

American Society of PeriAnesthesia Nurses
10 Melrose Avenue • Suite 110 • Cherry Hill • New Jersey 08003-3696
Tel: 877-737-9696 • Fax: 856-616-9601 • E-mail: aspan@aspan.org • Web: www.aspan.org

CLINICAL GUIDELINE FOR THE PREVENTION OF UNPLANNED PERIOPERATIVE HYPOTHERMIA

As early as 1989, the legislation that created the Agency for Health Care Policy and Research (now known as the Agency for Health Care Research and Quality) called for the development, periodic review, and update of clinically relevant guidelines. These guidelines could assist physicians, educators, and health care practitioners in determining how diseases, disorders, and other health conditions could effectively be prevented, diagnosed, treated and managed clinically. As the process for developing clinical practice guidelines has evolved, professional groups of health care practitioners have become involved in identifying health conditions affecting select patient populations and examining the ways in which different aspects of prevention, diagnosis, treatment, management, and the care process fit together.

Introduction

All health care providers are responsible for preventing hypothermia in the patient undergoing surgery. Published research has correlated significant adverse consequences such as impaired wound healing, adverse cardiac events, altered drug metabolism, and coagulopathies with unplanned perioperative hypothermia. With prevention and management of hypothermia, patients also experience a greater level of comfort, and avoid postoperative shivering and the unpleasant sensation of feeling cold.

Despite the availability of technology to prevent hypothermia, it remains an ongoing problem in the perioperative period. Recognition of the inadequate management of the patient's perioperative thermoregulation prompted the American Society of PeriAnesthesia Nurses (ASpan) to host a Consensus Conference on Perioperative Thermoregulation on February 7, 1998, in Bethesda, Maryland. A variety of health care disciplines and specialties endorsed and participated in the conference. One hundred ten perianesthesia nurses, operating room nurses, nurse anesthetists, anesthesiologists, surgeons, critical care nurses, medical surgical nurses, and industry representatives dialogued regarding temperature management and its impact on patient care.

Because this conference provided an open forum to discuss current practices regarding temperature management, specific research on perioperative temperature management was reviewed. Consensus on the definitions of normothermia and hypothermia was reached. The final outcome of the conference was the recommendations to establish a development panel to create a clinical guideline for the thermoregulatory management of perioperative patients.

On August 29, 1998, a ten-member multidisciplinary and multispecialty Guideline Development Panel convened in New York, New York, to write the *Clinical Guideline for the Prevention of Unplanned Perioperative Hypothermia* (referred to hereafter as the Guideline). The panel's mission was to improve patient outcomes through the maintenance of normothermia. The Guideline established by the panel was subsequently peer reviewed by individuals with expertise and/or special interest in the prevention and management of perioperative hypothermia.

After peer review, the Guideline was pilot tested in six health care institutions of varying size and location.

The intent of the Guideline is to provide clinicians with a practical, bedside approach to the prevention, care, and management of the adult surgical patient with unplanned perioperative hypothermia. The Guideline is designed to explore the physiological basis for perioperative hypothermia and cite clinical studies linking perioperative hypothermia to adverse outcomes. The Guideline has five major goals:

1. Establish a definition for normothermia.
2. Establish a definition for hypothermia.
3. Alert health care providers in perioperative settings of the importance of maintaining perioperative normothermia.
4. Provide ways to address the management of unplanned perioperative hypothermia.
5. Improve patient outcomes by establishing strategies to maintain perioperative normothermia.

Scope and Significance of the Condition

Every patient undergoing surgery is at risk for developing perioperative hypothermia.^{1,7} Contributing factors vary and may increase the risk for hypothermia in the surgical patient. Contributing risk factors include the following¹⁻⁸:

- Extremes of ages.
- Female sex.
- Ambient room temperature.
- Length and type of surgical procedure.
- Cachexia.
- Pre-existing conditions (peripheral vascular disease, endocrine disease, pregnancy, burns, open wounds, etc.)
- Significant fluid shifts.
- Use of cold irrigants.
- Use of general anesthesia.
- Use of regional anesthesia.

