Casualty Evacuation

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• University of British Columbia, Department of Critical Care Medicine

• Clinical Governance Advisor, London’s Air Ambulance

• Canadian Forces, Reserve Specialist Medical Officer
Objectives
Aim of this talk...

• Provide an overview of key concepts & issues unique to ground based casualty evacuation for clinicians who are not experienced in pre-hospital and transport medicine

• What this talk won’t do:
  • Go into details on management of specific issues
  • Teach you everything you need to know
Background & Assumptions
Context & Setting

Predominately traumatic injuries related to war

Fig. 1 Distribution of patients by mechanism of injury

Context & Setting

- Predominately traumatic injuries related to war
- Lack of air superiority
- Mixture of non-Prehosp trained clinicians, Prehosp Drs & Paramedics
First responder care
Level 1

Forward resuscitative care
Level 2

Theater hospital care
Level 3

Overseas definitive care
Level 4

U.S. definitive care
Level 5

Source: GAO analysis and Art Explosion (clipart).
Data was last updated October 14. These reports likely do not capture every instance of political violence.

Map: Alex Leeds Matthews • Source: The Armed Conflict Location & Event Data Project
Modes of Transport
Vehicles of opportunity
Mode of Transport - Decision Factors

- Patient Condition
- Distance
- Environment
- Time Sensitivity
- Safety
Triage

For Transport
**ADULT TRIAGE SIEVE**

- **WALKING**
  - Yes: **DELAYED PRIORITY 3**
  - No: **BREATHING**

- **BREATHING**
  - No: **DEAD**
  - Yes: **OPEN AIRWAY**

- **RESPIRATORY RATE**
  - Below 10 or 30 or more: **IMMEDIATE PRIORITY 1**
  - 10–29: **CAPILLARY REFILL**
    - Under 2 sec: **URGENT PRIORITY 2**
    - Over 2 sec: **RESPIRATORY RATE**

- **CAPILLARY REFILL**
  - If you are unable to obtain a capillary refill and the pulse is over 120 beats per minute then the patient is **PRIORITY 1**

**ADULT TRIAGE SORT**

**RESPIRATORY RATE**

<table>
<thead>
<tr>
<th>TOTAL SCORE</th>
<th>RESPIRATORY RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10</td>
<td>1-5</td>
</tr>
<tr>
<td>&gt; 29</td>
<td>1</td>
</tr>
<tr>
<td>6-9</td>
<td>2</td>
</tr>
</tbody>
</table>

**SYSTOLIC BLOOD PRESSURE**

<table>
<thead>
<tr>
<th>TOTAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 11</td>
</tr>
</tbody>
</table>

**GLASGOW COMA SCALE**

<table>
<thead>
<tr>
<th>TOTAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 12</td>
</tr>
</tbody>
</table>

**STEP 1: Calculate the GLASGOW COMA SCORE (GCS)**

- **A: Eye opening:**
  - Spontaneous: 4
  - None: 1

- **B: Verbal response:**
  - Oriented: 5
  - Inappropriate: 2

- **C: Motor response:**
  - Follows command: 6
  - Extension to pain: 2

**STEP 2: Calculate the TRIAGE SORT SCORE**

- **X: Convert Glasgow Coma Scale**
  - 13–15: 4
  - 9–12: 3
  - 6–8: 2
  - 4–5: 1
  - 3: 0

- **Y: Respiratory Rate**
  - 10–29: 4
  - > 29: 3
  - 6–9: 2
  - 4–5: 1

- **Z: Systolic Blood Pressure**
  - ≥ 90: 4
  - 76–89: 3
  - 50–75: 2
  - 41–49: 1

**Triage Sort Score = X + Y + Z**

**STEP 3: Assign a triage PRIORITY**

- **12** = **Priority 3**
- **11** = **Priority 2**
- **≤ 10** = **Priority 1**
- **0** = **Dead**

**STEP 4: Upgrade PRIORITY, dependent on the injury/diagnosis**
Stabilization & Packaging

For Transport
COMBAT MEDIC CARE UNDER FIRE PHASE

https://youtu.be/XXbaByUzKe0
COMA

- Cut clothes off
- Oxygen on
- Monitoring on
- Access (iv/io)
CONCURRENT ACTIVITY
Mike Christian HumanFactors UK ...

Self
Team
Environment

CRM & Human Factors Skills

https://youtu.be/s5V-GmqYZBA
Comparison between the initial assessment in an ICU vs on a battle field.

**ICU**

- A: Airway
- B: Breathing
- C: Circulation
- D: Disability
- E: Exposure
- F: Environment

**Battlefield**

- A: Airway
- B: Breathing
- C: Circulation
- D: Disability
- E: Environment
- F: Further injuries
DIAGNOSIS
Risk vs Benefit
TREATMENT
Pre-hospital Emergency Anaesthesia

Dr. Mike Christian
Research & Clinical Effectiveness Lead

London’s Air Ambulance Charity

https://www.youtube.com/watch?v=YVBzdLV-oGs
Indications

1. Airway (oxygenation) ✔
2. Ventilatory Failure ✔
3. Unconscious ✔
4. Agitated head injury ✔
5. Anticipated clinical course ✗
6. Humanitarian ✗
Mitigation

- 360 access
- Standardization
- Equipment kit dump
- Checklist
- Bubble
- Forward planning
PACKAGING
Why is packaging and handling important?

