A report of the WARMING UP DATE 2012 interactive webinar

UZ Leuven
Campus Gasthuisberg
Herestraat 49
3000 Leuven
Belgium

November 8, 2012

Prewarming minimises redistribution drop and contributes to perioperative normothermia

Prewarming is the only way to prevent initial postinduction hypothermia
Prof. Daniel I. Sessler MD
Department of Outcomes Research, Cleveland Clinic, Ohio, US

Minimise postinduction core temperature drop with prewarming
Prof. Johan Raeder MD, PhD
Oslo University Hospital, Ullevål, Norway

Health care professionals in the OR need to join forces in a patient warming strategy
Dr. Elke Van Gerven MD
UZ Leuven, Belgium
Prewarming minimizes temperature drop due to redistribution and contributes to perioperative normothermia

Anaesthesiologists Dr. Dan Sessler from the Department of Outcomes Research, Cleveland Clinic, Ohio, US, and Dr. Johan Raeder, from Oslo University Hospital, Norway, agree on the importance of patient prewarming to avoid postinduction hypothermia. It’s the only way to limit the initial temperature drop and the best start to maintain patient normothermia during an OR procedure.

During the WARMING UPDATE 2012 interactive webinar session on November 8, 2012, some 400 health care professionals in several European countries listened to leading anaesthesiology professionals share their thoughts on how to improve patient warming practices in the OR. Polls taken on the spot from webinar attendees clearly indicated that there is plenty of room to improve on patient warming strategies.

In a videotaped presentation, Dr. Sessler focused on aspects of thermoregulation during anaesthesia and on the substantial consequences of mild inadvertent hypothermia. Mild hypothermia has effects on many different systems in the body and is well-documented through several randomised trials. Most patients are at risk for at least one of the known complications, ranging from morbid myocardial outcomes to blood loss and transfusion requirements, prolonged duration of vecuronium muscle relaxant and of recovery.
According to Dr. Sessler, the main consequences of hypothermia can be summarised as follows:

**Major complications**
- Increases morbid myocardial outcomes
- Promotes bleeding and increases transfusion requirements
- Decreases drug metabolism
- Prolongs recovery duration

**Minor complications**
- Decreased drug metabolism
- Prolonged recovery duration
- Thermal discomfort

Dr. Sessler’s advice to health care professionals in the OR is to carefully monitor the core temperature of the patient when general anaesthesia is administered for more than 30 minutes and with large procedures under neuraxial anaesthesia. Prewarming is very helpful to maintain patient normothermia and keep the patient core temperature above 36 °C, Dr. Sessler concluded.

In Dr. Raeder’s presentation he focused on how to deal with the initial drop in temperature after administering anaesthetic drugs. Prewarming the periphery of the patient will help during the redistribution phase of the anaesthesia period, Dr. Raeder indicated. He referred to the results of a study on prevention of intraoperative hypothermia by preoperative skin-surface warming with hip surgery patients [Just B. et al. Anesthesiology, 1993; 79:214-8]. The study showed significantly higher core temperature during the operating room procedure with prewarmed patients. (Fig. 1)

**Core temperature**

![Core temperature diagram](image_url)

**Preoperative**
(no values from control)
- No increase during 0-45 min prewarming (while skin temp increases)
- Increase during 45-120 min prewarming (sweating), while skin temperature stabilizes

**Anaesthesia induction**
- Drop, but to normal values with prewarming
- Larger drop and to low values without prewarming

**End of anaesthesia**
(after 120 min with small blanket)
- Stable and normal values with prewarming
- Unstable and low values with control

References: Just B et al. Anesthesiology. 1993;79:214-8
Referring to another study (Hynson JM et al. Anaesthesiology, 1993; 79:219-28), Dr. Raeder pointed out that preinduction warming will cause patients to maintain higher skin and core temperatures, but will also result in decreased temperature drop during induction and during the first hour of the anaesthesia period. (Fig. 2)

Prewarmed patients also showed lower preoperative heat loss but also slightly less heat loss after induction.

To avoid perioperative hypothermia, Dr. Raeder advises skin warming before the start of the anaesthesia. Several methods exist to produce heat and compensate for heat loss: warm room air, warm fluids/gas and humidifying ventilation, cover the patient’s skin, warm blankets on the contact areas, warm airflow blankets, heat exchanging through skin with pads or pulsatile water, internal blood-heating (Cool-guard, H-Lung-Machine).