Negative consequences associated with perioperative hypothermia include the following:

- Patient discomfort from shivering.^{1,7,10,11}
- Untoward cardiac events.^{16,17,19,26-28}
- Adrenergic stimulation with a resultant increase in serum catecholamine levels.^{1,8}
- Impaired platelet function and reduced effectiveness of the coagulation pathway.^{2,6,16,21-25}
- Altered drug metabolism.^{8,20}
- Impaired wound healing with increased susceptibility to infection.^{18,34}

Perioperative hypothermia is a multidisciplinary/multispecialty problem. Management of this nursing and medical diagnosis requires the coordinated efforts of anesthesia providers, surgeons, and perioperative, perianesthesia, and critical care nurses. The cost of perioperative hypothermia

varies and can range from the cost of an extra cotton blanket to increased patient morbidity and mortality. Meta-analysis results demonstrate that hypothermia averaging only 1.5°C below normal caused cumulative adverse outcomes, which added \$2,500 to \$7,000 per surgical patient to hospitalization costs.⁹ Significant factors associated with elevated costs of patient care include the following^{1,16-28}:

- Increased length of PACU, ICU, and hospital stay.^{16,18,34}
- Increased red blood cell (RBC), plasma, and platelet use.¹⁶
- Increased need for mechanical ventilation.
- Increased cardiac problems and associated costs.

Meta-analysis results indicate that patients maintained at normothermic conditions throughout the perioperative period experience fewer adverse outcomes, and thus, health care costs decrease.⁹

Definition of the Patient Population

Although it is commonly agreed that unplanned perioperative hypothermia exists across all patient populations, this Clinical Practice Guideline is designed to address unplanned perioperative hypothermia in the adult surgical population from admission to the perioperative setting until discharge from all phases of postanesthesia care. Although it is appropriate and necessary to address unplanned perioperative hypothermia issues specific to the critical care/trauma and pediatric populations, those issues will be served more effectively through the development of an additional clinical practice task force and guideline.

CLINICAL PRACTICE GUIDELINE

Unplanned perioperative hypothermia is defined as a patient who presents with a body temperature below a predetermined level. This Guideline acknowledges that hypothermia may be present anytime a patient states they are cold.^{2,10} Further assessment and possible intervention are required.

Definitions and Basic Recommendations

Although the literature presents no consistent definitions of normothermia and hypothermia, it is the consensus of the panel experts that normothermia is best defined as a core temperature range from 36°C-38°C (96.8°F-100.4°F). Hypothermia is defined as a core temperature less than 36°C (96.8°F). Hypothermia may be present regardless of temperature if the patient describes feeling cold or presents with common signs and symptoms of hypothermia, such as, shivering, peripheral vasoconstriction, and piloerection.¹⁰

Temperature Measurement

Temperature measurement must be accurate and consistent. It is the responsibility of the practitioner to determine the best method for monitoring patient temperature and to use the temperature monitoring device correctly while considering accessibility of the site, patient comfort and safety.¹¹ Research indicates that during the perioperative period when core temperature rapidly changes the relationship between the temperatures measured at various body sites may differ considerably.^{11,12} Core temperature is measured in the pulmonary artery, the distal esophagus, nasopharynx and tympanic membrane.^{29,30,31,41} Core temperature can be estimated using the oral, axillary, and bladder sites.^{12,29,42} Adjusted skin temperatures and rectal temperatures reflect core temperatures reasonably well but become unreliable during Malignant Hyperthermia Crisis.^{12,29,43,44} (See Appendix A.)

A recent survey found infrared tympanic monitoring to be the preferred route of temperature measurement preoperatively and postoperatively.¹³ The correlation of infrared tympanic temperature measurements with core temperature has shown to be good in some studies^{45,46} and poor⁴⁷ in others. Research has indicated that the accuracy of the temperature reading is dependent on the operator, patient anatomy and the instrument.⁴⁷

Preoperative Patient Management

Assessment

- Identify patient's risk factors for unplanned perioperative hypothermia.³⁶
- Measure patient temperature on admission.
- Determine patient's thermal comfort level (ask the patients if they are cold).¹⁰
- Assess for other signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities).¹

Interventions

- Institute preventive warming measures for patients who are normothermic. (See definition.) A variety of measures may be used, unless contraindicated. Passive insulation may include warmed cotton blankets, socks, head covering, limited skin exposure, circulating water mattresses and increase in ambient temperature (minimum 20°C-24°C or 68°F-75°F).¹
- Institute active warming measures for patients who are hypothermic. (See definition.) Active warming is the application of a forced air convection warming system.^{3,4,5,11,33,34,35,36,40} Apply appropriate passive insulation and increase the ambient room temperature (minimum 20°C-24°C or 68°F- 75°F.)^{1,39} Consider warmed IV fluids.³⁸

Intraoperative Patient Management

Assessment

- Identify patient's risk factors for unplanned perioperative hypothermia.³⁶
- Determine patient's thermal comfort level (ask the patients if they are cold.)¹⁰
- Assess for other signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities.)¹
- Monitor patient's temperature intraoperatively.

