

Preoperative Pre-warming versus No Preoperative Pre-warming and Intraoperative Hypothermia: An Evidence-Based Practice Analysis

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Introduction

Inadvertent perioperative hypothermia occurs in approximately 50% to 70%¹ of all surgical patients, and is a risk for anyone undergoing general or neuraxial anesthesia,^{2,3} yet it can be prevented. Hypothermia is defined as a core body temperature of less than 36 degrees Celsius.¹⁻¹⁰ Body temperature is regulated by the hypothalamus.² Once anesthesia is induced, the body's ability to regulate temperature is reduced⁴ and the body's ability to produce heat is decreased.¹ General and neuraxial anesthesia have a vasodilatory effect to the body, which causes a core-to-peripheral shift in body heat.^{1,2} This redistribution of heat contributes to 65%-81%⁴ of the total decrease in core temperature. Core temperatures can decrease 1.6 degrees Celsius within the first hour⁴, and the average patient has a core heat temperature loss of 1 to 3 degrees Celsius.⁵ The most clinically relevant site for measuring normothermia is the blood flow to the hypothalamus in the brain.² The gold standard for invasive core temperature monitoring is the pulmonary artery.^{2,3} Since it is not feasible to monitor pulmonary artery temperatures, tympanic, esophageal, and nasopharyngeal temperatures are used as reliable measurements.² In general anesthesia esophageal temperature measurements are preferred because of the proximity to the aorta.²

Hypothermia is important to anesthesia providers due to the possibility of adverse events in the perioperative setting related to low body temperatures. These adverse events include: increased blood loss,^{2,6} increased wound infections,^{1,2,6,8} pressure ulcers,² cardiac events,^{2,4,6} increased hospital costs,⁵ increased length of stay,⁵ alterations in drug metabolism,³ prolonged effects of anesthesia³ and muscle relaxants,^{1,7} decreased metabolic rate,¹ shivering,^{1,6,8} coagulation and platelet function abnormalities,^{2,6,8} metabolic acidosis,^{1,8} and reduced patient satisfaction.^{2,5} Not only can the maintenance of normothermia during the perioperative period reduce these risks, but also can reduce care costs by \$2500 to \$7000 per patient.^{1,3} Pre-warming patients prior to the induction of anesthesia does not increase core temperatures,⁷ but instead increases peripheral heat, thereby decreasing the core-to-peripheral redistribution of body heat after the induction of anesthesia.^{2,3,7}

Purpose Statement

The purpose of this evidence based practice analysis is to examine if pre-warming patients prior to general and/or neuraxial anesthesia has an effect on perioperative hypothermia.

Methodology

A population, intervention, comparison, and outcome (PICO) question was determined to review the current literature regarding preoperative pre-warming and perioperative hypothermia. The PICO question constructed was: "In adults undergoing general and/or neuraxial anesthesia, does the addition of preoperative pre-warming compared to no preoperative pre-warming have an effect on intraoperative hypothermia?"

A literature review of current research was conducted using the following electronic databases: Medline, PubMed, CINAHL complete, Cochrane Library, and SCOPUS. Years included were studies from 2010 to 2018. Key words that were searched included: “prewarming”, “pre-warming”, “preoperative”, “hypothermia”, “active warming”, and “preventing perioperative hypothermia”, “anesthesia”, “prevention”, and “intraoperative hypothermia.” The search yielded approximately 227 studies from the various electronic databases. Studies were excluded if they were not in English, did not include prewarming of patients, studies that did not utilize general or neuraxial anesthesia, studies outside of the date range, and reviews. After careful review, 6 studies met the inclusion criteria for this evidence based practice analysis.

