SCOAP Metric:

Body Temperature is maintained appropriately during surgery

Rationale: Research indicates that maintaining normothermia can reduce infection rates, operative blood loss and length of hospital stay.

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Frequently Asked Questions

1. **What is Hypothermia?**
   - Hypothermia occurs when the core body temperature is < 36°C, while Hyperthermia is a temperature > 38.3 °C. (Sappenfield, 2013). Maintaining a body temperature (normothermia) between 36°C -38°C is best practice according to The American Society of Peri Anesthesia Nurses (Weirich, 08).

2. **What are the Effects of Hypothermia?**
   - Risk factors associated with hypothermia include:
     - Increased chance for intraoperative blood loss and the need of blood transfusions (Granum, 2019).
     - Increased risk for infection due to reduced immune activation and tissue healing (Granum, 2019).
     - Increased shivering which can increase the patient's metabolic rate up to five times the basal rate, increasing the oxygen demand and depleting glycogen and high energy phosphate stores (Sappenfield,2013).
     - Increased chance of post-operative cardiac events, recovery from anesthesia and a decrease in metabolism of common anesthetics (Sappenfield, 2013).

3. **What are the effects of anesthesia on a patient's thermoregulatory control?**
   - General anesthesia impairs the function of the hypothalamus which is the body's natural thermostat. Vasoconstriction is the body's normal response to hypothermia, but general anesthesia causes vasodilation, limiting the body's natural responses (Weirich, 2008).
   - The largest amount of heat loss is in the first hour of anesthesia due to heat redistribution. Redistribution hypothermia occurs after induction of general anesthesia by allowing the warmer blood from the core to mix with the cooler blood in peripheral body areas as it circulates. When the cool blood returns to the heart it causes the core body temperature to decrease (Weirich, 2008).

4. **What are different methods to prevent Hypothermia?**
   - Best practice is a combination of both active and passive warming methods to prevent hypothermia.
   - Prewarming patients prior to surgery increases peripheral tissue heat by decreasing the core-to-peripheral heat gradient so there is less redistribution in heat loss (Weirich,2008).
     - One active warming method is Forced Air Warming (FAW) which involves forced-air warming blankets with small holes to allow air to reach the patient, the air temperature that flows through the blanket is controlled by a warmed unit connected to the blanket (Weirich, 2008).
     - A passive warming method pre and intraoperatively includes using draped blankets on a patient.
   - Intraoperatively active warming methods include heated and humidified anesthesia gases, warmed IV and irrigation fluids and FAW. (Bashaw,2016).

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5. What are the best practices pre-operatively and perioperatively to maintain normothermia?

- Preoperatively:
  - Prewarming is the warming of peripheral tissues or skin surface before anesthesia. This prevents hypothermia especially the hour after anesthesia is administered (Granum, 2019).
  - Identify patient risk factors, measure patient's temperature on admission, and determine patient's thermal comfort. If patient is normothermic institute preventative warming measures such as heating blankets, increasing room temperature, and passive insulation such as heating blankets, socks, and limited skin exposure. If patient is hypothermic, institute the active warming measures such as forced air warming, passive insulation and increased room temperature (Clinical Guideline, 01).
- Intraoperatively:
  - Monitor the patient's temperature and observe for signs and symptoms of hypothermia. Institute active warming measures, warm fluids, increase ambient room temperature and provide passive insulation. Ensure that the patient's temperature is maintained at $\geq$ 36°C (96.8 °F) during the intraoperative period (Clinical Guideline, 01).

Measure Change Concepts

STANDARDIZE:
Standard: Limit heat loss in patients prior to operative procedure; keep at >36° C.
Process:

- Standardize process to use warming devices (warming blankets, hot air blankets, IV fluid heaters, filter heater hydrator for laparoscopic procedures, warming caps) to ensure patient temperature >36° C perioperatively.
- Warm patient preoperatively, intraoperatively and postoperatively.
- Standardize temperature monitoring method and process (perioperatively).
- Adopt method to evaluate, monitor and regulate patient temperature throughout perioperative period.