Research indicates that the greatest temperature decline occurs during the first hour of surgery.³³ Therefore, frequent temperature monitoring is indicated in all cases to detect and aid in the prevention of hypothermia. Intraoperatively, the anesthesia provider should follow professional association standards of practice for temperature monitoring:

- The American Society of Anesthesiologists recommends that "every patient receiving anesthesia shall have temperature monitored when clinically significant changes in body temperature are intended, anticipated or suspected."¹⁴
- The American Association of Nurse Anesthetists recommends that "body temperature shall be intermittently or continuously monitored and recorded on all patients receiving general anesthesia; the means to monitor temperature shall be immediately available for use on all patients receiving local or regional anesthesia and used when indicated."¹⁵
- In cases in which an anesthesia provider does not participate and the patient is under the care of a perioperative nurse (e.g., local minor surgery or conscious sedation), the temperature should be monitored at the beginning and end of the procedure. In cases lasting longer than 30 minutes, serial temperature measurements should be obtained at least every 30 minutes to monitor temperature trends.

Intervention

Implement warming methods.³⁴ These methods include but are not limited to:

- Apply appropriate passive insulation: warm blankets, socks, head covering, limited skin exposure, and circulating water mattress.

- Increase ambient room temperature. Follow the AORN Practice Guidelines for ambient room temperature (temperature of 20°C-24°C or 68°F-75° F).^{1,7,39}
- Institute active warming: Apply forced air warming system.^{3,4,5,11,34,35,36,37}
- Warm fluids: Intravenous and irrigants.³⁸
- Humidify and warm gases: Anesthetic.

Expected Outcome

The patient's core temperature should be maintained at 36°C (96.8°F) or above during the intraoperative phase unless hypothermia is indicated.

Postoperative Patient Management: Phase I PACU

Assessment

- Identify patient's risk factors for unplanned perioperative hypothermia.
- Assess temperature on admission to the Phase I PACU.³⁶
 - If hypothermic, monitor serial temperatures at a minimum of every 30 minutes until normothermia is achieved.
 - If normothermic, assess temperature again prior to discharge and as ordered by physician.
- Determine patient's thermal comfort level (ask the patients if they are cold).¹⁰
- Assess for signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities).¹

Interventions

If normothermic: Institute preventative warming measures:

- Apply appropriate passive insulation: warm blankets, socks, head covering, limited skin exposure, and circulating water mattress.
- Increase ambient room temperature (minimum 20°C-24°C or 68°F-75°F).^{1,39}
- Assess patient's thermal comfort level every 30 minutes.¹⁰
- Observe for signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities).¹
- Reassess temperature if patient's thermal comfort level decreases and/or signs of hypothermia are present.
- Measure patient's temperature prior to discharge.

If hypothermic: Initiate active warming measures

- Apply forced air warming system.^{3,4,5,11,34,35,36,40}
- Apply passive insulation: warm blankets, socks, head covering, limited skin exposure, and circulating water mattress.
- Increase ambient room temperature (minimum 20°C-24°C or 68°F-75°F).¹

- Warm fluids: Intravenous.³⁸
- Humidify and warm gases: Oxygen.
- Assess temperature and patient's thermal comfort level every 30 minutes until normothermia is reached.¹⁰

Expected Outcome

- Patient core temperature will be a minimum of 36°C (96.8°F) prior to discharge from PACU.
- All signs and symptoms of hypothermia should be resolved before discharge.¹
- Patient should describe feeling an acceptable level of warmth.¹⁰
- Preventive warming measures and observation for hypothermia will continue in Phase II PACU (ASU) or on the medical/surgical unit.

Exceptions

- Patient is unable to verbalize feeling cold (e.g., intubated patient).
- Patient may be discharged to a critical care unit despite being hypothermic where active warming measures will continue.