- Preventing further damage and reducing pain
- Clot protection
- Expedited emergency department assessment
- A means of carrying the patient to hospital
Moving patient can lead to clot disruption and worsening bleeding
10 degree roll only!
Care During Transport

Pitfalls & Precautions
Forward Planning
Consider Contingencies

Drugs

Supplies
Note: the calculator automatically doubles the requirement so the green box includes the contingency

### Oxygen requirement for ventilated patient (Hamilton T1)

<table>
<thead>
<tr>
<th>Patient Minute Volume (L)</th>
<th>FiO2 (keep as 1.0)</th>
<th>Transfer time (mins)</th>
<th>Required Oxygen for Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>x</td>
<td>140</td>
<td>= 3640</td>
</tr>
</tbody>
</table>

### Oxygen calculation for spontaneously breathing patient (nasal cannulae, facemask)

<table>
<thead>
<tr>
<th>Flow (L/min)</th>
<th>Transfer time (mins)</th>
<th>Required Oxygen for Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>x 60</td>
<td>= 1800</td>
</tr>
</tbody>
</table>

### Oxygen requirement for CPAP (Hamilton T1)

<table>
<thead>
<tr>
<th>Patient Minute Volume (L)</th>
<th>Leak (L/min)</th>
<th>FiO2 (keep as 1.0)</th>
<th>Transfer time (mins)</th>
<th>Required Oxygen for Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>+ 20</td>
<td>x 1.0</td>
<td>x 45</td>
<td>= 2664</td>
</tr>
</tbody>
</table>

### Oxygen requirement for High Flow (Hamilton T1)

<table>
<thead>
<tr>
<th>Flow (L/min)</th>
<th>FiO2 (keep as 1.0)</th>
<th>Transfer time (mins)</th>
<th>Required Oxygen for Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>x 1.0</td>
<td>x 60</td>
<td>= 1800</td>
</tr>
</tbody>
</table>

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https://retrieve.nhs.uk/sops/
Consider Contingencies

<table>
<thead>
<tr>
<th>Drugs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplies</td>
</tr>
<tr>
<td>Equipment</td>
</tr>
</tbody>
</table>

Changing status or complications

“Actions on...” or “What ifs”
(plan A, B, C)
**HYPOTENSION**

*Unexplained Hypotension*

**Alert Team:** "The patient is hypotensive. Can you help me troubleshoot?"

### IMMEDIATE ACTION

**Feel Pulse / Cycle NIBP**

### RAPID SCAN

<table>
<thead>
<tr>
<th>CHECK</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. PATIENT</strong></td>
<td>Own Airway - Conscious? Breathing? Peripheral pulse present? Cap Refill?</td>
</tr>
<tr>
<td><strong>3. VENTILATOR</strong></td>
<td>Alarms? (Read-out)</td>
</tr>
<tr>
<td><strong>4. INFUSIONS</strong></td>
<td>Vasopressor not delivering? Tissued drip? Pump alarming? Lines disconnected?</td>
</tr>
</tbody>
</table>

### PERI-ARREST or UNRESOLVED?

- Turn O2 to 100%
- Fluid or Blood Bolus
- Increase vasopressor infusion? Adrenaline bolus

### DO

1. **TRAUMA**
   - Re-assess ??? bleeding sites - scalp/limbs/body cavities etc
   - ? Spinal cord injury/ Massive head injury
   - Infusion sites above diaphragm in pelvic/abdo trauma

2. **CARDIAC CAUSE**
   - Dys-rhythmia
   - ? Cardiac US

3. **OBSTRUCTIVE CAUSE**
   - High PEEP/Dynamic Hyperinflation
   - US for ? Tamponade, PE, Tension Ptx

4. **MEDICATION RELATED**
   - Anaphylaxis/Transfusion reaction
   - Recesedation bolus, dose error

5. **RIGHT VENTRICULAR FAILURE**
   - PEEP, Normalise 02/CO2/pH, Review inotropes

6. **VASOPRESSOR RESISTANT**
   - Consider CaCl, HCO3, 2nd inotrope, steroids

7. **OTHER TECHNOLOGIES**
   - IABP, LVAD, ECMO - see appropriate EAC

8. **CALL SENIOR OR COLLEAGUE FOR ADVICE**
“The best performing units in the world deliver clinical excellence, not because they provide unique treatments or have access to highly technical equipment but because they deliver the most basic of care in a quality-assured manner with exquisite attention to detail.”

Dr G Davies
London HEMS 2009
A Framework for Case-Based Learning in Prehospital Medicine: The London’s Air Ambulance Experience

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The End