Responsibility:

- Assign responsibility for preoperative temperature monitoring and regulation to preop/holding area.
- Assign responsibility for intraoperative temperature monitoring and regulation to anesthesia department.
- Assign responsibility for postoperative temperature monitoring and regulation to PACU/SICU.

Timing: Perioperative
Documentation: Design and implement systematic documentation of patient temperature on every patient chart (paper or electronic).

DESIGN SYSTEMS TO AVOID MISTAKES:
Protocol:

- Provide devices and protocol for consistent measurement of patient temperature.
- Revise charting to include required fields for interval temperature monitoring.

USER REMINDERS:
Checklist

- Use (SCOAP) Surgical Checklist
- Operating Room Posters

GIVE PEOPLE ACCESS TO INFORMATION:

- Provide staff education.
- Provide regular feedback to physicians/surgeons/departments from SCOAP reports.

See Attached Resources and References list

CONSIDER PEOPLE AS IN THE SAME SYSTEM:

- Include Pre-op, anesthesiology, surgeons, PACU staff on team.

USE AUTOMATION:

- EMR alerts

PARTNER WITH PATIENT:

- Provide patient/family education about why it is important to stay warm during the perioperative period and what to expect during their experience, as well as how to communicate with staff about their comfort.

CELEBRATE SUCCESS:

- Keep team members, physicians, and stakeholders informed about the progress that has been made using multiple forums (newsletters, awards, success stories posters, balloons, etc.

References

Joshua W. Sappenfield, Caron M. Hong and Samuel M. Galvagno. (2013). Perioperative temperature measurement and management: moving beyond the Surgical Care Improvement Project. *Journal of Anesthesiology & Clinical Science.* ISSN 2049-9752

Intraoperative management of patient body temperature is a standard of care for practicing anesthesiologists. Merely complying with the Surgical Care Improvement Project (SCIP) measurement is inadequate for optimizing perioperative outcomes. Clinicians should have a sound understanding of available temperature monitoring sites, deleterious effects of hypothermia, and indications for therapeutic hypothermia. This foundation will help physicians use indicated modalities to improve patient outcomes throughout the perioperative period. The purpose of this paper is to review appropriate intraoperative temperature monitoring, the importance of maintaining normothermia, and indications for intraoperative hypothermia.

Horn, E. P., & Torossian, A. (2010). Perioperative Hypothermie - Prophylaxe, Therapie und Physiologie [Prevention of perioperative hypothermia]. *Anasthesiologie, Intensivmedizin, Notfallmedizin, Schmerztherapie : AINS*, *45*(3), 160–167

Inadvertent perioperative hypothermia impairs postoperative outcome in surgical patients due to ischemic myocardial events, wound infections and coagulation disorders. Body core temperature should be assessed 1-2h preoperatively and continuously during surgery. To prevent hypothermia patients and nursing clinical staff should be taught and trained. Preoperatively surgical patients should always be prewarmed by using convective warming devices, and active warming should be continued during operations longer than 1 hour. Warming of IV fluids is effective if infusion rates are above 1l/h. Core temperature should be measured in the recovery room and active warming should be started when patients are hypothermic or if they feel cold.