Postoperative Patient Management: Phase II PACU (ASU)

Assessment

- Identify patient's risk factors for unplanned perioperative hypothermia.³⁶
- Measure patient's temperature on admission.
- Determine patient's thermal comfort level (ask the patient if they are cold).¹⁰
- Assess for signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities).¹

Intervention

If normothermic: Institute preventative warming measures:

- Apply appropriate passive insulation: warm blankets, socks, head covering, limited skin exposure, and circulating water mattress.
- Increase ambient room temperature (minimum 20°C-24°C or 68°F-75°F).^{1,39}
- Assess patient's thermal comfort level every 30 minutes.¹⁰
- Observe for signs and symptoms of hypothermia (shivering, piloerection, and/or cold extremities).¹
- Reassess temperature if patient's thermal comfort level decreases and/or signs of hypothermia are present.
- Measure patient's temperature prior to discharge.
- Implement active warming measures if patient complains that they are cold or become hypothermic.^{3,4,5,11,34,35,36,40}

- Instruct patient and responsible adult of methods to maintain normothermia at home (i.e., warm liquids, blankets, socks, increased clothing, increased room temperature).

If hypothermic: Institute active warming measures.

- Active warming is the application of a forced air warming system.^{3,4,5,11,34,35,36,40}
- Apply appropriate passive insulation: warm blankets, socks, head covering, limited skin exposure, and circulating water mattress.
- Increase the ambient room temperature (minimum 20°C-24°C or 68°F- 75°F).^{1,39}
- Consider warmed IV fluids.³⁸

Expected Outcome

- Patient core temperature should be a minimum of 36°C (96.8°F) core prior to discharge.
- All signs and symptoms of hypothermia should be resolved before discharge.
- Patient should describe feeling an acceptable level of warmth.
- Signs and symptoms of hypothermia will be absent.
- Patient and/or responsible adult should describe methods of maintaining normothermia at home.

Endorsements

As of October 2002, the Guideline had been endorsed by the following professional organizations: ASPAN, ASA, AANA, AORN. Endorsements are pending from: ANA, ACS, AACN.

Glossary

Active Warming Measures: Forced air convective warming.

Assessment: A systematic method used for the collection of data about the patient.¹

Core Temperature: The thermal compartment of the body composed of highly perfused tissues where the temperature is uniform and high compared to the rest of the body.²

Expected Outcomes: The anticipated client status at designated interval post intervention.¹

Guidelines: Systematically developed statements based on the best available scientific evidence and expert opinion.¹

Hypothermia: A core temperature less than 36°C (96.8°F).

ICU: Intensive Care Unit.

Normothermia: A core temperature range of 36°C to 38°C (96.8°F to 100.4°F).

Passive Insulation: Warmed cotton blankets, reflective blankets, circulating water mattress, socks, head covering, and limited skin exposure.

Perioperative: The time periods including preoperative, intraoperative, and postoperative phase of surgical intervention.³

Phase I PACU: Post Anesthesia Care Unit.

Phase II PACU: Ambulatory Surgery Unit (ASU) or Same Day Unit (SDU).

Post Operative Shivering: Uncomfortable rhythmic muscle contractions to maintain core temperature.

Preventative Warming Measures: Initiation of passive insulation and/or active warming measures to maintain normothermia.

Standard: Authoritative statements enunciated and promulgated by the profession by which the quality of practice, service, or education can be judged.¹

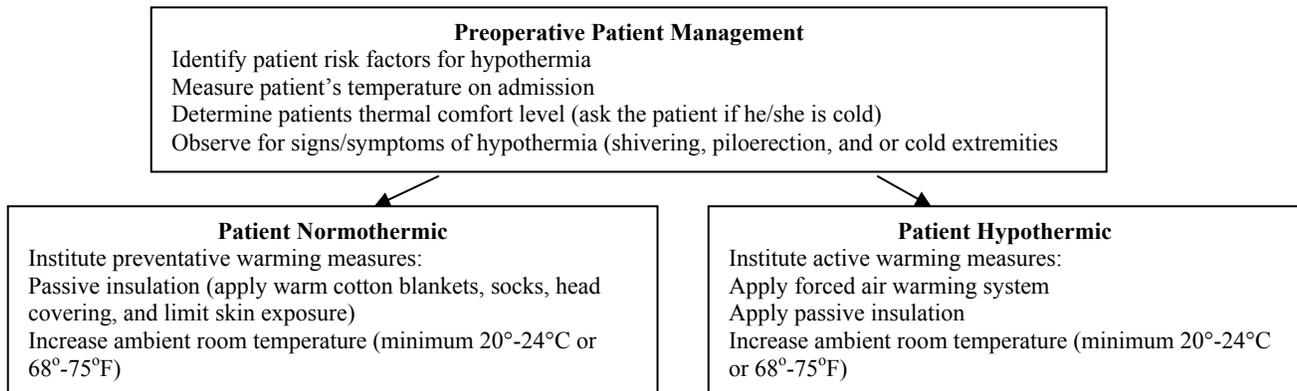
Thermal Comfort: A patient's subjective description of their temperature comfort level.