But it leaves no doubt, concludes Dr. Raeder, that it is important to avoid effects of redistribution by warming the skin prior to the start of the anaesthesia period.


European Multicenter Study on self-warming blanket efficacy

At the WARMING UP DATE 2012 interactive webinar session on November 8, 2012, Karin Ganlöv, Medical Director, Mölnlycke Health Care went into some detail on the practical use of the single-use BARRIER® EasyWarm® active self-warming blanket. She also provided details about the Clinical Investigation. (Fig 4)
The study was performed in 2011 at the University General Hospital, in Houston, Texas and at the Physicians' Surgical Care Center in Winter Park, Orlando, Florida, both in USA. 112 patients were enrolled and evaluated for safety and 68 were valid for protocol efficacy analysis.

The patients were scheduled to undergo general anaesthesia during a surgical procedure scheduled for a minimum of 60 minutes and maximum of 180 minutes. The schedule had to allow the subjects to be warmed with a fully activated active self-warming blanket for at least 30 minutes prior to anaesthesia.

Results

- Typical temperature drop of 1-1.5°C on induction of anesthesia did not occur in patients. A temperature drop of 0.6°C was recorded.
- The temperature was maintained at a stable level for 2.5 hours.
- No serious adverse events were reported.
- The active self-warming blanket was well received in terms of comfort and warmth by patients.

An Open-Label Study to Assess the Safety and Efficacy of an Active Warming Blanket Used to Maintain Normothermia during the Perioperative Period in the Prevention of Hypothermia

Study design

The study was performed in 2011 at the University General Hospital, in Houston, Texas and at the Physicians’ Surgical Care Center in Winter Park, Orlando, Florida, both in USA. 112 patients were enrolled and evaluated for safety and 68 were valid for protocol efficacy analysis.

The patients were scheduled to undergo general anaesthesia during a surgical procedure scheduled for a minimum of 60 minutes and maximum of 180 minutes. The schedule had to allow the subjects to be warmed with a fully activated active self-warming blanket for at least 30 minutes prior to anaesthesia.

Results

- Typical temperature drop of 1-1.5°C on induction of anesthesia did not occur in patients. A temperature drop of 0.6°C was recorded.
- The temperature was maintained at a stable level for 2.5 hours.
- No serious adverse events were reported.
- The active self-warming blanket was well received in terms of comfort and warmth by patients.

The polls carried out during the webinar among the attendants, clearly show more room for warming strategies in the OR.

<table>
<thead>
<tr>
<th>Question</th>
<th>Response options</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you currently monitor your patients’ core temperature during surgeries that last more than one hour?</td>
<td>a) Yes, always</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>b) Yes, sometimes</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>c) No</td>
<td>18</td>
</tr>
<tr>
<td>2. Do you use anything other than regular cotton blankets to prewarm your patients before surgery?</td>
<td>a) Yes, always</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>b) Yes, sometimes</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>c) No</td>
<td>49</td>
</tr>
<tr>
<td>3. Based on this evening’s presentation will you change your prewarming practices?</td>
<td>a) I already use active prewarming [other than regular cotton blankets]</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>b) Yes, I will start using active prewarming</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>c) It seems very interesting but I cannot make that decision on here and now</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>d) I will continue as before</td>
<td>9</td>
</tr>
</tbody>
</table>
There’s overwhelming evidence from large randomised trials that hypothermia causes severe complications. And although not every patient is susceptible to all hypothermia-related complications, it is the rare patient who is not susceptible to at least one of them. Normothermia is therefore the standard of care. How do you ensure it? “Any strategy will do,” says Dr. Daniel I. Sessler of the Department of Outcomes Research, at the Cleveland Clinic, Ohio, US, “but prewarming and intraoperative temperature management are two cornerstones of any perioperative warming strategy.”

As a resident, Daniel Sessler asked his professor’s advice on what to study in depth, and his professor said: “Go measure temperature, it’s easy.” Dr. Sessler was immediately captured by the physiological aspects of temperature management of the human body. He was “interested in the physiology, even if there was no clinical evidence that hypothermia caused anything more serious than postoperative shivering.”

“Clinically, there was very little understanding of temperature regulation and why it might be important,” recalls Dr. Sessler. “That was understandable because there was no evidence of complications, and therefore no compelling reason for anaesthesiologists to keep the patient warm; shivering was considered a normal phenomenon.”

