Adapted from Mild Perioperative Hypothermia by Daniel I. Sessler, MD, and Andrea Kurz, MDb

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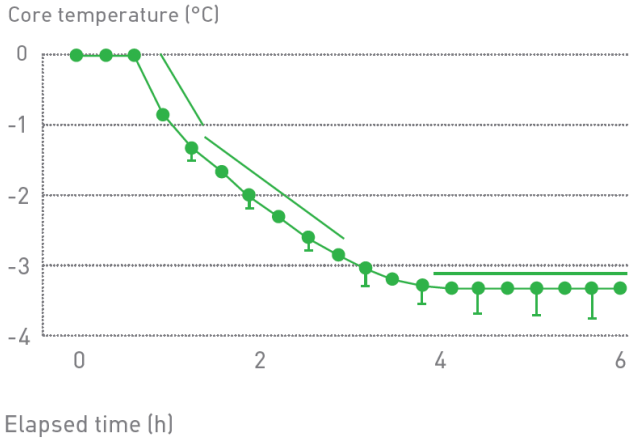
Body temperature is normally tightly regulated but perioperative hypothermia is common because anaesthetics impair the body's temperature control. Even mild hypothermia is associated with severe complications and should be avoided.

Inadvertent hypothermia results from anaesthetic-impaired thermoregulation and exposure to a cold environment. During general anaesthesia it follows a characteristic pattern: initial rapid decrease in core temperature followed by a slow reduction, which ultimately stabilises after 3 to 4 hours and then remains virtually unchanged.

Active pre-warming for as little as 30 minutes can prevent considerable heat redistribution.



Graph 1. Typical pattern of hypothermia during general anaesthesia

The initial drop occurs because anaesthetic-induced vasodilation allows core heat to flow outwards, warming the arms and legs at the expense of cooling the core. The result is a rapid 1° to 1.5°C redistribution hypothermia that develops during the first hour. The subsequent slow reduction in core temperature results simply from heat loss exceeding metabolic heat production.

Consequences of mild hypothermia

- Impaired coagulation, caused by a cold-induced defect in platelet function. Randomised clinical trials indicate that mild hypothermia significantly increases blood loss during hip arthroplasty and increases allogeneic transfusion requirements.
- Hypothermia can contribute to wound infections both by directly impairing immune function and by decreasing wound oxygen delivery. Mild intraoperative hypothermia triples the risk for surgical wound infection in patients undergoing colon surgery. It delays wound healing and prolongs the duration of hospitalisation by 20%, even in patients without infection.
- Hypothermia is uncomfortable and stressful, elevating blood pressure and heart rate. These factors contribute to what may be the most important consequence: a 3-fold increase in morbid myocardial outcomes.
- Drug metabolism is reduced by hypothermia.
- Shivering is potentially serious. Most shivering-like tremor is simply thermoregulatory shivering, although there is also tremor related to surgical pain. Shivering boosts metabolic heat production but the increase in heat is relatively small and shivering is rarely sustained for long periods.

Pre-warming prevents hypothermia

The initial drop in core temperature during anaesthesia caused by redistribution of heat from the central core to cooler peripheral tissues can be prevented by warming the skin surface before the induction of anaesthesia. Active pre-warming for as little as 30 minutes can prevent considerable redistribution.

90% of metabolic heat is lost via the skin's surface

Operating room temperature determines the rate at which the patient loses metabolic heat but room temperatures exceeding 23°C are required to maintain normothermia during all but the smallest procedures, so increasing ambient temperature is rarely a practical way of keeping surgical patients warm.

Only cutaneous warming will transfer sufficient heat to prevent hypothermia

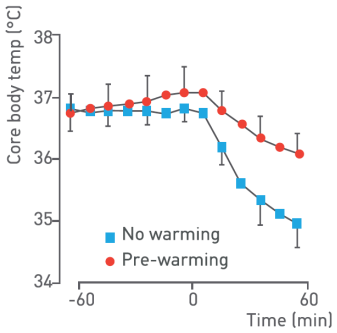
Insulators available include cotton blankets, surgical drapes, plastic sheeting and reflective "space blankets". A single layer of each reduces heat loss by about 30%, but passive insulation alone is rarely enough to maintain normothermia in patients undergoing large operations, and active warming will be required.

Because about 90% of metabolic heat is lost via the skin's surface, only cutaneous warming will transfer sufficient heat to prevent hypothermia. During operations circulating water and forced air can be used but circulating water mattresses are nearly ineffective, and pressure burns can occur even when water temperature does not exceed 40°C.Forced air is more effective and usually maintains normothermia even during the largest operations.

Temperature monitoring

Changes in core temperature during the first 30 minutes of general anaesthesia should be monitored when general anaesthesia is expected to last longer than 30 minutes. Perioperative monitoring of the core temperature can detect both fever and hyperthermia. Skin temperature, with a 2°C compensation added, is a good indicator of core temperature.

Core body temperature should be measured in most patients under general anaesthesia for longer than 30 minutes.



Temperature should also be measured during regional anaesthesia when changes in body temperature are intended, anticipated, or suspected.

Unless hypothermia is specifically indicated (eg, for protection against ischemia), efforts should be made to maintain the intraoperative core temperature above 36°C.

Currently available temperature management products:

- Bair Hugger forced warming systems
- Bair paws gown
- Bair Hugger forced air blankets (adult and paediatric)
- 241 Blood/fluid warming set (single use)
- Ranger irrigation fluid warming system
- Buddy blood/fluid warming system
- Blanketrol III conductive water therapy system (warming and cooling)
- Gelli roll pads (produce warmth and reduce pressure on patient)
- Norm-o-temp hyperthermia water system enFlow IV fluid warmer
- enFlow IV fluid warmer
- Patient Warming System – model 100 (circulating water warming unit)
- PerfecTemp (warming pad)
- Allon control unit (Circulating water warming control unit)
- Level 1 Equator convective warming system
- Level 1 Hotline blood and fluid warmer

Passive insulation alone rarely is sufficient to maintain normothermia in patients undergoing large operations

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