Unplanned Perioperative Hypothermia: An unexpected core temperature decrease to less than 36°C (96.8°F) as a result of surgery.

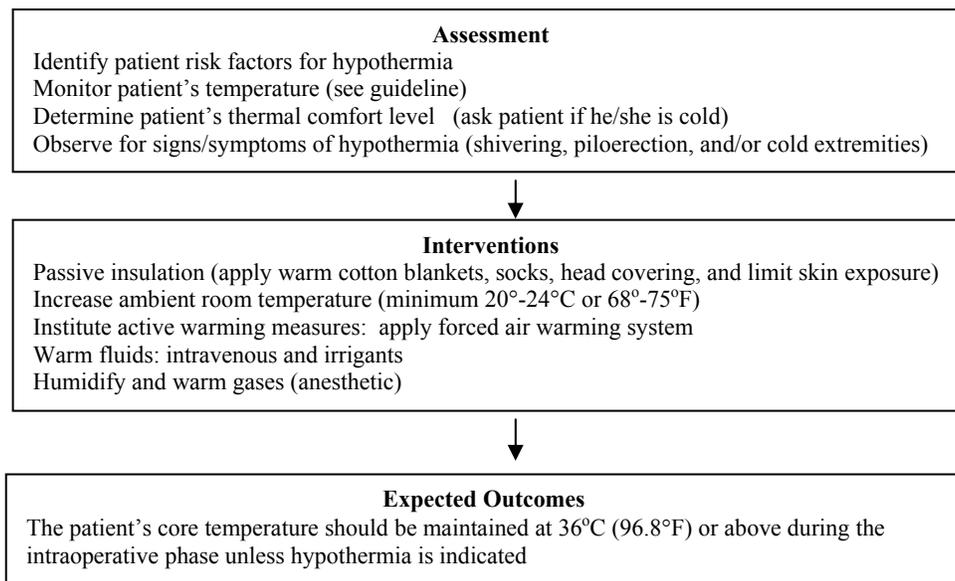
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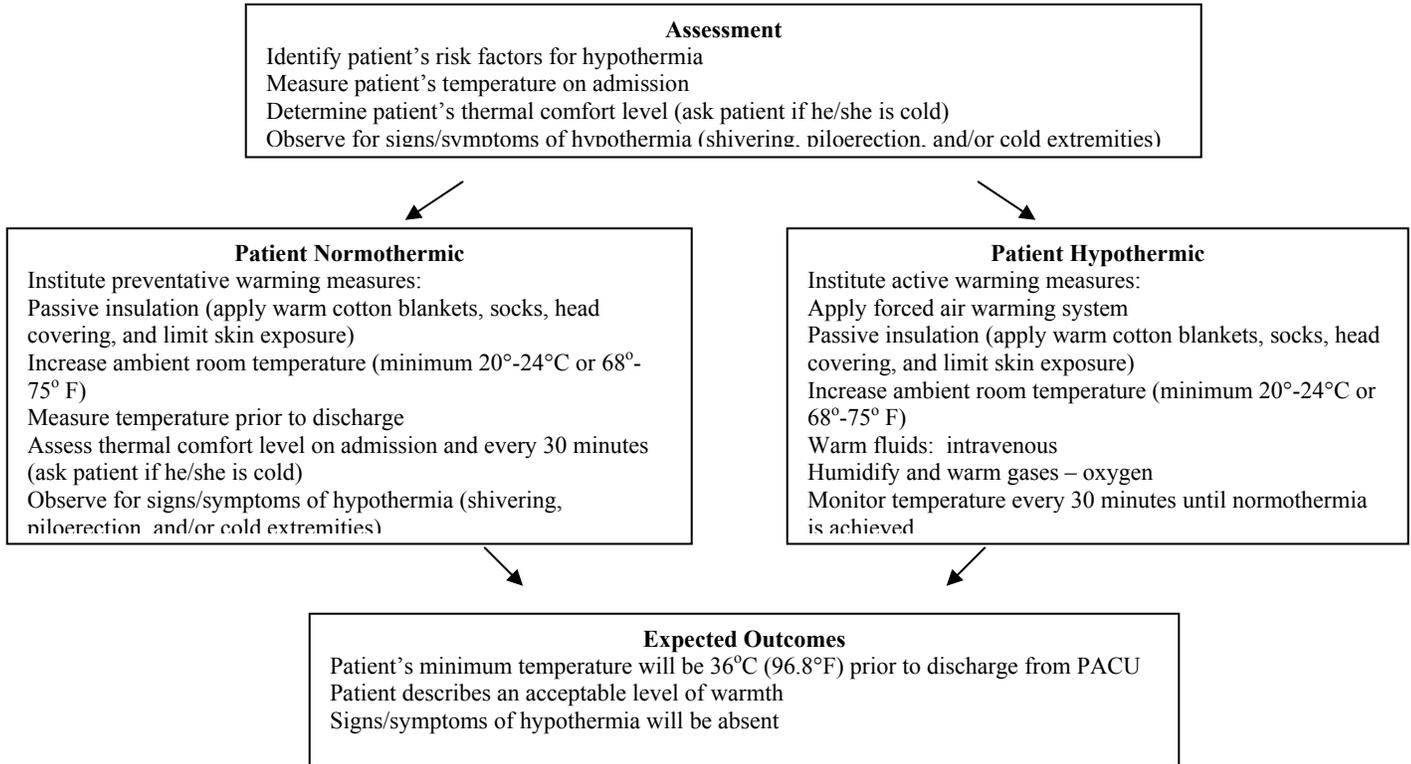
THERMAL MANAGEMENT FLOW CHART