Tipping point in 1996

Dr. Sessler started with studies on temperature regulation, then on temperature balance, then he evaluated the ways warmth entered and left the body, and finally he started looking at consequences of warmth leaving the body. “The tipping point which drew anaesthesiologists’ attention to the patient warming issue was the publication of two articles in 1996: Our study of wound infection published in the New England Journal of Medicine, and a study of hypothermia and blood loss transfusion requirements that we published in the Lancet. Also, an article on hypothermia and morbid cardiac outcomes by S.M. Frank in 1997 in the Journal of the American Medical Association drew considerable attention.”

“Prewarming is a highly attractive option and it should be used more often. It is probably the only way to avoid initial core to periphery temperature redistribution.”
Avoiding hypothermia is more effective than administering antibiotics

In spite of the overwhelming evidence linking intraoperative hypothermia to serious adverse effects, including increased morbidity and mortality outcomes, increased transfusion requirements, risk of wound infections and prolonged hospitalisation, it's hard to say what the real incidence of perioperative hypothermia is, Dr. Sessler points out. "There are no good recent cross-sectional studies. Many of the complications related to hypothermia do not occur during the anaesthetic period, but after. Take wound infection: It is often attributed to surgical problems. Surgical technique certainly contributes to infection risk, but too many people forget about the contribution of hypothermia — which might be just as important. In fact, maintaining normothermia is more effective than administering antibiotics. Heart attacks are another example: They usually occur one to three days after surgery and are rarely linked to intraoperative hypothermia. By the time a heart attack occurs, it is no longer considered an anaesthesia problem — although anaesthetic management may have been a key contributor."

"Prewarming is an interesting technique but it has not been used widely because of procedural and technical reasons — although efficacy of the methods is well documented in many randomised trials."

According to Dr. Sessler, there’s also ample reason to believe that the current incidence of hypothermia is much lower than what it used to be. In the past it wasn’t exceptional to see patients come in the recovery rooms with a temperature of 34.5°C, now temperatures are rarely below 35.5°C. Also, the studies that evaluate the complications of hypothermia are relying on a population that shows a higher risk of hypothermia. "That makes sense if you’re designing a trial, but you can’t just extrapolate the results to all patients."

What is the best practice to maintain patient normothermia? Dr. Sessler believes any strategy will work. "What most anaesthesiologists do is use insulating covers. It’s understandable, safe, effective, easy to use, and relatively inexpensive. Whatever works is fine to me. You don’t absolutely need to use an active system: Heating the room can be a solution. In Japan, for example, operating room temperature is kept near 25°C and — as might be expected — hypothermia is less of a problem than in other countries.

Maintaining normothermia during short procedures

Prewarming is a useful strategy, Dr. Sessler adds, particularly for short procedures. Counter-intuitively, it’s more difficult to keep normothermia during a short intervention. The initial hypothermia results from the internal redistribution of heat following the vasodilating effect of the anaesthesia. Prewarming can reduce this redistribution because it is an active system that regulates the temperature difference between the periphery and the core. Prewarming is an interesting technique but it has not been used widely because of procedural and technical reasons — although efficacy of the methods is well documented in many randomised trials, concludes Dr. Sessler.

In Dr. Sessler’s opinion, the best approach to avoid the initial postinduction hypothermia during the first hours of an intervention is a combination of prewarming and intraoperative temperature management. "Prewarming is a highly attractive option and it should be used more often. It is probably the only way to avoid the initial core-to-periphery redistribution of body heat."

Profile

Dr. Sessler is the Michael Cudahy Professor and Chair of the Department of Outcomes Research, at the Cleveland Clinic. He is also director of the Outcomes Research Consortium, the world’s largest clinical anaesthesia research group. Dr. Sessler has published a book on therapeutic hypothermia and more than 490 full research papers. His works are cited more than 1,350 times per year. Dr. Sessler has given invited lectures at more than 250 institutions. Among his awards is a Fulbright Fellowship and the 2002 American Society of Anesthesiology Excellence in Research prize.
“Minimise postinduction core temperature drop with prewarming”

Sensitivity of anaesthesiologists about perioperative warming to avoid inadvertent hypothermia is high, but there is an unacceptably low level of awareness of the preoperative skin surface warming benefits for both medical staff and patients, says Dr. Johan Raeder, Professor in Anaesthesiology at Oslo University Hospital, Norway. “We need to give anaesthesiologists a better understanding of the physiology of impaired thermoregulation with resultant core to periphery thermal redistribution to make them understand the importance of prewarming the patient.”

