Assessing TBI in the Field: The Prehospital/EMS Approach to Patients with Traumatic Brain Injuries (TBI)

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Medic Ambulance
Immediate Past President
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Potential Conflicts

- Medical Director, Medic Ambulance
- Past President, American College of Emergency Physicians
- Consultant, Appria Medical
- Will mention future potential projects that may implemented in the Prehospital or Emergency Medical Approach to Trauma
Traumatic Brain Injury (TBI)  
2014 data from CDC

- 2.5M TBI-related EM Visits
  - (53% increase since 2006)
- 3.8M concussions annually
- 288K Hospitalizations
- 57,000 deaths
- 30% of all deaths in US
- $76.5B in direct and indirect medical costs
- 250K military last decade
- Falls is leading cause (48%)
  - MVA/struck (28%)
- Result in both short & long term effects
### Grading TBI

- Severe (<9)
- Moderate (9-12)
- Mild (13-15)

<table>
<thead>
<tr>
<th>Feature</th>
<th>Response</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best eye response</td>
<td>Open spontaneously</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Open to verbal command</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Open to pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No eye opening</td>
<td>1</td>
</tr>
<tr>
<td>Best verbal response</td>
<td>Orientated</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible sounds</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No verbal response</td>
<td>1</td>
</tr>
<tr>
<td>Best motor response</td>
<td>Obey commands</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Localising pain</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Withdrawal from pain</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Flexion to pain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Extension to pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No motor response</td>
<td>1</td>
</tr>
</tbody>
</table>
EMS Approach

- 911 Called
- Safe scene
- Assess for immediate life threats
- Entire Assessment
- Stabilize to prevent further injury
- Head injuries often have neck/other injuries
- Resuscitation/Treatment
Teamwork on the Scene

- Police
- Fire
- EMS- ground
- EMS- air
- Medical direction
- Coordinate with receiving facilities
SOLANO COUNTY PREHOSPITAL TRAUMA TRIAGE ALGORITHM

TRAUMATIC ARREST
Consider field pronouncement

PEDIATRICS
Patients less than 15 years of age are considered pediatric and should be transported to the closest Pediatric Trauma Center.

BASE CONTACT
Paramedics are to use clinical judgment in each case and may contact the Designated Level II Trauma Base Hospital for consultation when needed for destination determination.

If patient has any of the following:
- Traumatic Arrest
- Uncontrolled Airway
- Uncontrolled Bleeding
- Rapidly deteriorating

Then:

Penetrating trauma to the head (excluding facial injuries); Or
- GCS 12 or less; Or
- Open or depressed skull fracture; Or
- Paralysis

Then:

Systolic BP less than 90 mmHg; Or
- Respiratory rate less than 10 or greater than 25/min; Or
- V9 inappropriate for age in children (see attached); Or
- GCS of 14 or 15; Or
- Pregnant patient >24 weeks with torso trauma

Then:

Penetrating injury to neck, torso, buttock, groin, or extremities proximal to knee or elbow; Or
- Flail Chest; Or
- 2 or more proximal long bone fractures; Or
- Amputation/ Crushed/ Degloved proximal to wrist or ankle; Or
- Pelvic Instability or crepitus with a possible fracture from a major trauma; Or
- Burn with TBSA >9%

Then:

Adult Falls greater than 20 feet; Or
- Children Falls: 2 times height of child or greater than 10 feet; Or
- High-risk vehicle accidents including:
  - Intoxication in the passenger compartment: greater than 12 inches occupant site; Or
  - Greater than 18 inches any site;
  - Ejection from vehicle, partial or complete, with injury; Or
  - Death in same passenger compartment,
  - Thrown from animal with injury; Or
- Vehicle vs. Pedestrian/Bicyclist: torso run over or thrown with impact greater than 20 mph; Or
- Motorcycle crash greater than 20mph with a stationary object or with rapid deceleration

Then:

CLOSEST EMERGENCY DEPARTMENT

CLOSEST DESIGNATED LEVEL I OR LEVEL II TRAUMA CENTER

CLOSEST APPROPRIATE DESIGNATED TRAUMA CENTER

LOCAL HOSPITAL

Revised 10-15-20
Solano County Trauma Protocols

**T-1 Traumatic Shock**
- Stabilize Airway
- Spinal Motion Restriction per Policy 6611 as necessary
- Control external hemorrhage using direct pressure, tourniquets, or hemostatic dressings
- Evaluate for non-obvious causes of shock. Treat tension pneumothorax per Protocol S-1, Needle Thoracostomy.

**T-3 Head and Spinal Trauma**
- Stabilize airway
- Spinal Motion Restriction per Policy 6611
- Hyperventilate patients with signs of cerebral herniation
- Assess for and remove all foreign body airway obstructions (FBAO). If the FBAO cannot be removed, perform a Needle Cricothyrotomy per Protocol S-4.
- Control external hemorrhage using direct pressure or hemostatic dressings. Do not use a tourniquet on head or neck hemorrhaging.

T2 Cardiac Arrest, T4 Chest Trauma
Prehospital Goals

- Assess
- Exposure
- Other causes of AMS (Glucose)
- Prevent further injury
- Immobilize/stabilize
When to intubate

<table>
<thead>
<tr>
<th>Indications for early intubation</th>
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<tbody>
<tr>
<td>Airway obstruction</td>
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<tr>
<td>Hypoventilation</td>
</tr>
<tr>
<td>Severe hypoxemia</td>
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<tr>
<td>Severe cognitive impairment (GCS score (\leq 8))</td>
</tr>
<tr>
<td>Cardiac arrest</td>
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<tr>
<td>Severe hemorrhagic shock</td>
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<tr>
<td>Discretionary indications</td>
</tr>
<tr>
<td>Facial injury</td>
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<tr>
<td>Altered mental status</td>
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<tr>
<td>Combativeness</td>
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<tr>
<td>Respiratory distress</td>
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<tr>
<td>Intoxication</td>
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<tr>
<td>Preoperative management</td>
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</tbody>
</table>
Right Ventilation

- Pulse oximetry >93%
- ETCO2 (35-40mmHg)
  - ~10 breaths/minute
  - 6-7cc/kg
- Signs of herniation (decerebrate posturing, dilated or symmetric NR pupils)
  - ETCO2 30-35 mmHG
  - ~20 breaths/minute
So where are the opportunities for EMS

- Avoid hospital visits
- Reduce hospital admissions/readmissions
- Better destination determination
- Avoid expensive transports
- Speed transfers
- Expedite diagnosis and treatment
New technology might improve diagnosis and decision making