# Environmental Emergencies

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## Objectives

1. Identify the pathophysiology and management of heat-related illness.
2. Recognize signs, symptoms, and treatment of cold-related emergencies.
3. Indicate the pathophysiology and prehospital treatment of drowning, and recognize various other environmental injuries.

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# Thermoregulation

- Thermogenesis (heat production) vs. thermolysis (heat elimination)
- Hypothalamus: “master thermostat” for the body, negative feedback loop
- Body attempts to maintain temperature within a degree of 98.6º F
- Blood vessels dilate or constrict, hormone secretion increases or decreases, muscle activity increases or decreases

## Basal Metabolic Rate

- BMR (basal metabolic rate): heat produced at rest (circulation, breathing, digestion)
- Minimal requirements of the body to sit still all day
- As the ratio of body surface area to body volume increases, heat dissipates more quickly – pediatric patients lose heat more quickly

## Heat Transfer

- Radiation
- Conduction
- Convection
- Respiration
- Evaporation

## Heat Cramps

- Muscle pains from loss of sodium from sweating
- Generally require sports drinks
- Imbalance of water and sodium

## Heat Exhaustion

- Water depleted (general dehydration) vs. sodium depleted (profuse sweating – hours to days)
- Generally a core temp over 100.4º F
- Headache, nausea, vomiting, fatigue, dizziness, pale and clammy skin

## Heat Exhaustion

- Treatment
  - monitor vitals and ECG (electrocardiogram)
  - remove from the hot environment
  - consider ice water immersion
  - NO ice packs or antipyretic medications
  - treat shivering with a benzodiazepine
  - titrate IV (intravenous) fluids

## Heatstroke

- Most deadly heat-related emergency (classic – passive vs. exertional – activity)
- Core body temp generally over 104º F
- Altered mental status
  - irritable
  - confused
  - combative
  - hallucinations

## Heatstroke

- Tachypnea, tachycardia, red and dry skin, potential for seizures
- No water-soaked sheets or rubbing alcohol – promote thermogenesis
- Rapid cooling via ice water immersion or evaporative cooling

## Heatstroke

- Monitor vitals including $ETCO_2$ (end-tidal carbon dioxide) and blood glucose level
- Monitor ECG
- Ice packs at the groin, axial areas, and neck
- Treat shivering with a benzodiazepine
- Titrate IV fluids

# Frostbite

- Frostnip
  - superficial
  - mild and slow onset
  - generally treated by passive warming
  - tingling and stinging sensations
  - waxy appearance

# Frostbite

- Deep frostbite
  - body part is exposed below the freezing point and cellular fluid begins to crystalize
  - increased viscosity
  - thrombus potential
  - hard and cold appearance
  - generally treated at a burn center
  - pad the part for protection
  - do NOT rub or massage the part

## Frostbite

- **Deep frostbite**
  - **consult medical control at a burn center for active rewarming instructions if transport is greater than one hour**

## Hypothermia

- **Mild hypothermia: core temp 90-95º F**
  - **shivering and "umbles" (stumbles, fumbles, mumbles, grumbles)**
  - **glycogen stores are being used**

## Hypothermia

- Severe hypothermia: core temp below 90º F
  - Osborn or J wave on ECG
  - metabolism slows
  - shunting to core
  - bronchospasm
  - bradycardia

## Hypothermia

- As the core temp continues to drop, ACLS (advanced cardiac life support) medications and defibrillation are not recommended
- Active or passive warming based on protocols

## Drowning

- Submersion drowning vs. near-drowning
- Spinal precautions if a head injury is suspected (diving)
- Advanced airway and ACLS/PALS (pediatric advanced life support) if indicated
- Monitor $ETCO_2$ waveform for bronchospasm
- Consider 10 mmHg of PEEP (positive end-expiratory pressure)

## Drowning

- Consider NG/OG (nasogastric/orogastric) tube for gastric decompression
- Anticipate ARDS (acute respiratory distress syndrome) and infection
- Salt vs. freshwater (saltwater pool?)

## Other Environmental Considerations

- Diving or altitude emergencies
  - nitrogen vs. $O_2$
  - gas expansion
  - extrinsic vs. intrinsic pressure
- Air quality issues (wildfires, high pollen count, etc.)
- Season: daylight vs. darkness
- Transport times to definitive care

## Other Environmental Considerations

- Availability of equipment/shelter
- Communications
- Multiple patients

## Review

- Patients can be hot when it is cold and cold when it is hot
- Are there external factors? (age, disability, medications, etc.)
- Safety of the environment
- Availability of equipment
- Continuous vital sign monitoring including ECG and blood glucose level

# Environmental Emergencies

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