Sohn, V. Y., & Steele, S. R. (2009). Temperature control and the role of supplemental oxygen. *Clinics in colon and rectal surgery*, *22*(1), 21–27. https://doi.org/10.1055/s-0029-1202882

Unrecognized and untreated intraoperative hypothermia remains a common avoidable scenario in the modern operating room. Failure to properly address this seemingly small aspect of the total operative care has been shown to have profound negative patient consequences including increased incidence of postoperative discomfort, surgical bleeding, requirement of allogenic blood transfusion, wound infections, and morbid cardiac events. All of these ultimately lead to longer hospitalizations and higher mortality. To avoid such problems, simple methods can be employed by the surgeon, anesthesiologist, and ancillary personnel to ensure euthermia. Similarly, another effortless method to potentially improve surgical outcomes is the liberal use of supplemental oxygen. Promising preliminary data suggests that high-concentration oxygen during and after surgery may decrease the rate of surgical site infections and gastrointestinal anastomotic failure. The precise role of supplemental oxygen in the perioperative period represents an exciting area of potential research that awaits further validation and analysis. In

this article, the authors explore the data regarding both temperature regulation and supplemental oxygen use to define further their emerging role in the perioperative care of patients undergoing colorectal surgery.

Sessler D. I. (2008). Temperature monitoring and perioperative thermoregulation. *Anesthesiology*, *109*(2), 318–338. https://doi-org.offcampus.lib.washington.edu/10.1097/ALN.0b013e31817f6d76

Most clinically available thermometers accurately report the temperature of whatever tissue is being measured. The difficulty is that there are no reliable core-temperature measuring modalities that are non-invasive and easy to use (— especially in patients not having general anesthesia). Body temperature should be measured in patients having general anesthesia exceeding 30 minutes in duration, and in patients having major operations under neuraxial anesthesia. Core body temperature is normally tightly regulated. All general anesthetics produce a profound dose-dependent reduction in the core temperature triggering cold defenses including arterio-venous shunt, vasoconstriction and shivering. Anesthetic-induced impairment of normal thermoregulatory control, and the resulting core-to-peripheral redistribution of body heat, is the primary cause of hypothermia in most patients. Neuraxial anesthesia also impairs thermoregulatory control, although to a lesser extent than general anesthesia. Prolonged epidural analgesia is associated with hyperthermia whose cause remains unknown. This article reviews temperature monitoring and the effects of general and regional anesthesia on thermoregulatory control.

Weirich T. L. (2008). Hypothermia/warming protocols: why are they not widely used in the OR?. *AORN journal*, *87*(2), 333–344. https://doi.org/10.1016/j.aorn.2007.08.021

Hypothermia, a common problem for patients having surgery, adversely affects multiple organ systems and physiologic functions. Research indicates that maintaining normothermia can reduce infection rates, operative blood loss, and length of hospital stay. Often, preventing hypothermia is not a high priority to surgical staff members because forced-air warming systems may cause field contamination and passive warming may increase the ambient OR temperature. In addition, inconsistent practices and lack of guidelines may affect team members' efforts. Surgical team awareness, education, and understanding of the effects of hypothermia are necessary components to enhance the ways clinicians provide quality, cost-effective patient care.

Doufas A. G. (2003). Consequences of inadvertent perioperative hypothermia. *Best practice & research. Clinical anaesthesiology*, *17*(4), 535–549. https://doi.org/10.1016/s1521-6896(03)00052-1

Perioperative hypothermia triples the incidence of adverse myocardial outcomes in high-risk patients. Mild hypothermia significantly increases blood loss and augments allogeneic transfusion requirement, but the molecular pathophysiology of this effect remains to be elucidated. Only 1.9 °C core hypothermia triples the incidence of surgical wound infection

following colon resection and increases the duration of hospitalization by 20%. Hypothermia adversely affects antibody- and cell-mediated immune defenses, as well as the oxygen availability in the peripheral wound tissues. Mild perioperative hypothermia changes the kinetics and action of various anaesthetic and paralyzing agents, increases thermal discomfort, and is associated with delayed post-anaesthetic recovery. Finally, mild core hypothermia influences pulse oximetry monitoring and various electrophysiological indices of the nervous system, with questionable clinical significance, as yet.

Clinical guideline for the prevention of unplanned perioperative hypothermia. (2001). *Journal of Perianesthesia Nursing, 16*(5), 305-314.

