Case Studies: Opportunities For Improvement in Rural Trauma Care

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Disclosure

I receive no relevant financial support for speaking as a representative of any institution, medical group, agency, or company.
Photographs

Out of Respect for privacy and HIPPA, no photographs of the actual patients have been used.

X-rays and CT scans are from the actual patients.
Objectives

Discuss the significance of rural trauma

Identify reasons behind the increased morbidity and mortality from rural trauma

Explore three rural trauma cases with unique patient presentations

Highlight opportunities for improvement in rural trauma care
Why Rural Trauma

60% of all injury deaths
20% US Population
Rural Trauma Mortality


Evaluated death rates in rural and urban settings

Conclusions:
- Fatalities likely to occur prior to hospital arrival
- Rural patients older, more co-morbidities, less severely injured, increased multi-system organ dysfunction
- Increased deaths likely due to
  - Extended discovery & transport time
Brown et al, Rural vs Urban Motor vehicle Crash Death Rates

Figure 2. Motor vehicle crash (MVC) death rates per 100,000 population.
Why a Higher Mortality?


- Seeking reasons for increased rural MVC related deaths

Determined mortality affected by:

- Increased EMS Response time
- Increased scene time
- Increased distance to trauma center
### Why a Higher Mortality?

**Table 2: Type of Vehicle by Location and Mortality**

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survivors</td>
<td>Mortalities</td>
<td>Total</td>
</tr>
<tr>
<td>ATV</td>
<td>8</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Bicycle</td>
<td>10</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>MVC</td>
<td>2,865</td>
<td>113</td>
<td>2,978</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>52</td>
<td>3</td>
<td>55</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>4</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>
Why a Higher Mortality?

Table 3: Response Times and Location versus Mortality

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Patients</th>
<th>Mean Response Time (min)</th>
<th>p Value (t test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No mortality</td>
<td>2,939</td>
<td>11.2</td>
<td>0.0002</td>
</tr>
<tr>
<td>Mortality</td>
<td>129</td>
<td>13.9</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No mortality</td>
<td>1,591</td>
<td>7.1</td>
<td>0.691</td>
</tr>
<tr>
<td>Mortality</td>
<td>35</td>
<td>6.8</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Response Times and Mortality versus Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Patients</th>
<th>Time on Scene (min)</th>
<th>p Value (t test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No mortality</td>
<td>2,939</td>
<td>14.8</td>
<td>0.420</td>
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<tr>
<td>Mortality</td>
<td>38</td>
<td>16.1</td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>No mortality</td>
<td>1,591</td>
<td>10.9</td>
<td>0.60</td>
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<tr>
<td>Mortality</td>
<td>15</td>
<td>11.6</td>
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</tr>
</tbody>
</table>

Table 7: EMS Transport Times and Location versus Mortality

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Patients</th>
<th>Mean Transport Time (min)</th>
<th>p Value (t test)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No mortality</td>
<td>2,939</td>
<td>14.0</td>
<td>0.0156</td>
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<tr>
<td>Mortality</td>
<td>38</td>
<td>10.3</td>
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<tr>
<td>Urban</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>No mortality</td>
<td>1,591</td>
<td>9.6</td>
<td>0.469</td>
</tr>
<tr>
<td>Mortality</td>
<td>15</td>
<td>8.9</td>
<td></td>
</tr>
</tbody>
</table>
The Impact of Variation in Trauma Care Times: Urban Versus Rural


- Washington state study on MVC fatalities

- Conclusions on transport times and mortality
  - Prehospital transport times 2x longer in rural areas
  - Death rate 3 times higher in rural areas
  - Preventable death rates in rural incidents is double that of urban rates
The Patients are Different Too

**A Comparison of Rural and Urban Trauma Patient Care**, North Coast EMS Agency and Harbor-UCLA Research and Education Institute

1,123 trauma transports reviewed

Conclusions:

Rural and urban trauma patients “fundamentally different”

Urban patients
- younger
- more seriously injured
- more penetrating trauma
The Patients

- Age
- Percent male
- ISS
- Percent penetrating

Urban and Rural comparisons are shown.
We Can Get Better

Goal

• Determine the nature of preventable trauma deaths
• Identify opportunities for improvement

Conclusion:
51% of preventable deaths had opportunities forprehospital care improvement
We Can Get Better

