EMS Subspecialty Certification Review Course

1.2.5 Environmental
1.2.5.4 Drowning, submersion, and diving injuries
1.2.5.5 Lightning and electrical injuries
1.2.5.5.1 Reverse triage

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Learning Objectives

- Differentiate EMS treatment priorities for **cold** and **heat** related illnesses
- Describe EMS treatment considerations for **high altitude**, **diving**, and **other water related injuries (drowning)**
- Review **lightning** and **electrical** injuries

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Introduction

- Environmental injuries are commonly encountered in many EMS systems.

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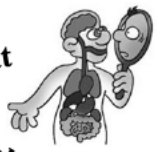
Introduction

- Specific treatment priorities are required for environmental injuries to decrease morbidity and mortality
- **Excess:**

Altitude
Heat
Lightning/Electrical
Submersion
Diving Pressures
Cold



have unique effects on the human body

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Cold-Related Illnesses

Hypothermia (Core Temp <35C)

- Urban
- Wilderness/ environmental
  - Acute
  - Subacute
- Mechanisms
  - Radiation
  - Convection
  - Conduction
  - Evaporation

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Hypothermia

- Clinical diagnosis without use of thermometer
  - Mild 32-35 (Shivering, progressive loss of function)
  - Moderate 28-32 (loss of shivering, prone to cardiac dysrhythmias afib, progression of confusion)
  - Severe <28 (Muscular rigidity, Loss of vital signs, Vfib, LOC)

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Hypothermia

- Active Rewarming in field generally not recommended
  - Active: External vs. Internal (fluids, foley lavage vs. CP Bypass)
  - Passive: Blankets, remove from environment

Prevention of further heat loss is very important

- **Gentle handling** and transport in supine position
  - In severe hypothermia – decreases chance of hemodynamic instability and arrest
- Hypothermic cardiac arrests may have improved survivability if transport to a medical facility is timely

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Non – freezing cold injuries

- Immersion/ Trench foot
- Social and environmental (Ch homelessness and alcoholism)
- Phases
  - Pretreatment: limb is blanched and yellowish white, edema, no pain
  - Treatment: hyperemic phase - hot, red, swollen and painful. Blisters and gangrene in severe (weeks)
  - Post hyperemic: Persistent cold sensitivity, paresthesias (years)

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Frostbite

May have a combination of both hypothermia and frostbite

- Superficial vs. Deep
  - Hard to determine clinically at the time of exposure
- Prevention
- Rewarming should only occur if refreezing **will not** occur
  - Pain Control
  - Immersion in 37-39 C water bath
  - NSAIDs/ Narcotic analgesia
  - Tetanus as needed
  - Antibiotics as needed

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Heat Related Illnesses

Can Co-Exist

Heat Exhaustion (volume/electrolyte depletion)

Heat Stroke (elevated Temperature >40 C)

- Rapid core temp cooling is a must
- Should be started in the field before transport
  - Controlled Immersion if proper equipment is available
  - Misting and ice to axilla/trunk/groin/neck
  - Paralysis may be required to stop shivering

Exertional Hyponatremia

- Seizures may occur (Need Na^+ - Normal Saline)

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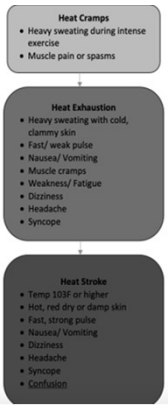

Heat Related Illnesses

Additional critical symptoms seen in heat stroke may include

- Anhidrosis (absence of sweating)
- Cardiac dysrhythmia
- Neurological signs (Altered mental status, ataxia, seizures, coma)
- Pulmonary edema
- Renal failure

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Management

- Cooling the patient is critical!
- Move patient from warm environment to cooler one
- Remove excess clothing
- Ice Packs to groin and axilla
- Apply soaked towels and fan
- Supplemental oxygen
- IV fluids
- Benzodiazepines as needed for seizures/ shivering

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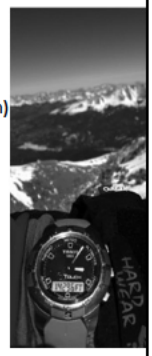
High Altitude Illness

