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The Effect Of Preoperative Reflective Hats And Jackets, And Intraoperative Reflective Blankets On Perioperative Temperature

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Abstract

Introduction: Mild perioperative hypothermia may delay awakening and increase recovery time. We addressed the effect of preoperative reflective hats and jackets, and intraoperative blankets on perioperative temperature.
Methods: After IRB approval and written informed consent, we completed two studies. In Study One, fifty-two patients were randomly assigned to receive either reflective hats and jackets (Thermo-LiteTM) or not on their arrival in our outpatient surgery clinic. Immediately before surgery, hats and jackets were removed and patients were again randomly allocated to receive either a reflective blanket or a standard cloth blanket for intraoperative use. In Study Two, fifty-three patients were randomly assigned to receive either a reflective hat or not, again on arrival to our outpatient clinic. Reflective jackets and blankets were not used. In all patients, tympanic membrane temperature was measured at eight points: (1) on arrival in the outpatient department (Arrival); (2) in the holding area (Holding); (3) immediately on arrival in the OR (In OR); (4) 30 minutes after induction of anesthesia (Induction); (5) prior to leaving the OR (Out OR); (6) upon arrival in the PACU (In RR); (7) prior to discharge from the PACU (Out RR); (8)prior to discharge to home (Home). Data were analyzed by ANOVA using SPSSTM.
Results: In Study One, there was a significant hat-jacket effect ($p<0.01$), but no significant blanket effect. However, patients using the reflective blankets were significantly warmer at Out OR, Out RR, and Home ($p<0.05$). In Study Two, both groups showed dips in temperature during surgery and recovery, but there was no significant effect of the hats alone.
Conclusions: Our results indicate that the combined use of preoperative reflective hats and jackets, but not hats alone, significantly reduced temperature drop during outpatient surgery. Intraoperative reflective blankets had a small, but not significant, effect on temperature. We conclude that the prevention of intraoperative heat loss is provided by preoperative reflective hats and jackets, is not improved with intraoperative reflective blankets, and is more closely related to the total body surface area covered than which area is covered.

Work done in the Department of Anesthesiology, LSUHSC Shreveport

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INTRODUCTION

Hypothermia occurs in most anesthetized patients [1,2,3]. Body heat loss occurs prior to anesthesia and rapidly after induction of anesthesia via four mechanisms: radiation, conduction, convection and evaporation [1-4], and intraoperative temperature decreases with the heat loss. Mild perioperative hypothermia, which is common during major surgery, may promote surgical-wound infection by triggering thermoregulatory vasoconstriction, which decreases subcutaneous oxygen tension [5,6]. Wound healing can be delayed because of a reduction in the deposition of collagen [7]. Moreover, adverse effects of hypothermia, such as cardiac complications, coagulation problems, and increased oxygen consumption can also occur [8].

Outpatients frequently have to wait for some time before they are taken to the operating room for surgery. Similarly, patients may stay in the Post-Anesthesia Care Unit for a prolonged period of time while attempts are made to rewarm them. Prewarming has been shown to reduce the decrease in temperature observed with induction of epidural anesthesia [9,10].

Many methods of intraoperative warming have been utilized to reduce heat loss. It has been said that the exposure of the head is the main source of heat loss due to its rich vascularity, and that covering the head can maintain the intraoperative temperature6. The purpose of these two studies was to ask and answer three questions: (1) Can reflective hats and jackets worn preoperatively decrease heat loss intraoperatively? (2) Do reflective blankets intraoperatively conserve heat any better than cloth blankets? (3) Will a reflective hat without a reflective jacket work as well as the hat/jacket together to conserve heat preoperatively and reduce temperature loss perioperatively? To answer these questions, we studied the effect of the following on perioperative temperature: (1) reflective hats and jackets worn preoperatively; (2) reflective hats alone worn preoperatively (without a jacket); and (3) reflective blankets used intraoperatively.

MATERIALS AND METHODS

With the approval of the Institutional Review Board (IRB) and following written informed consent from each patient, we completed two studies with an outpatient population of ASA I-III patients. The criteria for exclusion were any use of corticosteroids or other immunosuppressive drugs (including cancer chemotherapy) during the four weeks prior to surgery; a recent history of fever, infection, or both; serious malnutrition (low serum albumin, a low white-cell count, or the loss of more than 20 percent of body weight).

In Study One, fifty-two adult patients were randomly assigned to either receive reflective hats and jackets (Thermo-Lite™, TechStyles, Inc., Dallas, TX) (N=26) or not (N=26) on their arrival to our outpatient surgery clinic. Table 1 illustrates the study design. Just prior to transfer to the operating room for their surgery, the patients' hats and jackets were removed, and they were then further randomly allocated to receive either a reflective blanket (Thermo-Lite™) or a standard cloth blanket for intraoperative use (13 in each of four groups).