TABLE 3. Additional Criteria Warranting Consideration for OFI

<table>
<thead>
<tr>
<th>Quality of Care Filters</th>
<th>Elapsed Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient pronounced dead at scene</td>
<td>≥20 min</td>
</tr>
<tr>
<td>Prehospital on-scene time</td>
<td>≥20 min</td>
</tr>
<tr>
<td>Prehospital transport time</td>
<td>≥30 min</td>
</tr>
<tr>
<td>Total prehospital time</td>
<td></td>
</tr>
<tr>
<td>Patient in ED</td>
<td>≥2 h</td>
</tr>
<tr>
<td>Patient died in ED</td>
<td>≥15 min</td>
</tr>
<tr>
<td>Patient experienced unplanned return to room</td>
<td>Within 24 h of admission</td>
</tr>
<tr>
<td>Patient died</td>
<td>≥90 min before transfer</td>
</tr>
</tbody>
</table>

OFI specifically related to documentation in the prehospital phase of care ranged from absence of vital sign recording, missing time elements (i.e., dispatch, scene, departure, and so on), pertinent narrative notes, and so on.

TABLE 6. Opportunities for Improvement of Care—by Phase of Care

<table>
<thead>
<tr>
<th>Phase of Care (Patient Contacts)</th>
<th>Inappropriate Care Related to</th>
<th>Number of Occurrences*</th>
<th>Patient Contacts (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital (n = 254)</td>
<td>Airway management</td>
<td>58</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>C-spine</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Documentation</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Fluid resuscitation</td>
<td>31</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Medication</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Total prehospital</td>
<td></td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>ED (n = 248)</td>
<td>Airway management</td>
<td>28</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Documentation</td>
<td>24</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Fluid resuscitation</td>
<td>18</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Evaluation of abdomen or chest</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Inappropriate imaging/diagnostics</td>
<td>16</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Management of chest injury</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>39</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Recognition of injury severity</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Total ED</td>
<td></td>
<td>165</td>
<td></td>
</tr>
<tr>
<td>Post-ED (n = 141)</td>
<td>Documentation</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Fluid resuscitation</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate operation</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Management or monitoring of head injury</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>21</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Treatment of rebleeding</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Ventilator care</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Total post-ED</td>
<td></td>
<td>56</td>
<td></td>
</tr>
<tr>
<td>Total all phases</td>
<td></td>
<td>351</td>
<td></td>
</tr>
</tbody>
</table>

*Some patients were noted to have multiple errors in a single phase of care.
4 Ways to Improve Our Care Today

1. Performing thorough assessments to develop a complete problem list
2. Monitoring how patients change over time
3. Thinking “fix the small problem now, or deal with a big problem later”
4. Recognizing the additional consequences of delayed discovery and access
Today’s Cases

Case 1: 11yr female water skiing incident

Case 2: 19yr male, snowmobile vs tree

Case 3: 25yr male, tree stand fall/hanging from tree
Today’s Cases
Summer Camp Water Skiing Incident

**Background**
- Late July
- Ambient temp >80°F
- Water temp ~70°F

**Dispatch time:** **1530**
- Initial information: child injured in water skiing crash, arm amputation
- Local BLS ambulance dispatched
BLS Gets the Story

Elapsed time: 15min

11yr old Hispanic female on 3rd tier of waterskiing pyramid

Boat traveling ~35mph

Patient fell onto ropes, arm became entangled tearing lower left arm off

Patient pulled onto speedboat and brought to shore, still on boat
Initial Actions

Elapsed time: 22min

Assessment findings

- A&Ox4, anxious
- Denies LOC
- Complains of arm pain (10/10) and cold
- Minimal arm bleeding
- Degloving injury 2” distal from elbow becoming deeper distally until amputation 4.5” from elbow

Initial Actions

- ALS intercept requested
- Tourniquet applied and trauma dressing
- Ice packs to residual limb
- Oxygen via NRB
- HEMS requested (40min ETA)
Patient’s chief complaint: “Am I going to die?”

Assessment is same, documented “no active bleeding.”

