[8,9] However, little evidence guides the effective use of passive warming methods to promote normothermia. Studies are needed to address this gap. The preliminary data from this study provide information to the perioperative nurse and OR surgical team when considering the most effective passive warming method to improve the patient experience and prevent the risk for adverse patient outcomes.

LITERATURE REVIEW

The cold temperature of the OR environment contributes to patient heat loss because of temperature gradient differences between the patient's body and the ambient temperature.[10,11] Patient warming to maintain normothermia has become a standard part of the overall care of surgical patients to reduce complications attributed to perioperative hypothermia.[4] However, maintaining normothermia is a challenge in certain clinical scenarios, such as surgeries on patients in lithotomy positions (prostate, colon resections, hysterectomy), liver transplantation surgery, and open heart and trauma surgeries. The risk for these patients is hypothermia, or a body temperature less than 36° C (96.8° F), which has been shown to occur in 50% to 90% of all surgeries.[6,9] Hypothermia puts patients at risk for many adverse outcomes, including but not limited to prolonged postoperative recovery from anesthesia, suboptimal enzyme function, surgical site infection, increased perioperative blood loss, delayed wound healing, and increased cardiac morbidity events, including ventricular tachycardia.[3,11-14] Perioperative hypothermia results in part from patient skin surfaces that cannot be covered by active and passive warming methods in the OR. These peripheral thermal compartments, which can be 2° C to 4° C (3.6° F to 7.2° F) lower than core temperature, can rapidly dissipate total-body heat content up to 30% to 40% if not prevented or reduced.[15,16] Other mechanisms of perioperative hypothermia include the cooling effect of anesthetic gases, IV fluids, and the patient's reduced heat production because of lowered metabolic activity.[6,17]

To effectively maintain normothermia in surgical patients, both active and passive warming methods are typically used. Active methods include heated humidifiers, warmed IV fluids, circulating-water blankets and mattresses, and warming devices such as forced-air warmers that blow warm air into a blanket placed over the patient.[3,6,18] These active heating methods are effective in maintaining normothermia and have few complications.[11] Passive warming methods involve wrapping patient extremities with blankets, linens, and gel pads. However, these methods have been found to function poorly because of the porous nature of the linens and because as gel pads cool, they begin to add to heat loss, rather than protect from it.[6] This heat loss can be difficult to regain because of the limited skin surface available for active warming to rewarm the patient. The overall heat gain by active warming is usually inadequate to compensate for the greater heat loss via the extremities and the lower body.[10,14,19]

New passive warming devices have been developed by the US military for transporting trauma patients in adverse conditions, which incorporate insulation, wind-proofing properties, and reinforced and composite fabrics.[20] These new-technology passive warming devices may provide superior passive warming by reducing or preventing the peripheral heat loss at the beginning of and throughout surgery by effectively covering and insulating the peripheral compartments to allow the heating mechanism of forced-air warming (active warming) to keep the core thermal compartments warm.

METHODS

We conducted a retrospective observational cohort study comparing core body temperature outcomes for patients receiving one of two types of passive warming methods: new-technology passive warming or traditional passive warming consisting of linens and gel pads.

Operational Definitions

Hypothermia is defined as a core body temperature less than 36° C (96.8° F).[11,14]