Literature Review

A randomized explorative parallel-group study by Erdling and Johansson² was conducted to compare two intraoperative temperature measurement techniques evaluating 2 groups of patients with and without pre-warming. The study included 43 American Society of Anesthesiologists (ASA) physical status I or II patients undergoing elective colorectal surgery under combined general and regional anesthesia for a duration of at least 210 minutes. Patients included adult males and females between the ages of 32 to 92. Patients were randomly assigned to either Group A or Group B, in which Group A received preoperative and intraoperative warming (n=21) and Group B received intraoperative warming only (n=22). All patients were monitored with both nasopharyngeal and esophageal temperature probes. Patients were brought into the operating room (OR) where a baseline temperature was achieved using a nasopharyngeal probe inserted approximately 6 to 8 cm beyond the nostrils, based on the individual’s nose-to-ear distance. An epidural catheter was then inserted in all patients, and pre-warming for Group A (n=21) was then initiated. Patients were pre-warmed for 42 minutes using a forced-air warming device set to 43 degrees Celsius, before the test dose was given. Epidural anesthesia was started at 3 to 6 mL with 20 mg/mL of mepivacaine and 5 mcg/mL epinephrine just before the induction of general anesthesia. General anesthesia was initiated and an esophageal temperature probe was inserted immediately following intubation. Intraoperative warming was continued for Group A, and initiated for Group B (n=22) after surgical preparation was completed. All fluids were warmed to 39 degrees Celsius. All patients were hypothermic prior to the start of anesthesia (<36 degrees Celsius). At 210 minutes, mean temperatures differences were statistically significant in both esophageal Group A ($36.5^{\circ}\text{C} \pm 0.6$) and (Group B $35.8^{\circ}\text{C} \pm 0.7$), ($P=.001$); and nasopharyngeal Group A ($36.7^{\circ}\text{C} \pm 0.6$), Group B ($36.0^{\circ}\text{C} \pm 0.6$), ($P=.002$) probe measurements. This study concludes that pre-warming has a positive effect on core temperatures and even a short amount of pre-warming time may benefit the patient and prevent unplanned perioperative hypothermia.

Rosenklide et al.³ conducted a case-control study using the results from 2 cross-sectional studies to identify the incidence of unintended perioperative hypothermia for 60 patients greater than or equal to age 18, ASA physical status I or II, undergoing elective primary hip or knee arthroplasty under spinal or general anesthesia. Patients were divided into 2 groups of 30; the intervention group was pre-warmed between 30 to 45 minutes prior to induction of anesthesia with a BARRIER EasyWarm self-warming blanket at 44 degrees Celsius and the control group was given 2 warm cotton blankets. After induction, both groups received an upper body forced air warmer (Bair Hugger) set at 43 degrees Celsius. Baseline temperature measurements were taken

orally, and every 30 minutes after baseline until patient arrival in the post-anesthesia care unit. Guidelines have identified pulmonary artery catheter temperatures as the gold standard, so each oral temperature measurement added 0.5 degrees Celsius to increase the accuracy of measurements. None of the patients in the intervention group arrived in the preoperative holding area hypothermic (<36 degrees Celsius) and 10% (n=3) of the control group arrived in the preoperative holding area hypothermic. Mean core temperatures for the intervention group at 30-, 60-, and 90- minute time intervals were strongly significantly higher than the control group ($P<0.01$) and significantly higher than the control group at the 120-minute time interval ($P<0.05$). The largest significant temperature difference in the 2 groups was 0.57 degrees Celsius at the 30-minute interval ($P<0.01$) and the smallest difference was 0.3 degrees Celsius at the 90-minute interval ($P<0.01$). This study concludes that in patients undergoing hip or knee arthroplasty, under general or spinal anesthesia, pre-warming with a self-warming blanket and intraoperative forced air warming can prevent the initial drop in core temperatures after the induction of anesthesia, and reduce the incidence of perioperative hypothermia.

A prospective, randomized, multi-center controlled study conducted by Perl et al.¹⁰ looked at 68 ASA physical status I, II, or III patients undergoing general anesthesia for abdominal, lower limb, upper limb, chest, head and neck surgeries. The duration of the surgery ranged from 30 to 120 minutes. The 68 patients were divided into 3 groups via randomization from a computer generated list: control group A (n=30); passive pre-warming group B (n=20); and, active pre-warming group C (n=18). Control group A was given a hospital duvet prior to anesthesia, while passive pre-warming group B was given a mistral-air premium warming suit, and active-warming group C was given a mistral-air premium warming suit connected to a forced air warmer and actively warmed for 30-60 minutes prior to the induction of anesthesia. Intraoperatively, all groups were actively warmed with forced air warmers set to the maximum temperature and IV fluids were warmed to 37 degrees Celsius. Oral temperature probes were used to measure temperatures preoperatively and postoperatively, while an esophageal probe was placed intraoperatively in the distal esophagus. Measurements were taken 5 minutes after the induction of anesthesia and every 15 minutes until the completion of surgery. Group C core temperatures were significantly higher than both group A and group B at 15-, 30-, 45-, 60-, and 75-minutes after induction, as well as the end of surgery ($p<0.05$). The actively pre-warmed group C had no incidence of hypothermia by the end of surgery (n=0/18), which was significantly lower ($p<0.05$) than the control group A (n=8/30). There was no significant difference in hypothermia between group B (n=4/20) and group C (n=0/18). This study concluded that only active pre-warming demonstrated an advantage in preventing perioperative hypothermia.