Lack of understanding

Beyond trauma care and major surgery, normothermia hasn’t been an issue of much interest, Dr. Raeder says. In his opinion this is because it is quite cumbersome to take warming measures and the impact of hypothermia was never considered to be substantial, as patients always used to recover from it, eventually. “Consequently, many anaesthesiologists don’t know the specific physiology related to prewarming. Up to now, most of the tools available have been marketed as perioperative tools, rather than related to prewarming issues.”

“The best strategy to maintain normothermia starts with preanaesthetic skin surface warming to avoid the initial postinduction temperature drop.”

The change now is that there are simple and cheap devices to manage prewarming in an OR. Dr. Raeder is convinced the key to higher use of prewarming strategy is education of the anaesthesiologists and nurses. “We need to show them the physiology, so that they understand

Dr. Raeder is a clinical anaesthesiologist working with ambulatory care and general intensive and trauma care at Oslo University Hospital, Ullevål, in Oslo. From that perspective, he has always been sensitive to the issue of patient warming. “Emergency care is probably the only field of care that has always been conscious of the importance of keeping the patient within the limits of normothermia. We are consistently focused on the ‘golden hour’, the time span we have to, among other issues, prevent the patient from suffering severe hypothermia and take them into normothermia.” In Scandinavia there is prewarming equipment in the ambulances, because patients often are already cold when they enter the ambulance, says Dr. Raeder.
that it’s not just a matter of keeping the body warm during the period of anaesthesia. They need to understand the core to periphery thermal redistribution of body temperature at the very start of a procedure."

**Prewarming is the best start in normothermia strategy**

The best strategy to maintain normothermia starts with preanaesthetic skin surface warming to avoid the initial postinduction temperature drop and continues with keeping the patient warm and measuring their temperature consistently during the procedure. Prewarming is the only way to avoid postinduction hypothermia, and the best way to reduce the risk for perioperative hypothermia, underscores Dr. Raeder. "Skin surface warming is the only way to keep the patient warm preoperatively, as they cannot use warm drinks, they’re usually dressed in a skinny patient shirt, and they’re waiting in a cold corridor or room prior to the intervention. There are some conventional ways to try to keep the patient warm prior to the anaesthesia, but they are more to the comfort of the patient rather than to maintain normothermia."

"**Anaesthesiologists need to understand the core to periphery thermal redistribution of body temperature during the start of a procedure.**"

We should be aware that prewarming will prevent the initial drop of temperature and keep the patient comfortable, maintains Dr. Raeder. "This goes for procedures with general anaesthesia or spinal or epidural anaesthesia. Also, if you are sedated you have a lower threshold to start shivering, but your body can’t tell it’s cold and the issue may become bigger in terms of prolonged waking up and recovery time."

**Prewarming helps avoid perioperative hypothermia**

Dr. Raeder is enthusiastic about the single-use BARRIER® EasyWarm® active self-warming blanket. "The cost of the new device is not high, it is effective, very easy to use and our patients like it. We have been using it for some time and we have good feedback. We are currently gathering some data on it to have a more structured feedback. We are concerned about contamination from anything brought into the operating rooms, so we make sure the blankets are kept in a clean environment prior to taking them into the OR. The use of the blankets doesn’t change the way a patient is handled, but you need to make sure they don’t get in the way of the surgeon. During the procedure we keep them on the patient as much as possible, on the part of the body that is not involved in the procedure. We measure the patient’s temperature and we have found that basically this is sufficient to keep the patient within normothermia limits."

---

**Profile**

Dr. Raeder is a Professor in Anaesthesia at Oslo University Hospital in Norway, and has previously been Chairman for the Ullevål University Hospital’s Anaesthesia Department.

He is a member of the scientific committee for Ambulatory Anaesthesia in the European Society of Anaesthesiologists (ESA) and held the post of leader from 1994 to 1999. He has been a member of the editorial board of Acta Anaesthesiologica Scandinavica and Anaesthesia Analgesia. He has published over 150 clinical papers.

