TEMPERATURE MANAGEMENT

Unintentional Hypothermia and the Maintenance of Normothermia

Ian Sampson, M.D.
Temperature Management

• SCIP INF 7: Colorectal surgery patients with immediate postoperative normothermia

• SCIP Card 3: Intra or postoperative acute myocardial infarction (AMI) diagnosed during index hospitalization and within 30 days of surgery (Outcome)

• SCIP Global 1: Mortality within 30 days of surgery

• SCIP Global 2: Readmission within 30 days of surgery
EVOLUTION OF CURRENT THOUGHT ON TEMPERATURE MANAGEMENT

• 1960’s Benefits of Hypothermia
• 1970’s Operating Room Temperature Recommendations
• 1980’s Negative Effects of Hypothermia
• 1990’s More Negative Effects of Hypothermia
  Active Warming
• 2000+ Improved Active Warming
  SCIP
1996  Kurz A, Sessler DI, Lenhardt R:

2001  Melling AC, Baqar A, Scott EM, Leaper DJ:

2001  Flores-Maldonado A, Medina-Escobedo CE, Rios-Rodriguez HM,
Fernandez-Dominguez R:
# DEFINITION OF TERMS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Normothermia</td>
<td>$36.5^\circ\text{C} - 37.5^\circ\text{C}$</td>
</tr>
<tr>
<td>Core Temperature</td>
<td>Measured at 4 Sites</td>
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<tr>
<td>Near Core Temperature</td>
<td>Measured at 5 Sites</td>
</tr>
<tr>
<td>Inter-threshold Range</td>
<td>No Triggered Responses</td>
</tr>
<tr>
<td>Awake Inter-threshold Range</td>
<td>$0.2 - 0.4^\circ\text{C}$</td>
</tr>
<tr>
<td>Anesthetized Inter-threshold Range</td>
<td>$2 - 4^\circ\text{C}$</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>$&lt; 36.0^\circ\text{C}$</td>
</tr>
<tr>
<td>Recommended Operating Room Temperature</td>
<td>$68 - 73^\circ\text{F}$</td>
</tr>
<tr>
<td></td>
<td>$20 - 23^\circ\text{C}$</td>
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</tbody>
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CAUSES AND MECHANISMS OF UNINTENTIONAL INTRAOPERATIVE HYPOTHERMIA

• Anesthesia induced inhibition of thermoregulatory control

• Exposure to ambient operating room temperature

• Major Mechanisms:
  ➢ Radiation
  ➢ Convection
AMBIENT OPERATING ROOM TEMPERATURE

• Currently a secondary factor in maintenance of normothermia

• Recommended Range:
  68-73°F
  20-23°C

• Source: Department of Health. Standards for temperature design of operating rooms
  American Institute of Architects Design for Operating Rooms

• Evidence: Morris RH: 1970 – Anesthesiology: critical ambient temperature 21°C
  Morris RH: 1971 – Archives of Surgery: ambient temperature 24-26°C
  Morris RH: 1972 – Anesthesiology: critical ambient temperature 21°C

• Currently no regulations

• AORN Perioperative Standards and Recommended Practices 2009 Edition recommends
  68-73°F (20-22°C)

• Operating room temperature has not been indicated to be a direct factor in infection control
EFFECTS AND COMPLICATIONS OF UNINTENTIONAL HYPOTHERMIA

• Surgical Site Infection

• Morbid Myocardial Outcomes

• Coagulopathy, Bleeding, and Transfusion

• Delayed Wound Healing
Conditions leading to decreased (A) and increased (B) oxygen tension. Decreases in subcutaneous oxygen increase the incidence of surgical site infection. The maintenance of normothermia and adequate perfusion are important interventions that increase subcutaneous oxygen and help to prevent surgical site infection. The use of increased fractions of inspired oxygen or hyperoxia may also provide significant benefit.

Anesthesiology, V 105, No 2, Aug 2006
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EFFECTS AND COMPLICATIONS OF UNINTENTIONAL HYPOTHERMIA

• Altered Anesthetic Drug Effects
• Increased Cold Discomfort
• Altered Blood Chemistry
• Patient Monitoring Artifacts
• Postoperative Cognitive Dysfunction, Confusion, and Delirium
PREVENTION AND TREATMENT OF UNINTENTIONAL HYPOTHERMIA

• Recognize Patients at Risk
• Monitor Core or Near Core Temperature

• Active Pre-Warming for High Risk Patients
• Intraoperative Forced Air Warming
• Intravenous Fluid Warming
• Newer Conductive Warming Systems

• Passive Insulation
• Pre-Warming of the Operating Room
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SINGLE FOREARM WARMING SLEEVE
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• Passive Insulation
• Pre-Warming of the Operating Room
RESISTIVE UNDERBODY WARMING SYSTEM WITH VISCOELASTIC FOAM PRESSURE RELIEF
CONTROVERSIES AND RISKS

• Operating Room Temperature

• Effectiveness of Normothermia Strategy

• Risk of Wound Contamination
  ➢ Zink RS, Iaizzio PA: Convective warming does not increase the risk of wound contamination in the operating room. Anesth Analg 1993; 76:50-53

• Risk of Burns
Doctor Says a Device He Invented Poses Risks

By BARRY MEIER
Published: December 24, 2010

Dr. Scott D. Augustine, the inventor of a widely used piece of surgical equipment, now has a better idea — he wants hospitals to stop using the device during certain operations, asserting that it poses a danger to patients.

Two decades ago, Dr. Augustine, an anesthesiologist in Minnesota, helped pioneer the idea of keeping a patient warm during surgery. Doing so, studies have shown, produces benefits like less bleeding and a faster recovery.

Dr. Augustine’s invention, the Bair Hugger, changed surgical practices and made him a fortune. The device, which
SUMMARY

The maintenance of normothermia ( > 36.0° C ) has become the standard of care unless contraindicated.

At present forced air warming is the most effective, readily available and least invasive means of achieving this goal.