A randomized control study by Horn et al.⁸ looked at 200 adult patients, ASA I or II undergoing general anesthesia for greater than 30 minutes and less than 90 minutes. The surgeries included laparoscopic cholecystectomies, inguinal hernia repairs, breast surgeries, minor orthopedic surgeries and ENT surgeries. Patients were randomly divided into 4 groups by rolling a die. Patients in the control group (n=55) received passive warming, and the other three groups received active warming for 10- (n=52), 20- (43), or 30-minutes (n=50) pre-operatively. There was 20 minutes between pre-warming and the induction of anesthesia. Intraoperatively, forced air warming was initiated in all patients who became hypothermic (<36 degrees Celsius). Core temperatures were measured using a tympanic membrane probe, and the first temperature was

measured after a 5-minute equilibration period. Shivering was also measured using a 4-point visual scale. Upon arrival, 4 percent (8/200) patients were hypothermic (No=1; 10-min=3; 20-min=1; 30-min=3). At the start of surgery, after pre-warming, all of the hypothermic patients were normothermic, except for the patient who did not receive pre-warming. There were significant changes in core temperatures between the control group and the other three pre-warmed groups ($p<0.00001$). There was no significant difference between the three pre-warmed groups ($p=0.54$). The incidence of perioperative hypothermia was significantly more in the control group compared to all of the pre-warmed groups ($p<0.001$). Shivering was significantly less in all the pre-warmed groups compared to the control group ($p=0.02$). This study concluded that actively pre-warming patients for only 10 or 20 minutes prior to the induction of anesthesia reduces the risk of perioperative hypothermia and postoperative shivering versus passive insulation. Additionally, this study illustrated that intraoperative warming after a patient is already hypothermic will not reverse or prevent further hypothermia.

A prospective, open-label multinational, multicenter, randomized trial conducted by Torossian et al.⁷ compared an active self-warming blanket with passive thermal insulation in 246 adult patients undergoing elective orthopedic, gynecological, or ENT surgery. Patients were ASA physical status I, II, or III with a planned duration of general anesthesia of 30 to 120 minutes. Patients were randomized into 1 of 2 groups by a web-based generator system. The control group ($n=124$) used passive thermal insulation via warm cotton blankets 30 minutes before the induction of anesthesia. The intervention group ($n=122$) used active warming via BARRIER EasyWarm blanket set at 42 degrees Celsius for 30 minutes prior to the induction of anesthesia. Intraoperatively, the intervention group received forced air-warming, and the control group received rescue forced air-warming when temperatures dropped below 35.5 degrees Celsius. Temperatures were measured by tympanic membrane thermometer. Thermal comfort was also scored on a visual analog scale. Mean preoperative temperatures were significantly different between the two groups ($P=0.010$). Mean core body temperatures were significantly higher in intervention the group in the perioperative, intraoperative, and postoperative period ($P<0.001$). The incidence of hypothermia was significantly lower in the perioperative ($P<0.001$), intraoperative ($P=0.001$) and start of postoperative period ($P=0.001$). The thermal comfort levels for the intervention group were significantly higher than the control group both before and after surgery ($P<0.001$).

DeWitte et al.⁵ conducted a randomized control trial that included 27 adult patients, ASA physical status I, II, and III, with body mass indexes between 18 to 28 kg/m² undergoing laparoscopic colorectal surgery under general anesthesia for 90 to 260 minutes. The patients were randomly divided into 3 groups, including a control group ($n=8$), a resistive heating group ($n=9$) and a forced air-warming group ($n=9$). The control group received cotton blankets that were not warmed; the resistive heating group was given a Geratherm pre-surgical whole body cover set at 42 degrees Celsius for 30 minutes; and, the forced-air warming group with a blanket set to 42 degrees Celsius. Intraoperatively, all patients were warmed using a forced air warmer set to 42 degrees Celsius. The temperature measurements were taken using a tympanic membrane probe 10 minutes before pre-warming and continued throughout the perioperative period, mean skin temperatures located on the chest, arm, calf, and thigh, and an esophageal probe during the intraoperative period, placed after induction of anesthesia. The mean skin temperatures were significantly lower ($P<0.05$) in the control group during pre-warming and up