Interventions:
- Cut off wet clothing
- Heat in ambulance “to prevent shock”
- Intravenous access, 20ga, NS 75mL/hr
- Cardiac monitoring

Baseline vitals: 1546
pulse: 117
resp: 22
blood pressure 119/74
GCS: 15
Skin: pale cold dry
Pain: 10/10
A Decision to Make

20min to local ED via ground

3 hours to peds trauma center via ground

Wait 25min for HEMS arrival

Decided to drive to local ED to meet HEMS on their helipad

Elapsed time: 40min
Patient is found on stretcher, seated 45° angle, crying, obviously scared and anxious

Arm is covered in bandage, tourniquet has been removed, no bleeding

Remaining clothing removed

Report given to flight team
But Wait a Moment…

What happened to our patient?

Fell how far?

Traveling how fast?

Was she run over?

What is really wrong with our patient?

Elapsed time: 68min
Working Problem List

- Mechanism for spine injury
- Amputated arm
- Distracting arm pain
- Unknown total blood loss
- Multi-system trauma
Initial HEMS Actions

- Spine stabilization (regular longboard)
- 25mcg Fentanyl
- Full physical exam
- Complete history

Elapsed time: 70min
Past Medical History

• S/Sx: as noted previously
• A: No known drug allergies
• M: No home medications
• P: Plate glass injury, age 8
  – 6 hours reconstructive surgery
  – Several scars remain
  – Required in-patient psych counseling
• L: last meal at noon, urinating and defecating normally
• E: As previously stated
Head to Toe Exam

HEENT: airway self-maintained, no recent trauma noted to head, pupils equal at 4mm and reactive, multiple healed scars

Neck: trachea midline, no tenderness, no JVD
Head to Toe Exam

Chest: multiple healed scars, breath sounds equal bilaterally, right lateral chest tenderness, no pain on deep inspiration
Head to Toe Exam

Abdomen: soft and non-tender

Pelvis: Stable
Head to Toe Exam

- Extremities: left lower arm has circumferential degloving injury with complete amputation, remaining extremities have strong pulses with no evidence of injury and intact motor and sensory response.

- Skin: now pink warm and dry

- Back: no signs of injury other than a rope mark across the lower back, no spine tenderness.
## Vital Signs

<table>
<thead>
<tr>
<th>TIME</th>
<th>Pulse</th>
<th>B/P</th>
<th>Resp</th>
<th>Pain level</th>
<th>SpO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>1545</td>
<td>117</td>
<td>119/74</td>
<td>22</td>
<td>10</td>
<td>99%</td>
</tr>
<tr>
<td>1600</td>
<td>107</td>
<td>127/99</td>
<td>20</td>
<td>10</td>
<td>100%</td>
</tr>
<tr>
<td>1625</td>
<td>104</td>
<td>132/94</td>
<td>20</td>
<td>8</td>
<td>100%</td>
</tr>
</tbody>
</table>
Problem List

EMS Assessed
- Amputated Arm
- Shock
- Possible severe bleeding

HEMS Assessed
- Mechanism for Spine Injury
- Amputated arm
- Distracting arm pain
- Unknown total blood loss
- Multi-system trauma
Why the Disconnect?

- Injured children heighten rescuer anxiety
- Very distracting injury
- Patient brought to shore by counselors
- EMS classroom teachings
What are the Real Problems?

- Mechanism for Spine Injury
- Arm amputation with degloving injury
- Distracting injury
- High risk for infection

- Multi-system trauma
- Significant blood loss
- Shock
- High risk for infection
Multi System Trauma?

- Pt moving >35mph
- Fell from height
- Run over by skiers

Systems affected:
- Musculoskeletal system
- Nervous system (spine)
- Circulatory system
- Integumentary system
- Immune system
**Shock**

- A clinical syndrome where the body’s organs are not receiving adequate oxygenation and nutrients resulting in life threatening cellular dysfunction
- Types
  - Hypovolemic
  - distributive
  - obstructive
  - cardiogenic

**Acute Stress Reaction**

- A transient condition mediated by a stressful event that triggers a release of chemical mediators, that can mimic shock, but resolves once the stress is removed
- Types
  - Sympathetic
  - parasympathetic
Shock?

• Evidence for shock?
  – Hypovolemic
    • Pale skin
    • Mental status changes
  – Spinal shock?

No evidence

Does temperature influence shock?
They Turned Up the Heat

• Preventing cold is important because….
  – Hypothermia slows coagulation by up to 40%
  – Hypothermia slows healing
  – Hypothermia decreases neuron activity
  – Hypothermia causes cardiac irritability
  – Hypothermia depletes energy stores
  – Hypothermia slows metabolism
In Flight

• Pain management
  – Fentanyl 25mcg every 20min

• Fluid management
  – Normal Saline KVO
  – No symptoms of shock
In Flight

Psychological management

- Considerations
  - From Mexico
  - English second language
  - Second traumatic injury

- Actions
  - Requested translator
  - Constant comforting/reassurance

Elapsed time: 95min
In Flight

With 10min remaining in the flight, patient asks, “When are they going to put my arm back on?”