Figure 1

Table 1: Distribution of Subjects – Study One

		Hat and Jacket	
		No	Yes
Blanket	No	13	13
	Yes	13	13

In Study Two, fifty-three adult patients were randomly assigned to receive either a reflective hat alone (Thermo-Lite™) (N=30) or no hat (N=23) on arrival in our outpatient surgery clinic. Hats were removed prior to transfer to the operating room. These patients did not receive a reflective blanket.

For both studies, the operating room temperature was set at 21oC, and room temperature IV fluid was used. Tympanic-membrane temperatures of patients were taken at eight time points during the study. (1) On arrival to the outpatient surgery clinic (Arrival), (2) in the holding area (Holding), (3) immediately upon arrival in the operating room (In OR), (4) 30 minutes after induction of anesthesia (Induction), (5) prior to leaving the operating room (Out OR), (6) upon arrival in the postoperative anesthesia care unit (In RR), (7) prior to discharge from the PACU (Out RR), and (8) prior to discharge to home (Home).

For Study One, statistical analysis was performed with repeated measures 2-way analysis of variance. This allowed examination of the independent effects of the preoperative reflective hat and jacket and intraoperative reflective blanket, as well as the interaction of the two treatments. For Study Two, repeated measures analysis of variance was used to assess the effects of the reflective hats alone. Data were analyzed using the statistics program SPSS™ (SPSS, Inc., Chicago,Il). Significance was $p<0.05$.

RESULTS

In Study One, groups were matched in height, weight, and age (Table 2). Table 2.Repeated measures 2-way ANOVA revealed a significant hat/jacket effect ($p<0.001$), with significantly less temperature drop in the reflective hat-jacket group at the time of induction of anesthesia, on leaving the operating room, and on entering the recovery room ($p<0.05$) (Figure 1).

Figure 2

Figure 1: Temperature with and without hats/jackets

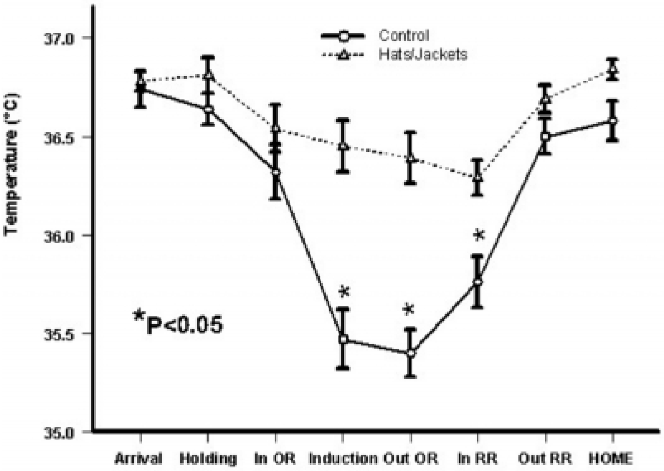


Figure 3

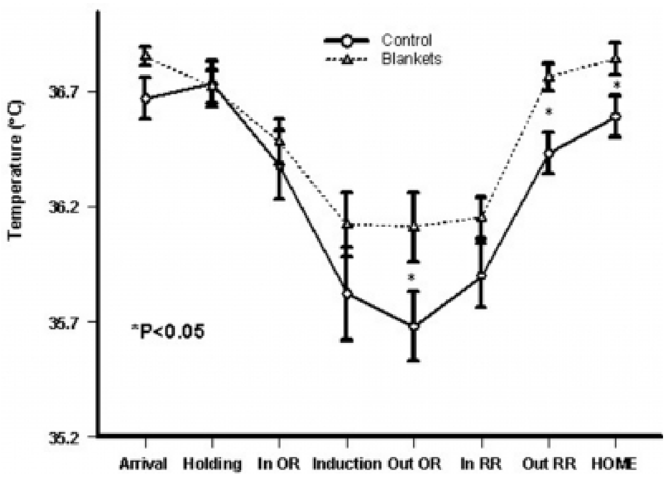
Table 2: Demographics of Study One

Age	46 ± 0.81 Years old	
Weight	79.86 + 2.3 kg	
Height	196 + 1.3 cm	
Sex	Male	Female
	24	28

Although there was no significant reflective blanket effect over the time of the study, patients who were given the reflective blankets were significantly warmer on leaving the operating room than were patients given the cloth blankets ($p<0.05$). This effect continued at discharge from the PACU and at discharge from the hospital ($p<0.05$). (Figure 2).

