Myths about Perioperative Hypothermia

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April 28, 2017
APIC Conference
Chicago, IL
Myths

VS

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Objectives

- Identify common myths about perioperative hypothermia;
- Describe the pathophysiology of perioperative hypothermia;
- Identify evidence-based practices for prevention of perioperative hypothermia.
Disclosures

- 3M
  - Dr. Steelman is a paid consultant

- VitaHEAT
  - The University of Iowa has received grant funding
  - Dr. Steelman is a paid consultant
Perioperative Hypothermia

- Compelling evidence identifies what interventions are needed to prevent perioperative hypothermia.
- This evidence is inadequately infused into clinical practice.
- Myths or erroneous beliefs are common.
- Debunking these myths is necessary to provide excellent patient care and improve patient outcomes.
- This is the next frontier for perioperative patient safety.
Myth # 1.

Perioperative hypothermia is not a significant issue.

**Rationale:**

- I haven’t seen a problem.
- No one has told me there has been a problem.
- We use therapeutic hypothermia for cardiac surgery.
Incidence of Perioperative Hypothermia

- 50-80% of all surgical patients

Frank SM, Shir Y, Raja SN, Fleisher LA, Beattie C. Core hypothermia and skin-surface temperature gradients: epidural versus general anesthesia
Surgical Site Infection

- Vasoconstriction
- Decreased oxygen in tissue
- Decreased neutrophil activity
- Decreased deposition of collagen
- Decreased immune function


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Thermoregulatory responses effect cold stress on the cardiovascular system.

- Increases the risk of morbid cardiac event and ventricular tachycardia.

Myocardial Events


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Blood Loss

- Platelet function & coagulation cascade are impaired
- Increased blood loss

Drug Metabolism

- Hypothermia reduces drug metabolism
- More than doubles the duration of action of neuromuscular blocking agents
- Increased length of stay in postanesthesia recovery

Myth # 2.

Increasing the ambient temperature of the operating room will prevent perioperative hypothermia.

Rationale:

- It’s just logical. At home, if we get cold, we turn up the room temperature.
How does Hypothermia Happen?

**General Anesthesia**
- Removes ability to employ behavioral responses
- Widens the interthreshold range 20-fold (0.2°C to 4°C)
- Diminishes the hypothalamic response

**Regional Anesthesia**
- Response is similar to general anesthesia
- Prevents normal activation of regional responses (sweating, shivering)
- Impairs central control of thermoregulation
  - Incorrectly judges skin temperature
  - Patients often feel warm when they are not
- Interthreshold range is increased by 0.6°C

Heat Loss

- Heat is lost into the cool operating room environment
- Large areas of skin often exposed during prepping and draping
- Internal organs often exposed during surgery
- Cool intravenous or irrigation fluids increase heat loss
Redistribution Hypothermia

- Most patients undergoing surgery experience hypothermia unless effective prevention is used.
- Redistribution of heat from core to periphery occurs upon induction of general anesthesia/administration of a spinal anesthesia.
- Occurs in patients undergoing surgery >30 minutes duration.
Increasing the room temperature in the OR

<table>
<thead>
<tr>
<th>Normal Core Temperature</th>
<th>Room Temperature</th>
<th>Gradient</th>
</tr>
</thead>
<tbody>
<tr>
<td>98.6°F</td>
<td>70°F</td>
<td>28.6°F</td>
</tr>
<tr>
<td>98.6°F</td>
<td>75°F</td>
<td>23.6°F</td>
</tr>
<tr>
<td>98.6°F</td>
<td>80°F</td>
<td>18.6°F</td>
</tr>
<tr>
<td>98.6°F</td>
<td>85°F</td>
<td>13.6°F</td>
</tr>
</tbody>
</table>
Active Warming Is Needed

- **Active** warming is required to prevent perioperative hypothermia. Peripheral tissues are heated, decreasing the temperature gradient between the core and periphery.

- Types of Active Warming:
  - Forced-air warming
  - Radiant warming
  - Circulating water garment
  - Energy transfer pads
  - Carbon fiber resistive technology
  - Silver/carbon ink resistive technology

- Warmed IV fluids when >1 liter administered
  - Adjunct; alone does not prevent hypothermia
Myth # 3.

Turning on the forced air warming after anesthesia start is effective prevention.

Rationale:

- I need to turn on the compression stockings before anesthesia starts, and I don’t have time to do both.
- Documentation does not indicate when I turned it on.
Preoperative Warming

- Active warming is more effective when patients are warmed 30 minutes before surgery.\(^1-4\)

- AORN Guideline\(^5\)
- ASPAN Guideline\(^6\)

Myth # 4.

Cotton blankets are adequate for preoperative warming.

