Lightning Mass Casualty Incident at 13,000 feet

Will Smith, MD, EMT-P, FAWM
www.wildernessdoc.com

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Disclaimer

- No financial relationships to disclose
- Dr. Smith is a Co-Medical Advisor for Grand Teton National Park
- Our opinions and not statement of the NPS or DOI
Introduction

- July 21, 2010 - approximately Noon
- Three parties of climbers (17 total patients)
- Struck by lightning near the summit of the Grand Teton (13,770 ft - 4197 m)
- The backcountry response involved a sophisticated MCI structure involving multiple agencies and resources
Objectives

- Discuss general wilderness medical issues
- Understand the rescue response to a wilderness MCI
- Review the spectrum of disease caused by lightning
Medical Oversight

- Urban/Rural EMS
  - Protocols - flexible
  - Training - appropriate for situation
  - QA - decisions risk vs. benefit
- Wilderness/Rescue EMS
  - Medical Director’s Involvement - On scene!
July 21st, 2010 Weather
1st Incident - Owen Chimney

- 12:24 - Possible SAR - info from Teton Co and Driggs
- 12:27 - Initial Jenny Lake SAR Page
- 5 People in party - 3 struck and paralyzed by lightning
- Owen Chimney Route
- Lost 911 Call
How quickly things can change!
2\textsuperscript{nd} Incident - Belly Roll

- 13:29 - 2\textsuperscript{nd} 911 call
- Party of 8 on Belly Roll
- One person fell over the ledge.
- 2 unconscious; 1 can’t move legs
- Unclear condition on others, some still ambulatory
3rd Incident - Above V Pitch

- 13:29 - 3rd 911 call
- Party of 4 above V Pitch, near Boulder Problem in the Sky - 100 vertical feet below summit of the Grand Teton
- 1 ambulatory, 1 Unresponsive, 2 Still paralyzed
Where do you start?

- Recognizing the situation + ICS = Plan
- Obtaining available resources
- Accessing the patients
- Triage
- Treatment
- Transport
Incident Command System (ICS)

Incident Command (IC)
Lupine Rescue Cache - ICP

Safety
PIO

Finance
Planning
Logistics
Operations
Lower Saddle

Helicopter LZ Manager
Staging
Forward Triage/Treatment
Short Haul
Ground Rescue
Heli Shuttle

Medical Group
Triage
Transport
Treatment

www.fema.gov/emergency/nims
Medical Plan

- Dr. Wheeler flown to the lower saddle
  - 11,650ft
  - 3550m
- Forward triage and treatment
- Dr. Smith stays at rescue cache and becomes medical group supervisor
  - 6,700ft
  - 2042m
- Overall incident medical response
Preparations

- Exum Hut was Volunteered as a Triage/Treatment Area
- Medical Gear was cached here
- Other Medical Providers
Patient Evacuation Begins
Short Haul Arrival
Assessment and Triage
Initial Triage Categories

- 1 Black
- 3 Red (to 1) (to 0)
- 4 Yellow (to 6) to (to 7)
- 8 Green (to 9)

Total patients: 16 (actually 17 patients)
- Triage
- Reverse Triage for Lightning

### Simple Triage And Rapid Treatment

<table>
<thead>
<tr>
<th>Step</th>
<th>Condition</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CAN YOU WALK?</td>
<td>YES → MINOR</td>
</tr>
<tr>
<td>2</td>
<td>BREATHING?</td>
<td>YES → RESPIRATIONS &lt;30 PER MINUTE?</td>
</tr>
<tr>
<td>3</td>
<td>RESPIRATIONS &lt;30 PER MINUTE?</td>
<td>YES → CIRCULATION CAP REFILL&lt;2 SEC?</td>
</tr>
<tr>
<td>4</td>
<td>CIRCULATION CAP REFILL&lt;2 SEC?</td>
<td>YES → DELAYED</td>
</tr>
<tr>
<td>5</td>
<td>MENTAL STATUS FOLLOWS COMMANDS?</td>
<td>YES → YES</td>
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</tbody>
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NPS EMS Field Manual
Version: 01/09
Procedure 1100
Triage Tags