This guideline is intended to serve as a practical bedside tool for anesthesia providers and perianesthesia/perioperative nurses in the promotion of perioperative normothermia. The goal of this guideline is to provide recommendations for both nursing and medical assessment and intervention designed to optimize patient outcomes. The guideline is also designed to promote collaboration, communication, and a true team approach across all disciplines in patient management across the surgical continuum.

Kurz, A., Sessler, D. I., & Lenhardt, R. (1996). Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. Study of Wound Infection and Temperature Group. *The New England journal of medicine*, *334*(19), 1209–1215.

Hypothermia itself may delay healing and predispose patients to wound infections. Maintaining normothermia intraoperatively is likely to decrease the incidence of infectious complications in patients undergoing colorectal resection and to shorten their hospitalizations.

Granum, Mia N, Kaasby, Karin, Skou, Søren T, & Grønkjær, Mette. (2019). Preventing Inadvertent Hypothermia in Patients Undergoing Major Spinal Surgery: A Nonrandomized Controlled Study of Two Different Methods of Preoperative and Intraoperative Warming. Journal of Perianesthesia Nursing, 34(5), 999-1005.

This study evaluated if a Full Access Underbody blanket when used preoperatively and intraoperatively in major spinal surgery prevents is successful at preventing hypothermia in comparison to other current methods. It was found that patients using the FAU blanket had a lower incidence of hypothermia at the start of the operation compared to the use of passive prewarming and active warming with the FBBSA at the start of the operation. Actively warmed patients using underbody warming systems were significantly less at risk of hypothermia than those being passively warmed.

Duff, Jed, Walker, Kim, & Edward, Karen-Leigh. (2018). Collaborative Development of a Perioperative Thermal Care Bundle Using the Guideline Implementability Appraisal Tool. Journal of Perianesthesia Nursing, 33(1), 13-22.

Perioperative hypothermia increases adverse complications for patients. These include infection at the surgical site, morbid cardiac events, and surgical bleeding. This article explores the use of knowledge tools as resources discussing a perioperative thermal care bundle to assist clinicians to provide to provide evidence-based care. The three main elements were observed: assessing patient's risk of hypothermia and contraindications to active warming; record temperature frequently preoperatively, intraoperatively and postoperatively; and actively warm, intraoperatively if they are high risk or anytime if they are hypothermic.

Bashaw, Marie A., DNP, RN, NEA-BC. (2016). Guideline Implementation: Preventing Hypothermia. AORN Journal, 103(3), 304-313.

This guideline was created by AORN for the prevention of unplanned patient hypothermia. It provides guidance to identify factors that are associated with intraoperative hypothermia, preventing hypothermia, educating perioperative personnel on this topic and relevant policies and procedures to implement.

Sessler D. I. (2016). Perioperative thermoregulation and heat balance. Lancet (London, England), 387(10038), 2655–2664

It is standard practice to monitor core temperature and maintain normothermia during general and neuraxial anesthesia. Major thermoregulatory defenses including sweating, arteriovenous shunt vasoconstriction and shivering. General anesthesia impairs thermoregulation and reduces the thresholds for vasoconstriction and shivering while neuraxial anesthesia impairs central thermoregulatory control and prevents vasoconstriction and shivering in blocked areas. An un-warmed anaesthetized patient can become hypothermic by 1-2 C when the body heat is redistributed from the core to the periphery as well as heat loss occurring through metabolic heat production.

Bender, M., Self, B., Schroeder, E., & Giap, B. (2015). Comparing new-technology passive warming versus traditional passive warming methods for optimizing perioperative body core temperature. AORN journal, 102(2), 183.e1–183.e1838

Traditional passive warming methods are mostly ineffective when reducing hypothermia throughout surgery. New technology passive warming has been shown to be more effective at maintaining normothermia throughout surgery. This study compared new technology passive warming with traditional methods. It was found that new technology passive warming may be an effective complement to current active warming practices to reduce perioperative hypothermia.