Hypothermia Presentation

Patient Forecast: 98.6 degrees.
Warm Air.
Sunny Outlook.
Thermoregulation

Thermal regulation is a balance between heat production and heat loss.

Despite marked changes in skin temperature, the body’s homeostatic mechanisms are able to maintain a core temperature between 36 - 37.5° Celsius (96.8 - 99.5°F).
Real Temperature Model

Temperature = 37.5°C / 99.5°F

Core Temp = 37.5°C / 99.5°F
Shell Temp = 34°C / 93.2°F (average)
Hypothermia

Hypothermia may be defined as a core temperature of less than 37° Celsius or 98.6° Fahrenheit

- Mild = 37° to 33.1° Celsius
  = 98.6° to 91.6 ° Fahrenheit
- Moderate = 30.1° to 33° Celsius
  = 86.18° to 91.4° Fahrenheit
- Severe = 26.9° to 30° Celsius
  = 80.6° to 86° Fahrenheit
Hypothermia May Result as a Consequence of Surgery

• Contributing factors include:
  – Cold operating room temperature
  – Length of surgery
  – Age
  – Type of surgery
  – Type of anesthesia
Causes of Hypothermia

• General anesthesia
  – depresses the hypothermia thermoregulating center

• Skeletal muscle relaxants and central nervous system depressants
  – abolishes shivering and motor activity which are important homeostatic mechanisms to produce heat

• Drugs that cause vasodilation, accelerating heat loss.
Effects of Anesthesia

• When the affects of anesthesia are combined with
  – Cool intravenous fluid
  – Cold preparatory solutions
  – Exposed body parts

It is not surprising hypothermia may result.
Four Ways of Heat Loss from the Human Body

- Radiation
- Evaporation
- Conduction
- Convection

Major causes of heat loss during surgery are **convection** and **radiation**
Radiation

- It occurs via infra red radiation and is a function of surface area
  - Infants have a high surface area-to-body mass ratio therefore are particularly vulnerable to heat loss by radiation

- Radiant heat exchange accounts for the majority of heat loss to the environment around the body
Evaporation

• Occurs from
  – Surgical skin preparatory solutions
  – The airway
  – Exposed thoracic and abdominal viscera
Conduction

• Occurs when body tissues and fluids come into direct contact with colder materials such as:
  – Skin with cold objects such as metal tables
  – Cold intravenous fluids and blood products
Convection

Occurs as a result of the ambient air circulation that removes the air warmed by skin and viscera.

The heat from the body is transferred to the circulating air.
Adverse Affects of Hypothermia

- Cardiovascular System
- Respiratory System
- Immune System
- Vascular System
- Renal System
- Shivering
- Metabolic and Electrolytes
Cardiovascular System

- Hypothermia induces atrial and ventricular arrhythmias, vasoconstriction, increased blood viscosity and depression of ventricular function
  - This can result in hypertension and increased myocardial oxygen demand, which can cause in severe cases cardiac arrest
Respiratory System

- Mild hypothermia causes fast breathing, decrease in respiratory minute volume, bronchorrhea and bronchospasm
- Temperatures below 32°C (89.6°F) are associated with hypoventilation, loss of protective airway reflexes and inhibition of hypoxic pulmonary vasoconstriction
- Severe hypothermia can cause pulmonary edema
Coagulation/Immune System

- During hypothermia increased bleeding may occur due to reversible platelet dysfunction.
- Hypothermia decreases immune function by impairing white blood cells ability to combat bacteria resulting in an increased susceptibility of surgical wounds to infection.
Vascular System

• General decrease in blood flow to all organs
  – this is first seen in the skeletal muscles and extremities, followed by the kidneys and finally the flow to the heart and lungs is reduced
Renal System

• As the temperature decreases, the possibility of kidney failure increases, resulting in a progressive decrease in renal blood flow and the kidneys filtration rate

• These changes impair renal clearance of water soluble drugs and inhibit sodium and potassium re-absorption resulting in increased urine production
Shivering

- Increased oxygen consumption
- Increased heart beat
- Hypertension
- Metabolic acidosis
- Increased myocardial oxygen demand
Beneficial Effects of Hypothermia

• Mild hypothermia provides increased tissue tolerance to reduced blood flow, especially in cardiac and neurosurgical patients
Cost of Hypothermia

• Significant
  – increase in use of blood products
  – increase in ICU time and hospital stay
  – increase in infection, myocardial infarction, probability in receiving transfusions, mechanical ventilation and mortality
Cost of Hypothermia

- Hypothermia averaging only 1.5°C / 2.7°F results in adverse outcomes that negatively affect patient lives.
- Depending on cost assumptions this can add $5,000 to $15,000 per surgical patient.
Cost of Hypothermia

- Patients in whom normothermia has been maintained during surgery experience fewer adverse outcomes resulting in decreased costs.
- Maintaining normothermia is significantly more cost effective than treating hypothermia.
What is Convective Warming?

Convective warming is the transfer of heat through airflow.
Methods of Warming

• Passive
  – increasing ambient air, warm cotton blankets, reflective thermal drapes and insulating blankets

• Active
  – convective patient warmers, IV fluid warmers, radiant warmers, circulating mattresses, and heated humidified gases
Convective Patient Warming

- Proven to be the most effective method of maintaining normothermia
- Greatly reduces both convective and radiant heat loss by eliminating the gradient between the patient and ambient air
Fluid Warming

• Effective in treating hypothermia when used in conjunction with convective warming

• Fluid warming is insufficient on its own to prevent hypothermia or restore normothermia expeditiously
Warming Blankets

- Select correct style and size
- Ensure hose is attached securely
- Secure the position of the blanket
- Place blanket directly against patient skin
- The warming blanket requires a cover, and when using, ensure airflow is not disrupted.
- Monitor temperature setting
LIFE-AIR 1000®
Progressive Dynamics Medical offers patient warming blankets for all patients’ needs.
Soft-Flex®

• Patented piercing pattern for the flow of air from the cover to the patient provides a gentle bath of warmed air. Valves control how air is distributed.

• Flaps created when the cover is pierced function like a diffuser mixing up the air flow. This results in avoiding the potential of “hot” spots and reduces skin irritation.
Patented flexible pillow pattern in the SOFT-FLEX® Warming Cover allows care giver quick and easy access to the patient for either assessment or patient care.

Material can be disposed of by the hospital’s standard infectious waste incineration protocols. The by-products are: water vapor, carbon dioxide and a land fill non-hazardous ash.
Soft-Flex® Sizes

Upper Body
Surgical
PD1103

Lower Body
Surgical
PD1105

Recovery Room
Adult
PD1101

Recovery Room
Pediatric
PD1104

Full Body
Surgical
PD1107
Convective Air Warming System

– Microprocessor controlled system, improves accuracy and safety.
– 5 temperature settings
– 0.2 micron 95 percent HEPA-filtration
– Retractable flashing over-temp light with audible oscillating warming tone
– Self-diagnostic, no special equipment required
References

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