How does one respond?
Trauma Center Arrival

- Negative CT of
  - Head
  - Neck
  - Chest
  - Abdomen/pelvis
- Full trauma lab panel
  hematocrit 41,
  hemoglobin 11.8
- Arm was never recovered

Elapsed time: 110min
<table>
<thead>
<tr>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 day admission to Pediatric Trauma Center</td>
</tr>
<tr>
<td>Operative repair of residual limb</td>
</tr>
<tr>
<td>Skin graft from thigh</td>
</tr>
<tr>
<td>Wound-V.A.C. application</td>
</tr>
<tr>
<td>Psychology consultation</td>
</tr>
</tbody>
</table>
Take Away Points

Low volume high intensity events

• Leads to increased potential for missing more serious problems

Go back to, and trust your assessment for identifying problems

As anxiety wears off, be prepared to manage psychological concerns
Case 2: Snowmobile vs Tree

Background
- Late December
- Dark by 1700
- Ambient temperatures 25°F

Dispatch time: 1912
- Snowmobile crash in national forest
- Snowmobile rescue also responding

Elapsed time: 0min
Patient Access

- Several miles from trailhead
- Mature, non harvested forest
- 45 min of searching to access patient
- HEMS requested during search at 2000

Elapsed time: 64min

EMS at trailhead by 1933
Initial Assessment

- Presentation: 2016
  - 19yr old male seated upright
  - Chest pain 10/10
  - Difficulty breathing (pursed lips)
  - Blood around mouth
  - Slightly combative
  - >2min period of unresponsiveness
  - Thrown >10’
  - Major damage to snowmobile

Elapsed time: 65min
Scene Management

Attempted oxygen

Attempted cervical collar

Placed seated on long board
  • Lying down increases pain

Manual stabilization maintained

Transported via rescue sled to closest trail head

Elapsed time: 80min
Ambulance Care

- Loaded into heated ambulance: 2035
  - Oxygen 15LPM
  - Clothing removed
  - Assessment performed
  - IV access x2
  - Medications
    - Fentanyl
    - Zofran
  - Cardiac monitor

Baseline vitals: 2042
pulse: 100
resp: 28
blood pressure 139/98
GCS: 15
Skin: pale cold dry
SpO₂: 94% (on oxygen)
Assessment Findings

Pupils PERRL, no blood or deformity in ears or nose; dried blood on mouth, tongue lacerated, no deformity or tenderness in the head
Assessment Findings

Chest: no bruising, deformity, or uneven chest rise. Lungs are diminished upper left and bilateral lower lobes.
Assessment Findings

Abdomen: soft, no tenderness, pelvis is stable
Assessment Findings

Extremities atraumatic, intact CSMx4

Repeat vitals: 2055
pulse: 85
resp: 26
blood pressure 152/93
GCS: 15
Skin: pale cold dry
SpO₂: 94% (on oxygen)
HEMS Arrival

- Patient contact made 2100
  - Pt upright on cot
  - Manual stabilization (no c-collar)
  - Complaints
    - Respiratory distress becoming worse
    - Chest pain (no relief)
New Assessment Findings

Pursed lip breathing, pt focused on respirations

Chest: subcutaneous emphysema left chest from collarbone to nipple
Decision Time

Don’t RSI
- GCS 15
- Airway maintained
- SpO\textsubscript{2} OK on O\textsubscript{2}

RSI
- Pursed lip breathing
- Subcutaneous emphysema
- Fighting immobilization
- Cannot lay flat
- Flight altitude
- 55min flight