Figure 4

Figure 2: Temperature with and without blankets



In Study Two, the groups were matched in height, weight, and age; however, there were a few more women than there were men (Table 3). ANOVA revealed that there was no significant difference in temperature over time between the two groups (Figure 3). Both groups showed dips in body temperature upon arrival in the operating room, temperature decrease during anesthesia and surgery, then an increase over time to reach temperatures slightly lower than those recorded upon arrival at the outpatient clinic the morning of surgery.

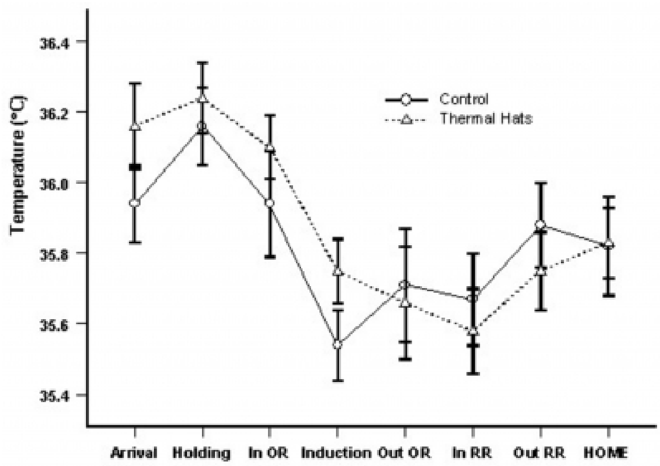
Figure 5

Table 3: Demographics of Study Two

		Control	Reflective hat
No		23	30
Age (years)		36	39
Height (cm)		173	171
Weight (kg)		86.4	86.4
Sex	Female	11	19
	Male	12	11

Figure 6

Figure 3: Temperature with and without hats



DISCUSSION

Mild perioperative hypothermia (approximately 2° C below the normal core body temperature) is common after surgery [7]. It is a common cause of delayed awakening and increased length of stay in the post anesthetic care unit [11]. Heat loss in the operating room occurs via four mechanisms: radiation, conduction, convection, and evaporation. The major causes of heat loss are radiation and conduction. In clinical practice, it can result from anesthetic-induced impairment of thermoregulation, exposure to cold, and altered distribution of body heat [5],[12]. The reflective hats, jackets, and blankets used in our studies most likely primarily reduce heat loss by radiation. Tympanic membrane temperatures are considered to be a more accurate indication of core temperature than other methods, and are easy to measure rapidly with minimal discomfort to the patient [1],[13],[14],[15],[16].

The presence of sufficient intraoperative hypothermia triggers thermoregulatory vasoconstriction, and postoperative vasoconstriction is universal in patients with hypothermia. Mild core hypothermia can also directly impair immune functions and the production of antibodies [4],[5],. Thus, hypothermia may increase patients' susceptibility to perioperative wound infections [6],. A wound infection can prolong hospitalization and substantially increase medical costs. In patients undergoing surgery, the risk of such an infection ranges from 3 to 22 %, depending on such factors as the length of surgery and underlying medical problems[9],.

Prolonged time in the postoperative anesthesia care unit (PACU) for rewarming is a frequent complication [11],[17]. For outpatients and inpatients as well, prolonged recovery can significantly increase costs [18],[19].

It has been said that the exposure of the head is the main source of heat loss due to its rich vascularity, and that covering the head can maintain the intraoperative temperature 6. In addition to this study, recent evidence by Sessler et al [20] suggests that the head is no more radiant than any other body surface. In our study, only those patients who had both thermal hats and jackets preoperatively experienced a significant attenuation of intraoperative heat loss. Application of intraoperative reflective blankets resulted in a small, but not significant, effect on temperature. The thermal hat alone, worn preoperatively, could did not effectively maintain intraoperative temperature. Kamitani's study showed that the intraoperative temperature was significantly better maintained in those patients with their head and face covered. The reason for the difference between our results and Kamitani's is probably that their patients had both their heads and faces covered. Since the face surface area represents about 9% of the whole body's, Kimitani's results actually support ours, i.e., that the area of body surface covered is more important than where the body surface is covered.

CONCLUSIONS

Using a reflective jacket and hat preoperatively, while the patient is waiting for surgery, is effective in decreasing intraoperative heat loss. Patients also readily accept these devices. Though radiation from the head has been believed to be an important source of heat loss, our study showed that providing the patient with only a reflective hat pre-operatively does not have the same effect of decreasing heat loss as does providing both a reflective hat and jacket. Less surface area is covered. Also, our study shows no obvious increased effect of a thermal blanket compared to a regular blanket to prevent body heat loss intraoperatively. The reflective jacket and hat in the holding area is an effective and cost-effective way to reduce intraoperative heat loss.

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