to 70-minutes after induction compared to the pre-warmed groups. Mean body temperatures differed significantly between the control group and the other two groups at 5 minutes after induction of anesthesia and from 30 minutes to 90 minutes after induction of anesthesia ($P < 0.05$). The forced-air warming group's core temperatures were significantly higher than the control group at 5-, 40- and 50-minutes after the induction of anesthesia ($P < 0.05$). This study suggests that heat distribution from the core to periphery during the induction of anesthesia is partially prevented by 30 minutes of pre-warming. In this study, there was no perioperative hypothermia in the pre-warming groups. This study concludes that 30 minutes of pre-operative warming along with intraoperative warming can prevent the risk of perioperative hypothermia.

Reference and study design	Sample (n) Type of anesthesia and surgery	Groups	Pre-warming: Time and Method	Temperature measurement Tools and Temperatures	Results
Erdling and Johansson, 2015 Randomized explorative parallel-group study	n=43 ≥32-92 yrs ASA I-II Combined general anesthesia and regional (epidural) Duration of at least 210 min Elective colorectal surgery	Group A (Pre-warming) n=21 Group B (no pre-warming) n=22	Pre: Group A - 42 minutes, Forced-air device (Warm Touch, Nellcor, Gaymar, Smith's Medical) set to 43°C; started in OR after epidural catheter insertion but before test dose given Group B - nothing Intra: Forced-air device during 210 min of surgery All fluids warmed to 39°C	Preop: Nasopharyngeal; All patients were hypothermic before start of anesthesia (<36°C) Intra: Nasopharyngeal and esophageal, skin Esophageal Group A 36.5°C ± 0.6 Group B 35.8°C ± 0.7 Nasopharyngeal Group A 36.7°C ± 0.6 Group B 36.0°C ± 0.6	Mean temperature differences at 210 min were statistically significant at both sites of measurement esophageal ($P = .001$) and nasopharyngeal ($P = .002$) Pre-warming has a positive effect on core temperature and even a short pre-warming time may be of benefit for the prevention of unplanned hypothermia Negative correlation between esophageal temp and age ($r^2 = -.381$, $P < .012$) Esophageal temp and BMI <25 BMI 35.81°C ± 0.66 >25 BMI 36.46°C ± 0.59 ($P < .001$) -Age and BMI is of importance to core temperature
Rosenklide et al., 2017 Case-control study	n=60 ≥18 years ASA I-II Spinal or general anesthesia Primary hip or knee arthroplasty	Intervention group (Pre-warming) n=30 Control (no pre-warming) n=30	Pre: Intervention group – 30-45 min using BARRIER Easy Warm self-warming blanket averaging 44°C Control group: covered with quilt Intra: Forced air warming set at 43°C for all	Preop: Oral with 0.5°C added Intervention group: No patients were hypothermic on arrival to OR Control group: 10% hypothermic (<36°C) upon arrival to OR n=3 Intra: Oral with 0.5°C added The mean core temperature remained above 36°C for all time intervals in both groups except in control group at 60-min interval (<36°C)	Mean core temperatures for the intervention group were strongly significantly higher than control group for 30-, 60-, and 90- min time intervals ($P < 0.01$) Mean core temperatures for the intervention group were significantly higher for 120-min interval ($P < 0.05$) Pre-warming with a self-warming blanket decreases the initial drop in core temperature after induction of anesthesia and the incidence and risk of unplanned perioperative hypothermia Pre-warming with a self-warming blanket combined w/ intraoperative forced air warming reduced the incidence and risks of unplanned perioperative hypothermia among