**Rationale:**

- Blankets feel good. Patients like them.
- Our documentation system includes this in the menu of interventions for prevention of hypothermia.
- It is less expensive than forced air warming.
Ineffective Prevention

- Passive warming retains heat only
  - Cotton blankets
    - Reduce heat loss by only 33% in non-anesthetized persons\(^1\)
  - Heated cotton blankets
    - Effect lasts 10 minutes\(^1\)
    - In an RCT, resulted in core temperature of 35.5°\(\text{oC}\)\(^2\)
  - Reflective blankets\(^3\)

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### Cost of Using Warmed Cotton Blankets

<table>
<thead>
<tr>
<th>Supply/Labor</th>
<th>Cost per Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laundering blankets</td>
<td>$10.80</td>
</tr>
<tr>
<td>Labor: Nursing assistant stocking blankets (1.5 minutes)</td>
<td>$0.30</td>
</tr>
<tr>
<td>Labor: RN applying cotton blankets (2 minutes/blanket)</td>
<td>$6.60</td>
</tr>
<tr>
<td>Total cost supplies and labor</td>
<td>$17.70</td>
</tr>
</tbody>
</table>

$17.70 per patient for an ineffective method of prevention of hypothermia.
Myth # 5.

Warming intraperitoneal gases during laparoscopy is an effective intervention for preventing hypothermia.

**Rationale:**

- It is logical.
- Most of our patients are laparoscopic and this is an easy intervention.
- Surgeon X wants this.
- It prevents lens fogging.
Heated $\text{CO}_2$ is Ineffective

Heated $\text{CO}_2$ with or without humidification for minimally invasive abdominal surgery.
Birch DW, Manouchehri N, Shi X, Hadi G, Karmali S.

- Core temperature
- Pain
- Morphine consumption
- LOS
- LOS in PACU
- Lens fogging

Ineffective and costly.
Potential Cost Avoidance: CO(2) Insufflation Tubing

<table>
<thead>
<tr>
<th># Laparoscopies</th>
<th>Cost of tubing</th>
<th>Weekly Cost</th>
<th>Annual Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>50/wk</td>
<td>$37</td>
<td>$1,850</td>
<td>$96,200</td>
</tr>
<tr>
<td>100/wk</td>
<td>$37</td>
<td>$3,700</td>
<td>$192,400</td>
</tr>
</tbody>
</table>
Myth # 6.

Compliance with the quality performance indicator means we are providing excellent patient care.

Rationale:

- That is why they make quality performance indicators.
- It is evidence-based.
- Administration is happy with our results.
Quality Performance Measure

Perioperative Temperature Management

- Written by the AMA Physician Consortium for Process Improvement (PCPI) Anesthesia and Critical Care Workgroup
- Endorsed by the National Quality Forum (NQF)\textsuperscript{23}
- Used by The Joint Commission, Centers for Medicare and Medicaid Services
Surgery patients with perioperative temperature management (SCIP-Inf-10). HHS:004093

NQMC Related Measures:

- Surgical care improvement project: percent of surgery patients for whom either active warming was used intraoperatively for the purpose of maintaining normothermia or who had at least one body temperature equal to or greater than 96.8°F/36°C recorded within the 30 minutes immediately prior to or the 15 minutes immediately after Anesthesia End Time. NQMC:003807

<table>
<thead>
<tr>
<th>HHS Agency</th>
<th>Centers for Medicare &amp; Medicaid Services (CMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure Steward</td>
<td>Centers for Medicare &amp; Medicaid Services (CMS)/The Joint Commission</td>
</tr>
</tbody>
</table>
| Topic or Condition | Surgical Procedures  
- Perioperative Care |
| Measure Domain | Process |
| Care Setting | Hospital inpatient |
| Denominator | All patients, regardless of age, undergoing surgical procedures under general or neuraxial anesthesia of greater than or equal to 60 minutes duration |
Quality Performance Measure

• Process measure
• No evaluation of fidelity
• Compliance can be achieved without appropriately using active warming or achieving normothermia

• Inspires checklist mentality and complacency
The Gap

The Gap between Compliance with the Quality Performance Measure "Perioperative Temperature Management" and Normothermia.
Steelman VM, Perkhounkova YS, Lemke JH.

5.8% of patients for whom the quality performance measure was met were hypothermic upon admission PACU.
Data Are Needed

- Preoperative warming adherence
  - Preop area
  - Later: ED, inpatient units

- Intraoperative warming adherence
  - % use of active warming technology
  - % started before induction of anesthesia

- Percent patients who are hypothermic
  - => 30 minutes surgery duration
  - Stratified by surgical service
  - Later: Stratified by problem-prone areas
Summary

- Myths about perioperative hypothermia are a barrier to achieving full adoption of evidence-based practices and optimal patient outcomes.
- Understanding the pathophysiology of perioperative hypothermia is essential.
- Active warming preoperatively and intraoperatively is essential.
- Education is never enough.
- Measure patient outcomes, not quality performance measures.
Your Questions
References