Acute Mountain Sickness (AMS)
- Headache, fatigue, anorexia, dizziness, N/V
- Mild (Hydration, hold ascent, NSAIDS, O2, Zofran)
- Moderate to Severe (Acetazolamide, Steroids)

High Altitude Cerebral Edema (HACE)
- Ataxia, Altered Mental Status, Seizure, Death
- **Descent**, Dexamethasone (Decadron), Oxygen
- Lasix/ Mannitol to reduce ICP

High Altitude Pulmonary Edema (HAPE)
- Cough, resp distress, severe hypoxia, death
- **Descent**, Oxygen, NIPPV, CCB, Diuretics
- PDE-5 inhibitors for prevention

Can Co-Exist



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High Altitude Illness

- Rescuer Prophylaxis
  - Acclimatization (rescuer staged prior to rescue)
  - Chemoprophylaxis (acetazolamide, dexamethasone)
  - Oxygen supplementation
- Portable Hyperbaric Chamber
  - Drop 3,000ft with continuous foot pumping
  - Limited patient access during treatment

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Diving Injuries

Think gas laws
- Injury of descent
  - Ear, sinus, suit, dental
- Injury at depth
  - Nitrogen narcosis (diving martini rule)
  - Oxygen toxicity -free radicals VENTDIC
  - Immersion Pulmonary edema

Visual changes
Ear ringing
Nausea
Tingling/ twitching
Irritability/ anxiety/ confusion
Dyspnea/ dizziness
Convulsions

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Diving Injuries

Injury of ascent
- **Overpressure Syndromes** (Barotrauma) Ear, GI, Sinus, Pulmonary
- **Arterial Gas Embolism (**on ascent, gas bubble lodges in critical body systems)
- **Decompression Sickness** (DCS) aka bends/ chokes/ staggers

- Supportive care
- Hyperbaric Chambers and Oxygen
  - Divers Alert Network (DAN) (919-684 9111) 24/7

DAN DIVERS ALERT NETWORK

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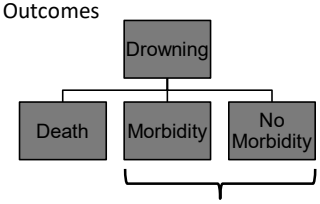
Drowning

Process of experiencing respiratory impairment from submersion/immersion in a liquid (WHO)

Possible Outcomes



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Drowning Resuscitation

- Resuscitation is same as cardiac arrest EXCEPT:
  - Hypoxic arrest so emphasis on oxygenation (Ventilations in water)
  - Evaluate for other trauma (ie. Head, neck, etc.) – no empiric collar
  - High incidence of vomiting in resuscitation = aggressive mgt
  - Consider environmental hypothermia 2/2 submersion
  - If resuscitated = temp to post resuscitation protocols
- No longer emphasis on:
  - Dry vs. Wet Drowning (fluid in airway/lungs)
  - Freshwater vs. saltwater

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Lightning and Electrical Injuries

Lightning

- Direct strike usually = death
  - Splash = "jump" from nearby object
  - Contact = touching struck object
  - Ground = transmitted through ground
- Temporary vasospastic paralysis aka 'keraunoparalysis'
  - Pallor, pulseless, cool limbs
- Blunt Trauma
- Burns
  - Superficial > deep

Electrical Injuries

- Factors: Voltage, type of current, amount of current, resistance, pathway of current, and duration of contact
- Alternating Current (AC) vs Direct Current (DC)
- 20-50 mA thoracic tetany/ resp arrest; 50-100mA Vfib
- Deep burns may occur from both
- Scene safety is of utmost important to prevent rescuer injuries
- Management: Cardiac dysrhythmia, respiratory arrest, trauma, burns

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Lightning

- Reverse Triage
  - Temporary loss of respiratory drive (medulla)
  - Dilated pupils are NOT prognostic
  - Immediate respiratory support and CPR
  - Those not in arrest are unlikely to die
- Consider spinal immobilization and 2nd trauma
- Lighting less likely to cause deep burns like electrical current but myoglobinuria and renal injury can occur

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