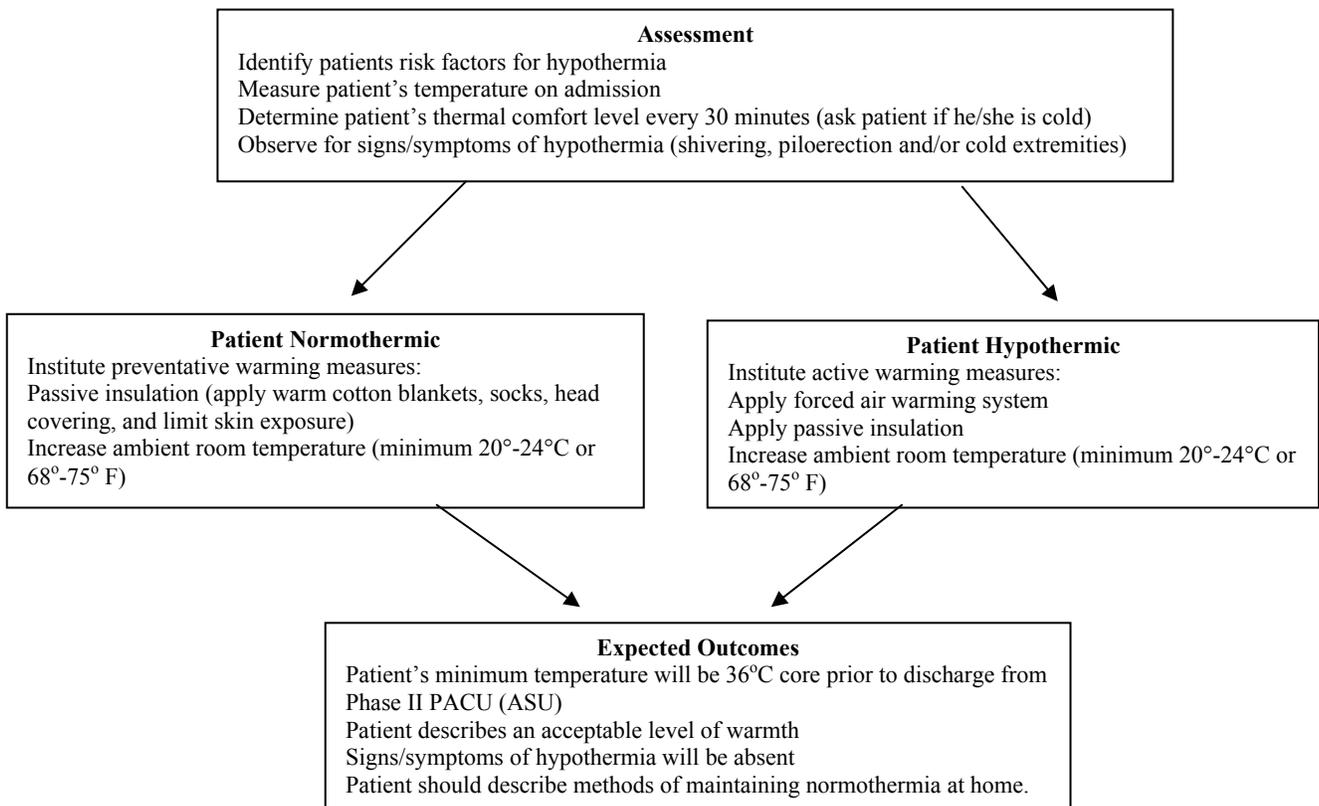
Intraoperative Patient Management



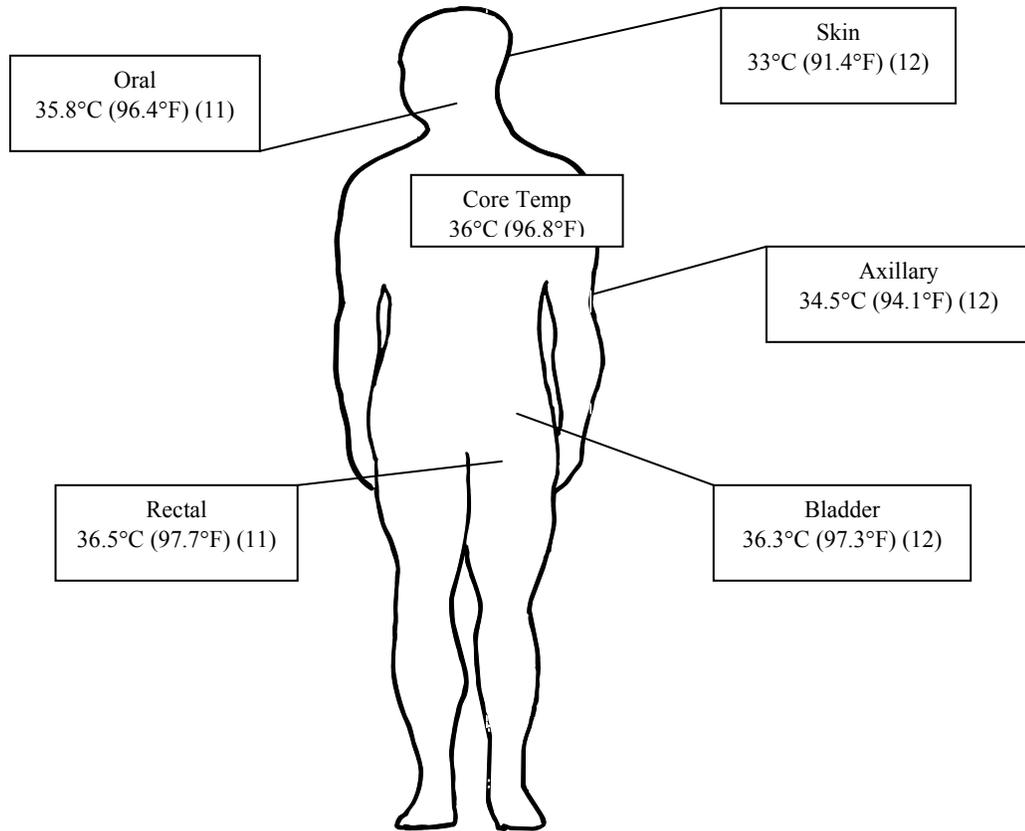
Postoperative Patient Management: Phase I PACU



Postoperative Patient Management: Phase II PACU (ASU)



TEMPERATURE EQUIVALENCY CHART



Conversion Formulas

$$F = C \times \frac{9}{5} + 32$$
$$C = F - 32 \times \frac{5}{9}$$

Core Temperature Measurement Sites – Pulmonary artery, Tympanic membrane*, Nasopharynx, and Esophagus.

Sites that Estimate Core Temperature – Oral, axillary, skin, bladder and rectum*.

*Rectal temperatures are equal to core temperature when the patient is normothermic. Rectal temperatures become unreliable measurement when temperature flux is anticipated. (29)

*Accuracy of tympanic temperatures can vary depending on the instrument, operator, and the patient.

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