

Review Article

## Cold in the Operating Room: Understanding and Preventing Perioperative Hypothermia for Safer Surgical Outcomes

Paniagua J, Hajibandeh K, Pachtinger L, Horeczko D, Oberley W

Department of Medical and Surgical Sciences, Spain

\*Corresponding Author: Pachtinger L, Department of Medical and Surgical Sciences, Spain

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### Abstract

Perioperative hypothermia, defined as a core body temperature below 36°C during the preoperative, intraoperative, or postoperative period, remains a common yet preventable complication of surgical care. The condition results from impaired thermoregulation caused by anesthesia, exposure to cold operating room environments, and surgical interventions. Unintended hypothermia can lead to numerous adverse outcomes, including increased blood loss, surgical site infections, prolonged recovery, cardiovascular complications, and higher healthcare costs. Despite advances in perioperative management, many patients remain vulnerable to temperature-related complications. This article explores the pathophysiology, risk factors, clinical consequences, assessment methods, and evidence-based prevention strategies associated with perioperative hypothermia. Emphasis is placed on the importance of multidisciplinary collaboration, patient warming techniques, and adherence to clinical guidelines to enhance patient safety and improve surgical outcomes.

### Introduction

Maintaining normal body temperature is a critical component of patient safety during surgical procedures. Perioperative hypothermia occurs when a patient's core temperature falls below 36°C before, during, or after surgery. It is one of the most frequently encountered complications in perioperative care, affecting approximately 50–90% of patients undergoing surgery without active warming measures.

Although often underestimated, perioperative hypothermia can significantly impact patient recovery and increase the risk of postoperative complications. Understanding its causes and implementing preventive interventions are essential responsibilities of healthcare professionals involved in surgical care

### Physiology of Thermoregulation

The human body maintains a stable core temperature through a complex thermoregulatory system controlled primarily by the hypothalamus. Heat is generated through metabolic activity and conserved through mechanisms such as vasoconstriction and shivering.

During surgery, anesthesia disrupts these protective mechanisms by:

- Inhibiting hypothalamic temperature regulation
- Reducing metabolic heat production
- Causing peripheral vasodilation
- Impairing the body's ability to shiver

As a result, body heat is redistributed from the core to peripheral tissues, leading to a rapid decline in core temperature

### Causes of Perioperative Hypothermia

Several factors contribute to perioperative hypothermia:

#### 1. Anesthetic Agents

General and regional anesthesia impair thermoregulatory responses and promote heat redistribution.

#### 2. Cold Operating Room Environment

Operating rooms are often maintained at low temperatures for staff comfort and infection control purposes, increasing heat loss from the patient.

**3. Surgical Exposure** Large surgical incisions and prolonged exposure of internal organs accelerate heat loss through radiation and evaporation.

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### 4. Administration of Cold Fluids

Intravenous fluids, blood products, and irrigation solutions administered without warming can significantly reduce body temperature.

### 5. Patient-Related Factors

Certain patients are at higher risk, including:

- Elderly individuals
- Neonates and infants
- Patients with low body mass index
- Individuals with endocrine disorders
- Patients undergoing lengthy or major surgical procedures

### Clinical Consequences

Perioperative hypothermia can negatively affect multiple organ systems.

### Increased Surgical Site Infections

Hypothermia causes peripheral vasoconstriction, reducing oxygen delivery to tissues and impairing immune function. This increases susceptibility to postoperative wound infections.

### Excessive Blood Loss

Low body temperature interferes with platelet function and coagulation pathways, leading to increased intraoperative bleeding and greater transfusion requirements.

### Cardiovascular Complications

Hypothermia elevates sympathetic nervous system activity, increasing the risk of:

- Hypertension
- Tachycardia
- Myocardial ischemia
- Cardiac arrhythmias

### Delayed Recovery

Patients experiencing hypothermia often require extended recovery room stays due to:

- Delayed anesthetic metabolism
- Postoperative shivering
- Increased oxygen consumption
- Delayed wound healing

### Patient Discomfort

Postoperative shivering and cold sensation are common complaints that negatively impact patient satisfaction and recovery experience.

### Assessment and Monitoring

Continuous temperature monitoring is essential for early detection and management of hypothermia.

Common monitoring sites include:

- Esophageal temperature probes
- Nasopharyngeal probes
- Bladder temperature sensors
- Tympanic membrane thermometers

Guidelines recommend regular temperature monitoring for procedures lasting longer than 30 minutes, particularly when general or neuraxial anesthesia is used.

### Prevention Strategies

Preventing perioperative hypothermia is more effective than treating established hypothermia.

### Preoperative Warming

Active warming before anesthesia induction helps increase peripheral tissue temperature and reduces core-to-peripheral heat redistribution.

Methods include:

- Forced-air warming blankets
- Warming gowns
- Warm environments in preoperative holding areas

### Intraoperative Warming

Active warming during surgery is considered the standard of care.

Techniques include:

- Forced-air warming systems
- Conductive warming mattresses
- Radiant warming devices

### Warmed Intravenous Fluids

Heating intravenous fluids and blood products before administration minimizes temperature loss and supports thermal stability.

### Maintaining Operating Room Temperature

Appropriate environmental temperature management is particularly important for pediatric, elderly, and high-risk patients.

### Postoperative Temperature Management

Monitoring should continue in the recovery area until normothermia is achieved and maintained.

### Role of the Multidisciplinary Team

Successful prevention of perioperative hypothermia requires collaboration among:

- Surgeons
- Anesthesiologists
- Perioperative nurses
- Recovery room staff

Establishing standardized warming protocols and ensuring compliance with evidence-based guidelines can significantly reduce hypothermia-related complications

### Future Directions

Technological advances continue to improve temperature management during surgery. Emerging innovations include intelligent warming systems, continuous wireless temperature monitoring, and predictive algorithms that identify patients at high risk for hypothermia. These developments may further enhance patient safety and optimize perioperative outcomes.

### Conclusion

Perioperative hypothermia remains a significant yet preventable challenge in surgical care. The condition is associated with increased infection rates, cardiovascular complications, blood loss, prolonged recovery, and higher healthcare costs. Early identification of at-risk patients, routine temperature monitoring, and implementation of active warming strategies are essential for maintaining normothermia throughout the surgical journey. Through evidence-based practice and multidisciplinary collaboration, healthcare providers can minimize the adverse effects of perioperative hypothermia and promote safer, more effective surgical outcomes.

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