					patients undergoing hip or knee arthroplasty
Perl et al., 2014 Prospective, randomized, multi-center controlled study	n=68 18-70 years ASA I-III General anesthesia Duration 30-120 min Abdominal, Lower limbs, upper limbs, chest, head and neck surgeries	Group A (control: hospital duvet) n=30 Group B (passive pre-warming) n=20 Group C (active pre-warming) n=18	Pre: Group A (control: hospital duvet) Group B (passive pre-warming w/ mistral-air premium warming suit) Group C 30-60 minutes (active pre-warming w/ forced air warmer connected to mistral-air premium warming suit) Intra: all warmed with forced air warmers on maximum IV fluids warmed to 37°C	Preop: Oral Group A: 36.2°C±0.4 Group B: 36.2°C±0.4 Group C: 36.4°C±0.4 Intra: Oral (15 min after induction) Group A: 36.1°C±0.5 Group B: 36.2°C±0.4 Group C: 36.6°C±0.4 At end of surgery: Group A: 36.3°C±0.5 Group B: 36.4°C±0.4 Group C: 36.9°C±0.4 Arrival to PACU: Group A: 35.9°C±0.6 Group B: 35.9°C±0.3 Group C: 36.6°C±0.4	Actively warmed Group C core temperatures were significantly higher than Group A and Group B during anesthesia and at the end of surgery and admission to PACU (p<0.05) Only active pre-warming demonstrated an advantage in prevention of perioperative hypothermia
Horn et al., 2012 Randomized control trial	n=200 ≥18 years ASA I-II General anesthesia Duration >30 and <90 min Laparoscopic cholecystectomy; inguinal hernia repair, breast surgery, minor orthopedic surgeries, and ENT surgeries	Control (no pre-warming) n=55 10 min pre-warming n=52 20 min pre-warming n=43 30 min pre-warming n=50	Pre: No pre-warming group; Forced air warming 10 min group, 20 min group, 30 min group There was 20 min between end of pre-operative warming and start of anesthesia Intra: Forced air warming for patients that needed it No pre-warming 37/55 (65%) 10 min 16/52 (31%) 20 min 1/43 (2%) 30 min 3/50 (6%)	Preop: tympanic membrane No pre-warming n=1 were hypothermic upon arrival to OR (<36°C) and all the rest were ≥36°C Intra: Tympanic; No pre-warming 38/55 (69%) became hypothermic (<36°C) 10 min 7/52 (13%) 20 min 3/43 (7%) 30 min 3/50 (6%) Shivering measures visually using a 4-point scale	Significant differences in changes of core temperature between the non-pre-warmed group and all the pre-warmed groups (p<.00001) No significant difference between the pre-warmed groups (p=.54) Incidence of hypothermia was significantly greater in the non-pre-warming group compared to the 10, 20, and 30 min pre-warming group (p<.001) Shivering was observed significantly less in the pre-warming groups than the non-pre-warming group (p=.02) Results demonstrate starting active warming intra-operatively for the first time, when core temperatures have already decreased below 36°C does not reverse or prevent further hypothermia Pre-warming patients for only 10 or 20 min before general anesthesia considerably reduces the risk of peri-operative hypothermia and reduces postoperative shivering in comparison to passive insulation

