Death in the White Mountains
Jennie V. Duval, M.D.
Chief Medical Examiner
New Hampshire

Learning Objectives

- Categorize deaths occurring during recreational activities in this region
- Recognize environmental hazards created by weather conditions and terrain
- Understand the obstacles encountered during search and recovery of remains
Death in the White Mountains

- Falls
- Hypothermia
- Avalanches
- Falling objects
- Drowning
- Lightening strike
- Hyperthermia
- Dehydration/starvation?
- Natural
- Suicide
- Homicide

Death in the White Mountains (1849-2016)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>74</td>
</tr>
<tr>
<td>Natural</td>
<td>57</td>
</tr>
<tr>
<td>Hypothermia</td>
<td>46</td>
</tr>
<tr>
<td>Avalanches</td>
<td>14</td>
</tr>
<tr>
<td>Drowning</td>
<td>12</td>
</tr>
<tr>
<td>Falling rock/ice</td>
<td>6</td>
</tr>
<tr>
<td>Missing</td>
<td>4</td>
</tr>
<tr>
<td>Homicide</td>
<td>2</td>
</tr>
<tr>
<td>Lightening</td>
<td>2</td>
</tr>
<tr>
<td>Hyperthermia</td>
<td>2</td>
</tr>
</tbody>
</table>

Hypothermia
Definition of Hypothermia

- Classic definition
  - Core body temperature < 95°F (35°C)
- Better definition
  - 3.6°F (2°C) decrease in normal core temperature

Stages of Hypothermia

<table>
<thead>
<tr>
<th>Stage</th>
<th>Temperature (°F)</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>89.6 – 95.0</td>
<td>Shivering, amnesia, dysarthria, poor judgement, ataxia, apathy, cold diuresis</td>
</tr>
<tr>
<td>Moderate</td>
<td>82.4 – 89.6</td>
<td>Stupor, cease shivering, arrhythmias, paradoxical undressing</td>
</tr>
<tr>
<td>Severe</td>
<td>71.6 – 82.4</td>
<td>Loss reflexes, hypotension, bradycardia, VF</td>
</tr>
<tr>
<td>Profound</td>
<td>48.2 – 71.6</td>
<td>EEG silencing, asystole</td>
</tr>
</tbody>
</table>

Autopsy Findings in Hypothermia

- **Skin**
  - Red lividity
  - Erosions (ears, nose and hands)
  - Enhyema (backs of hands/knees)
- **Cardiovascular**
  - Muscle degeneration
- **Pulmonary**
  - Hemorrhage, edema
  - Bronchopneumonia
- **Gastrointestinal**
  - Wischnewsky spots (stomach, ileum, colon)
  - Acute pancreatitis
- **Renal**
  - Acute tubular necrosis
  - Vacuolated epithelial cells
- **Biochemical**
  - Increased vitreous glucose
  - Increased urinary catecholamines
Cause of Death in Avalanche

- 32 deaths from 2006-2007 through 2017-2018
  - Asphyxia 72%
  - Trauma 19%
  - Both 9%

- 110 deaths from 1994 – 2015 (Sheets et al. 2018)
  - Asphyxia 65%
  - Trauma 29%
  - Other 5% (most hypothermia)

Death due to Asphyxia

- Snow occludes upper airway
- Rebreathing expired air
  - Accelerated with ice mask
  - Delayed death if air pocket present

Death due to Hypothermia

- Respiratory depression and bradycardia
- Non-palpable pulses from peripheral vasoconstriction
  - CPR on perfusing rhythm can precipitate VF
- Gentle handling to avoid precipitating VF
Core Temperature Afterdrop

- Continued decline in temperature after removal from cold
- Due to equilibration between warmer core and cooler periphery by conduction and convection (circulatory hypothesis)
Drowning

Autopsy Findings in Drowning

External
- Partially undressed or nude
- Pale skin with pink lividity
- "Washerwoman" skin
- Cutis anserina (goose flesh)
- Froth about mouth and nose

Internal
- Intramuscular hemorrhages
- Distended lungs with hemorrhage, edema
- Froth in trachea, bronchi
- Water in stomach, sinuses
- Middle ear hemorrhage
- Dilated RV
- Brain swelling

Do ....
- Check weather
- Leave a plan
- Sign guest registries
- Adequate equipment, supplies
- Heed all warnings
- Descend same trail
- Take an avalanche course

Don’t ....
- Hike/ski/climb alone
- Rely on cell phone
- Expect immediate rescue by helicopter
References