- Every Patient
- Continuity of Care
- Start to Finish
Lupine Meadow - ICP

Photo: Jackson Hole News and Guide  www.jhnewsandguide.com
EMS Resources

- Ambulances
  - Medic 1 (GRTE) - Triage
  - Medic 3 (GRTE) - Transport
  - Medic 10 (JHFEMS) - Transport
  - Medic 60 (JHFEMS) - Transport
  - Medic 70 (JHFEMS) - Transport
EMS Resources

- 2 Transport Vans (approx 7-10 pax)
- 1 Suburban
- 2 Air Ambulance Helicopters (Standby)
- Additional Resources on Standby (ROW)
  - Medic 20 (JHFEMS)
  - Medic 2 (GRTE)
More Problems!?!  

- Hospital Incidents
  - 14:29 Hospital Without Power
  - 15:00 (approx) fire in ventilation fan in Living Center
  - MCI from Grand Teton
- Verizon Cell Phone Towers - Out of Service
Patient Total = 17

- 1 patient dead - recovered body following day
- 1 patient refused treatment at Lupine
- 15 patients transported to SJMC
  - 7 patients (1+2+2+2) in 4 ambulances
  - 8 patients (1+7) in 2 vans - 1 pt developed chest pain enroute to hospital (ALS/BLS w/ AED)
St. John’s Medical Center

- 9 Patients Seen (6 patient refused care)
- 5 Admitted (mild rhabdomyolysis)
- Family, Media, Legal, Social Work, Law Enforcement
Lightning

- DC current from 1/10 to 1/1,000 of a second
- Voltage exceeds 10 million volts
- Peak temperature in milliseconds rises to 30,000K
  - 5 times hotter than the sun and give a shock wave of 20 ATM = may lead to mechanical or blast trauma
- Similar forces to an IED blast
Lightning

- 300 injuries and 100 deaths/year in United States
- 30% of Strike Victims Die [2/3 in first hour]
  - Respiratory Failure or Fatal Arrhythmia
  - Reverse Triage for Lightning Victims
- 74% of Strike Victims have Permanent Disabilities

MMWR 1998;47:391-4
Lightning Injuries

- Prolonged Respiratory Arrest
- Cardiac Arrest (Asystole to other dysrhythmias)
- Paralysis (Transient) - Keraunoparalysis
- Blunt and Baro Trauma
  - Ruptured Ear Drums (50-80%)
- Rhabdomyolysis / Compartment Syndrome
Lightning Injuries

- Burns
  - Skin - “flashover effect” - Superficial Burns
    - Lichtenberg figures - current on skin causing branching cutaneous lesions - Pathognomonic of lightening injury
  - Deep burns - Scalp/Legs
  - Skeletal - bones have most resistance (highest heat)
Field Treatment

- Reverse Triage
- BLS
  - CPR (prolonged - 15 to 30 min), Defibrillation
  - Bandage
- ALS
  - Airway, pain control, IV fluids

WILDERNESS MEDICAL SOCIETY PRACTICE GUIDELINES

Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Lightning Injuries

Chris Davis, MD; Anna Engeln, MD; Eric Johnson, MD; Scott E. McIntosh, MD, MPH; Ken Zafren, MD; Arthur A. Islas, MD, MPH; Christopher McStay, MD; William ‘Will’ R. Smith, MD; Tracy Cushing, MD, MPH
Prevention

- Trip planning
  - Avoid ridge lines after morning
  - Early summit, Early descent
- Spread out group if caught in storm
- Remove jewelry and other metal objects

http://gcmd.nasa.gov/records/GCMD_NLDN.html
Detection

- Ground based - multiple antennas
- Portable devices (hand held, aircraft)
- Space based
- Each has limitations (weather radar)
- ‘Flash to Bang’ - inaccurate (5 sec = 1 mile)

www.amazon.com
$73.24
Does lightning strike twice...?

- July 26, 2003
- Lightning strike on upper Grand Teton friction pitch
- 2 parties (5 injured, 1 death)

- Be careful around lightning!
Summary

- Wilderness MCI - plan and train for the worst
  - Medical oversight, protocols, flexibility
- Lightning injuries and treatment
  - Reverse triage, delayed injuries (rhabdomyolysis)
- Prevention - Don’t get struck!
- Wilderness Medical Society Lightning Guidelines
Questions?

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