

# Environmental Illness - Cold Related Concerns

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- \* Discuss cold related injuries and treatment
- \* Discuss hypothermia and treatment
- \* Discuss avalanche victim care and considerations

## \* Objectives

- \* Chilblains (Pernio)
- \* Trench Foot
- \* Frost Nip
- \* Frost bite



## \* Cold Related Injuries

- \* Superficial soft tissue injury which occurs when predisposed persons are exposed to cold and humidity, then rewarmed
- \* Predisposition can be from connective tissue diseases or may be idiopathic
- \* The exposure damages capillary beds which causes redness, swelling, blisters and inflammation
- \* Most common fingers, toes, ears, and nose

## \* Chilblains



\* **Chilblains**

- \* Prevention is key! - Keep warm and dry.
- \* Most resolves on its own in 1-3 weeks.
- \* No lasting damage from Chilblains unless secondary infection
- \* Steroid creams may help burning and itching

## \* Chilblains - Treatment

- \* One of the most common of the “immersion foot syndromes”
- \* Caused by prolonged exposure to cold, damp and unsanitary conditions
- \* First noted in Napoleon’s army in 1812
- \* “Trench” refers to the prevalence of the condition in WWI during trench warfare.
- \* Has been seen in British music festivals from cold, muddy, wet conditions over a few days

## \* Trench Foot

- \* Unlike frostbite, does not require freezing temperatures
- \* May occur in temperatures up to 60 F, and as little as 13 hours of exposure
- \* Exact mechanism is unknown but excessive sweating (hyperhidrosis) is considered a contributing factor

## \* Trench Foot



\* **Trench Foot**

- \* Numbness
- \* May become red or blue
- \* Necrosis, decay and swelling
- \* Open blisters which may then become infected with fungus (tropical ulcer/jungle rot)
- \* Advanced cases result in gangrene and potentially amputation

## \* Trench Foot

- \* Prevention!
- \* Keep feet warm and dry as possible
- \* If trench foot has started, need to keep feet dry and apply warm compresses to increase blood flow
- \* Any open wounds need to be debrided and treated for infection
- \* Treated properly most will heal without sequelae except for pain with rewarming

## \* Trench Foot - Treatment

- \* Condition of tissue damage due to freezing
- \* Caused by insufficient blood flow to areas of tissue when ambient temperature falls below freezing
- \* Decreased flow may be from medical conditions, medications, or heat conserving physiology
- \* Risk factors include beta blockers, DM, peripheral neuropathy



\* **Frostbite**

- \* May be from prolonged exposure to temperatures just below freezing or may be instantaneous from exposure to super cooled substances
- \* Wind chill factors must be taken into account
- \* Tissue damage from freezing of water in the cells and the subsequent cellular destruction from ice crystal formation



\* **Frostbite**

- \* Frost bite is categorized in similar fashion to burns
- \* 1<sup>st</sup> degree - “frost nip” only top layers of the dermis. Little water content. Usually no lasting damage
- \* 2<sup>nd</sup> degree - all skin layers freeze, but SQ tissue is not. Cutaneous nerves may also freeze
- \* 3<sup>rd</sup> degree - freezing of SQ tissue, muscles, tendons, blood vessels, larger nerves

\* **Frostbite**



\* Frostbite



\* Frostbite  
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- \* Try not to walk on or massage frozen parts
- \* "To warm or not to warm"
- \* Refreezing is the worst thing that can happen so do not warm if chance of refreezing
- \* If going to warm, want to do it as quickly and completely as possible without burning
- \* Hot water immersion - 104-108 F
- \* Do not use direct heat, can't feel burns



\* **Frostbite**

- \* Need to completely rewarm, look for flushing at distal portions
- \* Debride clear blisters, leave hemorrhagic ones
- \* NSAIDS/Opioids for pain control
- \* Reduce dislocations early after complete thaw, wait for fracture care until swelling decreases
- \* Hypothermia/afterdrop
- \* May consider TPA within 24 hours after deep FB

\* **Frostbite**

- \* Early surgical treatment usually not needed
- \* May take 1-3 months to determine tissue viability
- \* Transfer to burn units has been successful in severe cases



\* **Frostbite**

- \* Core temperature decrease below 35 C
- \* Usually insidious in nature, but may be quicker in cases of cold water immersion or avalanche burial
- \* Lowest documented survival was 7 yo near drowning in Sweden with core temp of 13 C or 55.4 F