He has previously been leader of the European Society of Anaesthesiologists (ESA) Scientific Committee for Ambulatory Anaesthesia. He is a founding member of Eurosiva.
Interview with Dr. Elke Van Gerven, UZ Leuven, Belgium

“Health care professionals in the OR need to join forces in a patient warming strategy”

We need to increase awareness with health care professionals in the OR about normothermia maintenance and stimulate them to team up for a warming strategy, says Dr. Elke Van Gerven. Dr. Van Gerven will lead UZ Leuven’s participation in an international clinical investigation of the safety and efficacy of an active warming blanket used to maintain normothermia during the perioperative period in the prevention of hypothermia versus no active warming.

“We hope to revive the European TEMMP study and eventually create ‘best practices’ in Europe regarding perioperative normothermia maintenance.”

Dr. Van Gerven emphasises one major action point when discussing the use of prewarming and warming strategies in the OR: Educate all health care professionals. “Nurses need to understand that every preoperative procedure they follow can contribute to the heat loss of the patient: Infusing the arm or foot, or taking an ECG which requires removing blankets; they have to re-cover the patient afterwards. Often patients are left cold and uncomfortable, and they don’t mention that they are cold or think that it is ‘normal’. All health care professionals need to join forces here: If the surgeon does not want a blanket covering the patient during a procedure, who will tell them otherwise?”

All health care professionals in the OR need to agree

Even if complications are not necessarily related to the OR and often are transferred with the patient to the departments, avoiding complications is almost exclusively an OR responsibility. Prior to the surgical intervention patients need to be prepared at the department shortly before and there is little opportunity to involve the staff there in the prewarming strategy. Additionally, departments will never be able to force the OR to make sure the patient maintains normothermia, confirms Dr. Van Gerven.

The temperature of an operating room varies between 15°C to 18-20°C, continues Dr. Van Gerven. “To convince a surgeon that normothermia of a patient is crucial and no obstruction to the quality of his work, we need tools that are non-obtrusive. The BARRIER® EasyWarm® active self-warming blanket is a new development that is very appealing to all health care professionals in the OR: It’s not an obstacle during the surgical procedure, it doesn’t transfer heat to the surgeon, it doesn’t produce noise like forced air warming devices.”
Surgeons want to tell their patients after the procedure that everything went well. If the patient needs more time to wake up and regain normothermia after the intervention, the surgeon will need to wait longer or may not be able to tell the patient directly. “It’s probably our best argument to persuade surgeons,” says Dr. Van Gerven.

With patients who are awake during the intervention, it is difficult to measure their temperature in a comfortable way. But the physiology is the same: Postinduction hypothermia happens and the patient has the same thermoregulation problems. “Because these interventions are usually short, the focus on normothermia is low. But even if the intervention takes just 20 minutes, there are many moments of heat loss for the patient: Undressing, changing from a bed to the OR table, being infused... It’s basically what patients recall afterwards: They were cold and uncomfortable.”

“The BARRIER® EasyWarm® active self-warming blanket is a new development that is very appealing to all health care professionals in the OR.”

**Striving for best practices**

“We hope that we can help to establish guidelines on maintaining normothermia. The NHS NICE guidelines of 2008¹ are mostly still unknown and the European TEMMP study group², which used questionnaires to understand the attitude of health care professionals in Europe on maintaining perioperative normothermia, was stopped before it formulated concrete guidelines. We hope to revive this study and eventually create ‘best practices’.”

**Why OR teams often lack perioperative warming and prewarming strategies:**

**Surgeons:**
- OR is too warm
- Too much heat generated by the blanket
- Too warm when surgeon has physical contact with blanket
- Too noisy (i.e. forced air warming device)

**Anaesthesiologists:**
- Normothermia for short interventions not really a concern
- Patient temperature is not monitored during short procedures with local anaesthesia

**OR nurses:**
- Surgeon does not want heat source nearby
- Routine actions do not include keeping patient warm
- Too little concern for patient comfort
- Need to step out of routine actions included in procedure

**Profile**

Dr. Elke Van Gerven is Associate Head of the Anaesthesiology Department of UZ Leuven, Belgium. An emergency physician, Dr. Van Gerven has recently completed a degree in clinical disaster management. She teaches several courses on anaesthesia and intubation techniques and is also involved in several quality improvement initiatives.

---

**Recommended literature**

Frank SM et al. Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events: a randomized clinical trial. JAMA. 1997; 277: 1127–34.


For more information, please visit www.molnlycke.com