<p>Torossian et al., 2016</p> <p>Prospective, open-label, randomized, multicenter European study</p>	<p>n=246</p> <p>≥18 years</p> <p>ASA I-III</p> <p>General anesthesia</p> <p>Duration 30-120 minutes</p> <p>Elective orthopedic, gynecological, ENT surgery</p>	<p>Intervention group (Forced-air warming) n=122</p> <p>Control (passive warming) n=124</p>	<p>Pre: Intervention group Forced-air warming 30 min before induction of anesthesia w/ BARRIER EasyWarm blanket 42°C</p> <p>Control: passive warming 30 min before induction of anesthesia w/ warm cotton blankets</p> <p>Intra: Intervention group: Forced air-warming</p> <p>Control group: when temperatures dropped below 35.5°C rescue warming initiated (forced-air warming)</p>	<p>Preop: Tympanic</p> <p>Intervention group: 36.9°C, SD±0.3</p> <p>Control group: 36.8°C, SD±0.3</p> <p>Intra: Tympanic</p> <p>Intervention group: 36.5°C, SD±0.4</p> <p>Control group: 36.3°C, SD±0.3</p> <p>PACU: Tympanic</p> <p>Intervention group: 36.3°C, SD±0.5</p> <p>Control group: 36.0°C, SD±0.5</p>	<p>Mean preoperative temperatures differed significantly (P=.010)</p> <p>Mean core body temperatures were significantly higher in intervention group in the perioperative period (P<.001), intraoperative period (P<.001), and postoperative period (P<.001)</p> <p>Hypothermia incidence in the intervention group was significantly lower in the perioperative period (P<.001), intraoperative period (P=.001), and start of postoperative period (P=.001)</p> <p>Thermal comfort levels were significantly higher for the intervention group vs control group before and after surgery (P<.001)</p> <p>Pre-warming surgical patients w/ BARRIER EasyWarm blanket for 30 min improves patients' mean core body temperature throughout the perioperative period</p>
<p>DeWitte et al., 2010</p> <p>Randomized control trial</p>	<p>n=27</p> <p>≥18 – 80 years</p> <p>ASA I-III</p> <p>General</p> <p>Duration of 90 to 260 min</p> <p>Laparoscopic colorectal surgery</p>	<p>Group 1: Cotton blankets not warmed n=8</p> <p>Group 2: Resistive heating n=9</p> <p>Group 3: Forced air warming n=9</p>	<p>Pre: Group 1: cotton blankets that were not warmed</p> <p>Group 2: 30 min resistive heating w/ Geratherm “pre-surgical” whole body cover</p> <p>Group 3: 30 min forced-air warming</p> <p>Intra: All patients forced air warming for duration of surgery set to 42°C</p>	<p>Preop: tympanic membrane, mean skin temperatures (Mean of 4 sites: chest, arm, calf, thigh)</p> <p>Group 1: 35.9°C±0.5°C</p> <p>Group 2: 35.9°C±0.5°C</p> <p>Group 3: 35.9°C±0.5°C</p> <p>Intra: esophageal, mean skin temperatures (Mean of 4 sites: chest, arm, calf, thigh)</p> <p>After 50 minutes</p> <p>Group 1: 35.9°C±0.3°C</p> <p>Group 2: 36.5°C±0.4°C</p> <p>Group 3: 36.2°C±0.3°C</p> <p>PACU: approx. 1 hour after arrival</p> <p>Group 1: 35.4°C±1.0°C</p> <p>Group 2: 35.6°C±0.5°C</p> <p>Group 3: 35.5°C±0.8°C</p>	<p>The mean skin temperature was statistically lower (P<.05) in the control group compared with the other groups during pre-warming and until 70 minutes after induction</p> <p>Mean body temperatures differed significantly between the control group and resistive heating group at 5 min after induction and from 30 min to 90 min of anesthesia (P<.05)</p> <p>Forced-air warming group body temperatures were significantly higher than control group at 5, 40, and 50 min after induction of anesthesia (P<.05)</p> <p>Intraoperative esophageal temperature changes suggest that redistribution of heat is partially prevented by 30 min of pre-warming with both resistive heating and forced air warming</p> <p>Hypothermia did not occur in 2 pre-warming groups</p> <p>Intraoperative warming with 30 min of pre-warming can prevent hypothermia and should be considered as part of the anesthetic management when patients are at risk of postoperative hypothermia</p>

Conclusion

The purpose of this evidence based practice analysis is to examine if pre-warming patients prior to general and/or neuraxial anesthesia has an effect on perioperative hypothermia. Six studies were reviewed and all 6 studies concluded that pre-warming has a positive effect on preventing unintended perioperative hypothermia. Two studies were randomized control trials,^{7,9} 2 were prospective randomized trials,^{6,10} 1 was a case-control study,³ and 1 was a randomized explorative parallel-group study.² Based on the conclusions of this evidence based practice analysis, it is recommended to provide active pre-warming for a minimum of 10 minutes⁷ to 30 minutes prior to the induction of general or neuraxial anesthesia to prevent perioperative hypothermia.^{2,3,6,9,10}

Intraoperative force-air warming was used on all patients^{2,3,9,10} in 4 of the 6 studies, while “rescue” forced-air warming was utilized in 2 of the 6 studies based on the temperatures of the patients.^{6,7} Fluids were warmed in 2 of the 6 studies intraoperatively.^{2,10} Strengths of this evidence based practice analysis include the level of evidence, and reliability and validity of the studies. All of the studies had adequate sample sizes based on the statistical tool used to show significance. Limitations to this evidence based practice analysis include the cost associated with the pre-warming of patients in different clinical settings. The benefit to the patient has been explained above, however, the cost analysis of providing active warming was not discussed. Some studies used active warming preoperatively and intraoperatively, while others used active warming preoperatively and then used a “rescue” warming intraoperatively if temperatures dropped, which could have affected patient outcomes.

Intraoperative hypothermia is a preventable risk when receiving general and neuraxial anesthesia. Anesthesia providers should be vigilant in preventing and treating hypothermia. The adverse events that can occur when a patient is hypothermic can be devastating.^{2,3,6,7,9,10} The solution to this problem is simple and effective. Providing prewarming to patients undergoing general or neuraxial anesthesia is a clinical recommendation that can improve patient outcomes and satisfaction, and should be implemented in every clinical setting.

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