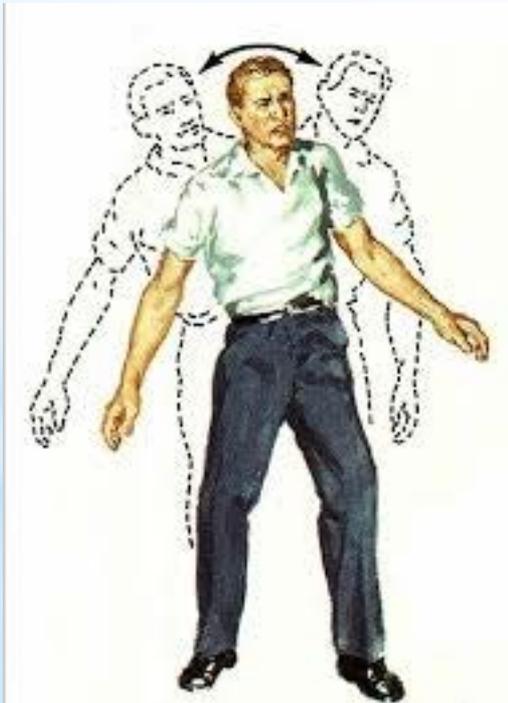
\* **Hypothermia**

- \* Mild Hypothermia - 32-35 C
- \* Sympathetic nervous system stimulation
  - \* Shivering, tachycardia, vasoconstriction
  - \* Efforts to conserve and increase heat production
- \* Cold diuresis
- \* Confusion
- \* Hepatic dysfunction
- \* Glucose regulation problems



# \* Hypothermia

- \* Moderate Hypothermia - 28-32 C
- \* Increased, then decreased shivering
- \* Severe confusion, ataxia, decreased coordination



\* Hypothermia

- \* Severe Hypothermia -  $< 28\text{ C}$
- \* Bodily systems falter and fail
- \* Decreased HR ( $< 30$ ), BP, RR
- \* Incoherent actions, stupor, coma
- \* VF/VT
- \* Clinical death



\* **Hypothermia**

- \* Paradoxical undressing
- \* Failure of capillary and small vessel sphincter muscle control leads to sudden return of warm blood to skin
- \* Hypothalamus sense of body temperature is derived from cutaneous nerves
- \* Person suddenly “feels” hot and in confused state may strip off all clothing
- \* Can be mistaken in urban environments for sexual assault concerns



\* **Hypothermia**

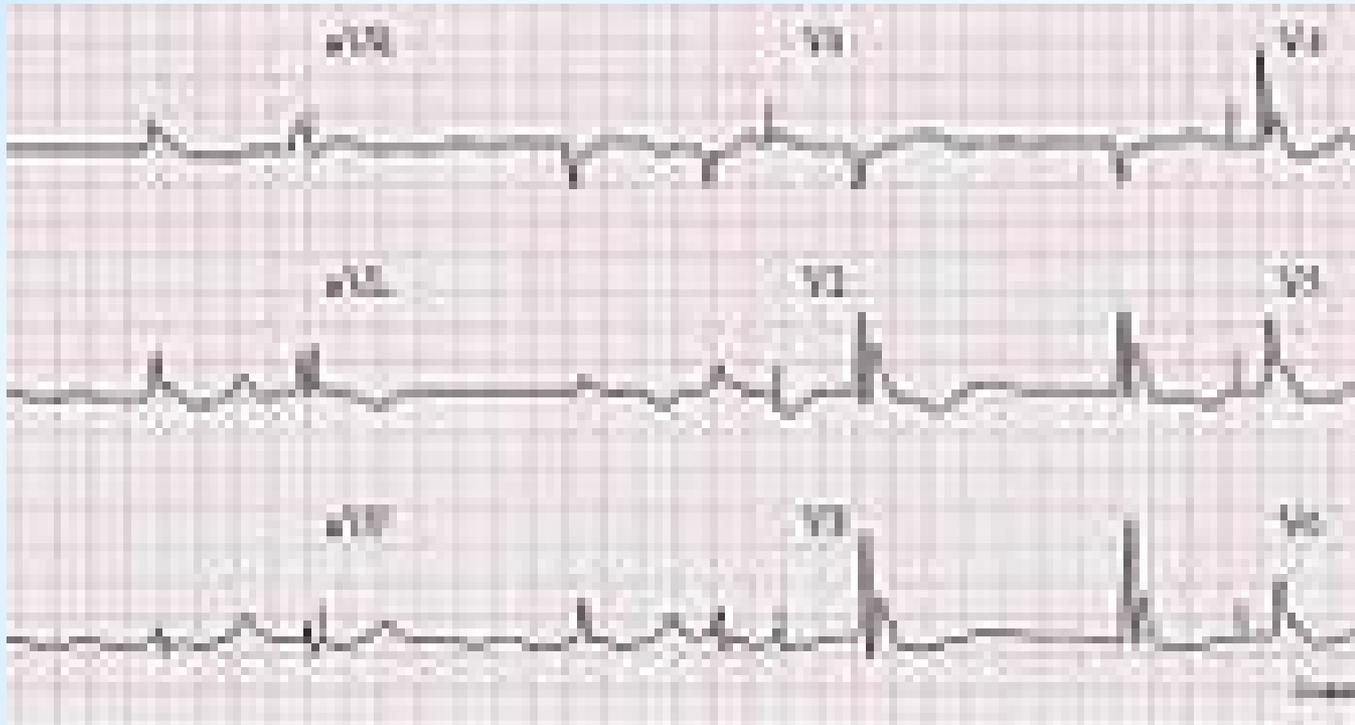
- \* Terminal burrowing
- \* End stage primitive mammalian response to end of life
- \* “Hide and die” syndrome
- \* Victims may be found under beds or in other tight, confined spaces
- \* Victims may be naked after paradoxical undressing