55min flight
Rapid Sequence Intubation

• Medications
  – Fentanyl
  – Etomidate
  – Succinylcholine

• Oral tracheal intubation 8.0 ID
  – EtCO$_2$
  – Bilateral breath sounds
  – Cord visualization
<table>
<thead>
<tr>
<th>Full immobilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continued sedation and paralytics</td>
</tr>
<tr>
<td>EMT reports at 2117</td>
</tr>
<tr>
<td>• Difficult to ventilate</td>
</tr>
<tr>
<td>• Increased subcutaneous</td>
</tr>
<tr>
<td>• emphysema noted left chest</td>
</tr>
<tr>
<td>• Breath sounds now absent</td>
</tr>
<tr>
<td>on left</td>
</tr>
<tr>
<td>Chest decompression via Turkle needle</td>
</tr>
<tr>
<td>• Positive airflow return</td>
</tr>
<tr>
<td>• Increased compliance</td>
</tr>
<tr>
<td>• noted</td>
</tr>
<tr>
<td>• Breath sounds return</td>
</tr>
</tbody>
</table>
HEMS Transport

- **Airborne:** 2137

- **Medications**
  - Fentanyl 300mcg total
  - Midazolam 5mg initial, 2mg x3
  - Vecuronium 10mg total

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**Vitals: 2130**
- pulse: 88
- resp: 12
- blood pressure 147/92
- GCS: 1,1,1: 3
- Skin: pale cold dry
- SpO₂: 98%
- EtCO₂: 36mmHg

---

**Repeat vitals: 2200**
- pulse: 91
- resp: 12
- blood pressure 148/92
- GCS: 3
- Skin: pale cold dry
- **SpO₂: 85%**
- EtCO₂: 30mmHg

---

**Repeat vitals: 2115**
- pulse: 85
- resp: 12
- blood pressure 153/98
- GCS: 3
- Skin: pale cold dry
- SpO₂: 99%
- EtCO₂: 34mmHg
Challenges Arise

- 2150-2215 progressive...
  - Increasing difficulty ventilating
  - Subcutaneous emphysema right chest
  - Decreasing SpO₂ levels

- Needle chest decompressions
  - Right anterior chest 18ga needle
  - Left mid-axillary line 18ga needle

- Improved SpO₂ levels, continued poor compliance

Elapsed time: 180min
Trauma Center Arrival

- SpO₂ stable remainder of flight
- Despite exposure, core temperature 98.2°F
- Subcutaneous emphysema
  - Abdomen
  - Pelvis
  - Groin

Elapsed time: 210min
Trauma Center Findings

Chest x-ray
Right hemopneumothorax worse than left

Head CT
Intracranial hemorrhage and swelling
Additional Findings

• T1 fracture
• Right clavicle fracture
• Right first rib fracture
• Sternum fracture
• Initial labs:
  – pH 7.25
  – pCO₂ 53
  – pO₂ 130
  – Hgb 14.5
Diffuse Subcutaneous Emphysema?

- Present from clavicles to groin
- Not typical of lung injury
- Exploratory surgery performed
  - Fascia ruptured along chest and abdomen wall
  - Requires stretching forces
  - Allowed air to leak down abdomen
  - Exacerbated by flight?
Trauma Center Management

• Admitted to the trauma/surgical intensive care unit for 2 weeks
  – Previously mentioned exploratory surgery
  – Surgical sternum repair
  – Surgical clavicle repair
  – Chest tubes in place for 10 days (L) and 21 days (R)
  – Intracranial hemorrhage non-surgical
  – T-1 fracture did not require surgery
• Discharged after 22d to rehab facility
Chest Depth and Needle Chest Decompression

- 110 cases

- Standard needle 4.4cm, <2in

Standard angiocath needle is unsuccessful in 50% of needle chest decompressions
Needle Chest Decompression

3.9cm

3.8cm
Take Away Points

Consequences of delayed access

- Would RSI have been needed?
- Would chest decompression have been needed?

Decision to delay assessment to ambulance

Patients change over time, >3hrs from accident to trauma team

- Slow spread of subcutaneous emphysema
Case 3: Fall From Tree Stand

Background
• Early December
• Light snow cover
• Hunting season
• Ambient temperature 15°F

Dispatch at 1725
• Man found hanging from tree
• HEMS Auto launch
EMS & Rescue Arrival

Accessed <1/2 mile into forest

Patient found ~15’ above ground

- ~4-5’ below tree stand
- Pelvis harness
- Uncontrollably shivering
- Awake and lethargic
- Chief complaint
  • Cannot feel legs
  • Hanging >3 hours
Removal

• Extrication took 20min
• Rope rescue system used
• Moved via ATV to ambulance
  – 8min drive
BLS Assessment

