

Environmental Core Content

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❖ Hypothermia

- **Definition: <35°C (95°F)**
- **Research limitations**
- **pathophys:**
 - **Measuring temperature**
 - ◆ **oral**
 - ◆ **axillary**
 - ◆ **forehead**
 - ◆ **rectal**
 - ◆ **esophageal**
 - ◆ **ear**
 - ◆ **EKG**
 - **heat debt:**
 - ◆ **incipient hypothermia,**
 - ◆ **massive cooling without hypothermia (500-2000 kcal)**
 - **hypothermia and mental functioning:**
 - ◆ **mild: 34-35° C=93-95° F**
 - ◇ **memory recall normal**
 - ◇ **new memory only 70%**
 - ◇ **1.5x mental functioning**
 - ◆ **severe:**
 - ◇ **paradoxical undressing**
 - ◇ **contributor to other deaths**
 - **predisposing factors:**
 - ◆ **immature thermoregulation**

- ◆ disease
- ◆ drugs
- ◆ debilitation
- cardiovascular
 - ◆ ventricular fibrillation threshold
- and Geisinger study
 - ◆ cold diuresis
 - ◇ dehydration
 - ◇ level/seizures
 - ◆ other arrhythmias
 - ◇ pacing/atropine
 - ◇ “they all get better”
- Hypothermia Etiology
 - Primary/secondary
 - Acute/Subacute/Chronic
 - Third-spacing and elderly vs.
- rewarming
- Treatment
 - active/passive
 - internal/external
 - “afterdrop” “rewarming shock”
 - rapid rewarming
 - fluid if very rapid
 - core first
 - food
 - thoracotomy
 - NG and rectal and bladder lavage
 - Bair hugger
 - bypasses
 - rewarming rates:

- ◆ warm IVs: lactate metabolism
- ◆ charcoal vest
- ◆ warm water immersion
- **BCLS:**
 - “warm but not yet dead”
 - “pink is good, blue is bad, air must go in and out”
 - one or three minutes for pulse?
 - hypocapnia protective
 - long pauses: “metabolic icebox”
 - CPR vs. bradycardia circulation to coronaries
 - half-speed CPR?
- **ACLS:**
 - defibrillation below 86° F (30°C)
 - bretylium, lidocaine, procainamide
- **Complications**
 - pneumonia
 - pancreatitis
 - coagulopathy
 - DIC unresponsive to heparin/dextran (may cause precipitation of cryofibrinogen in elderly)
- ❖ **Local Cold Injury**
 - **Chilblain (pernio)**
 - Prolonged cold exposure
 - Cheek and back of hand
 - acute vs. chronic

- association with Raynaud's + smoking
- Calcium channel blockers
- Trench foot (immersion foot)
 - Patton, 1944: more casualties from trench foot than from the Germans
 - cold and wet, but above freezing
 - swelling + tight boots?
 - Three phases:
 - ◆ cold exposure and vasospasm; cold, pale, wooden (later swelling)
 - ◆ inflammation (Wholey's story)
 - ◆ healing
 - Treatment: as for frostbite minus rewarming
- Frostnip: pale, still soft
- Deep Frostbite
 - Pathophys
 - ◆ Freezing of interstitial fluid > dehydration (rubbing with snow?)
 - ◆ Visible evidence of damage delayed until rewarmed
 - ◆ Platelet aggregation
 - ◆ inflammation (ibuprofen)
 - ◆ individual (genetic) and racial difference in susceptibility, also nutritional state, hypothermia, smoking.
 - Natural History
 - ◆ blisters, red

- **Grading: I-IV (same as burns) – but delayed grading**
- **Field diagnosis: palpation**
- **Prevention:**
 - ◆ **non-cotton socks**
 - ◆ **properly-fitting boots**
 - ◆ **“two-sock frostbite”**
 - ◆ **role of hypothermia and debilitation**
 - ◆ **rapid cooling but subfreezing fluids**
 - ◆ **wind-chill equivalent temperature**
- **Treatment**
- **rapid rewarming in 105-110°F (41-43°C) water.**
 - ◆ **Despite Hippocrates, Baron Larrey, and many others**
 - ◆ **numb, avoid fires, heat packs (Hippocrates and Larrey right about that)**
 - ◆ **and hypothermia:**
 - ◇ **litter**
 - ◇ **Hubbard tank**
 - ◆ **not “prevent slow rewarming”:**
- Mt. Hood treatment (not!)**
 - ◆ **“can walk on frostbitten feet” (not!)**
 - ◆ **avoid refreezing**

- **ibuprofen?**
- **dextran?**
- **IV reserpine?**
- **sympathectomy?**
- **Aloe Vera?**
- **surgical resection (not!)**
- **Treat infections**
- **Supportive care**
- ❖ **Submersion**
 - **Cold water submersion**
 - **mammalian diving reflex**
 - **hypoxia**
 - **protective hypothermia**
 - **Warm water submersion**
 - **“breaking” + Heimlich maneuver**
 - **“dry drowning”**
 - **delayed pulmonary edema**
 - **delayed renal failure**