\* **Hypothermia**

- \* Surface thermometers are not effective
- \* Need core temperature
- \* Esophageal, rectal, bladder thermometers
- \* Adjunctive testing
  - \* ECG
  - \* Coagulation studies
  - \* Hepatic studies

## \* Hypothermia - Dx



\* Hypothermia - Dx

- \* Prolonged evaluation of vital signs
  - \* May need to check HR > 60 seconds
  - \* Any VS should preclude CPR
- \* Gentle handling - irritable heart muscle can fibrillate very easily
- \* Should gently ventilate and avoid any invasive airway unless CPR is performed

\* **Hypothermia**

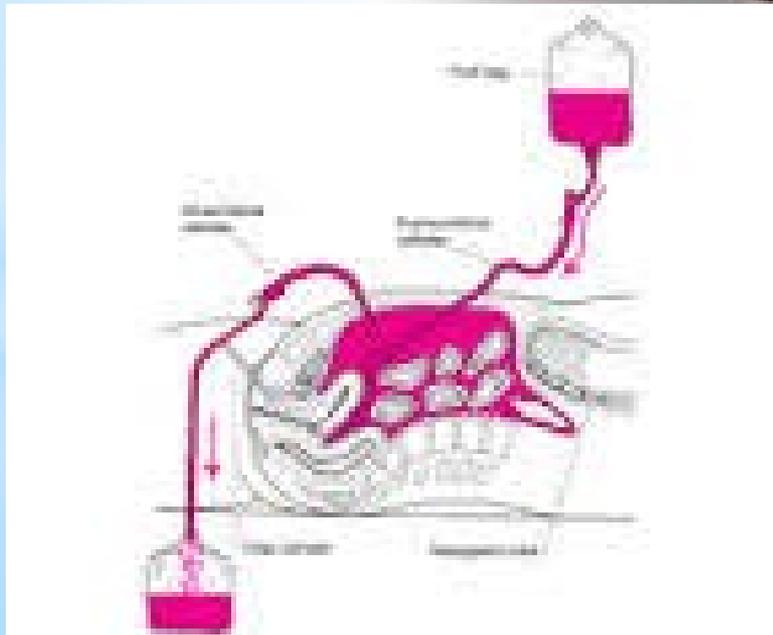
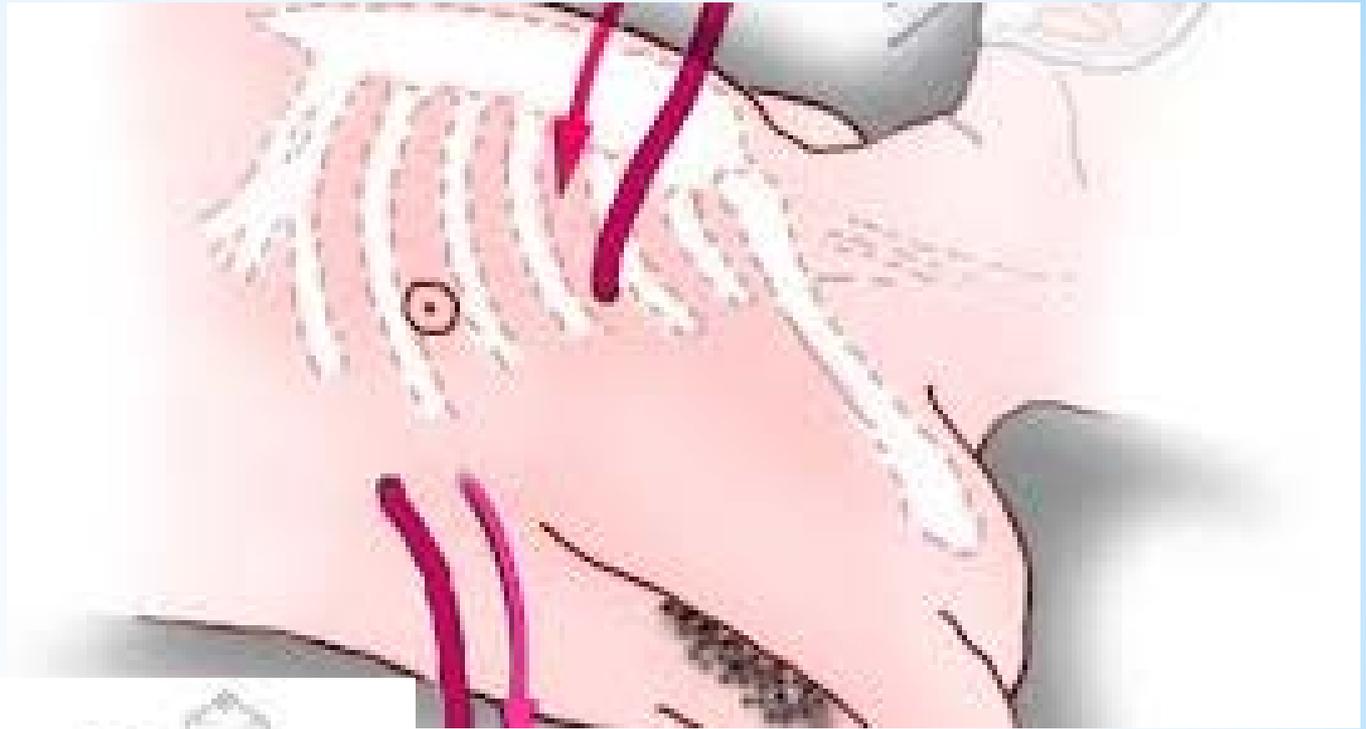
- \* Do not treat perfusing arrhythmias as most resolve with T improvement (bradycardias, atrial fibrillation, frequent PVCs)
- \* Treatment of clinical death
  - \* Prolonged CPR may be necessary
- \* Defibrillation and medications are unlikely to be effective until core T > 30 C, then ACLS
- \* If VF/VT may shock once, but then just CPR.

## \* Hypothermia

- \* Treatment of hypothermia
- \* Mild - Passive rewarming with blankets, warm liquids, food
- \* Moderate - active external rewarming with heat blankets, hot packs, warmers, bair huggers
- \* Severe - active internal rewarming with gastric/bladder irrigation, peritoneal or thoracic lavage, cardiopulmonary bypass



# \* Hypothermia



\* Hypothermia

- \* Prognosis?
- \* Near drowning in children may survive > 1 hour of profound hypothermia
- \* Cold decreases metabolism and oxygen demand
- \* Mortality of severe or profound hypothermia still ranges 37-75%
- \* Must eventually have some signs of life - no technique can warm the dead to normal body temperatures

## \* Hypothermia

- \* Trauma and asphyxia are primary causes of death in avalanche victims
- \* Hypothermia, hypoxia and hypercapnea become issues with prolonged burial (>35 minutes)
- \* Primary considerations are rapid access to victim, airway clearance and treatment of severe traumatic injuries.



## \* Avalanche Care

- \* Ski/snowmobile with people who you know and trust as they will be the ones who save you
- \* Be prepared with the correct equipment and training
  - \* Transceivers
  - \* Shovels/probes
  - \* Some emergency care equipment
- \* Prevention/avoidance is paramount
- \* The family that skis together dies together!



## \* Avalanche Care



\* Questions?