- Removed clothing
- Placed cardiac monitor
- “in and out of consciousness”
- “complains of no feeling in both legs”
- On physical exam
  - Intact weak motor skills in all extremities
  - No sensation lower extremities

Baseline vitals: 1800 pulse: 90 resp: “fatigued” blood pressure: N/D GCS: 3,2,1 = 6 Skin: pale and cold SpO₂: not documented

Elapsed time: 35min
HEMS Arrival

- Documented: 20’ above ground
- Primary assessment
  - A&Ox0
  - Violent shivering
  - “pt does not respond”
  - Cold to the touch

Elapsed time: 42min

Repeat vitals: 1806
pulse: 67
resp: 6 and shallow
blood pressure: 114/83
GCS: 1,1,2 = 4
Skin: pale and cold
SpO$_2$: not documented
Problem List

- Hypothermia
- Decreased level of consciousness
- Exposure
- Leg numbness
- Possible rhabdomyolysis
Interventions

- IV Access
  - One IV placed
  - Warmed IV fluids
  - Rapid Sequence Intubation
    - Routine medications
    - 8.0 ID ETT on first attempt
  - Atropine at 1808
    - Unclear reason

<table>
<thead>
<tr>
<th>repeat vitals: 1813</th>
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<tbody>
<tr>
<td>pulse: 108</td>
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<tr>
<td>resp: 12 assisted</td>
</tr>
<tr>
<td>blood pressure: 174/109</td>
</tr>
<tr>
<td>GCS: 1,1,1=3</td>
</tr>
<tr>
<td>Skin: pale and cold</td>
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<tr>
<td>SpO₂: 100</td>
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<tr>
<td>EtCO₂: 41mmHg</td>
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</tbody>
</table>
HEMS Transport

- Continuous warmed IV Fluids
- Medications
  - Fentanyl
  - Midazolam
  - Vecuronium
- Hot environment provided
- Physical exam
  - No other evidence of trauma
- Vital signs remained stable

Elapsed time: 60min
Trauma Center Arrival

- Remained intubated
- All CT scans negative for injury
- Pertinent Labs
  - CK 205 (50-400)
  - pH 7.42 (3.5-7.45)
  - pCO2 35 (34-45)
  - Lactate 1.2 (<2)

arrival vitals: 1840
  pulse: 186
  resp: 12 assisted
  blood pressure: 141/85
  GCS: 1,1,1=3
  Skin: pale and cold
  SpO2: 100
  EtCO2: 41mmHg
  Temp: 98.6°F oral, 96.6°F (bl)

Elapsed time: 60min
Admitted to SICU

Extubated after 6 hours

Lower extremity sensory loss continued
  • Associated with nerve compression
  • Returned within 36 hours
Did you Catch it?

- Differences in mental status documented
- SpO$_2$ prior to intubation?
- Why was atropine given?
- Temperature in the field?
- Difference in height above the ground documented
Mental Status

BLS Documentation
• “in and out of consciousness”
• “complains of no feeling in both legs”
• GCS: 3,2,1=6

HEMS Documentation
• “A&Ox0”
• “does not respond”
• GCS: 1,1,2=4
Hypothermia?

Bladder temperature on ED Arrival 96.6°F
Mild Hypothermia

- Awake with mental status changes
  - Agitated
  - Confused
  - Lethargy
- Uncontrollable shivering
- Increased urine output
- Fully active
- Maintains muscle control
- Skin is pale, cool, clammy

Left: 98.6°F
90-95°F
Moderate Hypothermia

- Awake with profound mental status changes to V on AVPU
- Shivering ceases at 86°F or when sugar stores are depleted
- Vital signs depressed
- Skin very pale, cyanotic
Severe Hypothermia

- P or U on AVPU
- No shivering
- Vital signs severely depressed and difficult to assess
- Cardiac dysrhythmias
- May appear dead
- DIFFICULT TO ASSESS

Below 82°F
Take Away Points

• It's important to establish baseline vitals
• Essential everyone knows important facts
• Double check documentation for
  – Accuracy
  – Completeness
• Severe hypothermia
  – No shivering
  – Unresponsive
Summary

- Rural trauma is responsible for 60% of trauma deaths
- Many of these deaths are preventable
- We can decrease preventable deaths
  - Staying calm
  - Always providing the same thorough assessment
  - Monitoring for changes over time
  - Remembering our documentation does impact in-hospital care
What Questions Do You Have?

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See you at EMS Expo 2014