The Kids are Alright: Management of Pediatric Trauma

Christi Thornhill, DNP, RN, ENP, ACNP-BC, CPNP-AC, CP-SANE
Director Trauma Services, CARE Team, Fostering Health and Clinical Surgical Excellence Program
Objectives

- Analyze the differences in the ABC’s of pediatric trauma care
- Determine the goals of pediatric trauma resuscitation
- Describe the initial resuscitation and stabilization of pediatric trauma patients utilizing an interdisciplinary team
- Summarize common injury patterns, physiologic differences, and treatment approaches used in pediatric trauma centers that may differ from adult trauma centers
Kids are not little adults!

The number of people in the room for a pediatric resuscitation is inversely proportional to the weight of the child in kilograms!
The algorithm is the same!

- But you must consider:
  - Anatomic differences
  - Metabolic differences
  - Cognitive differences
Case Study

- 2-year old female involved in ATV rollover
- Crying and pale
- Abrasion to right jaw, right chest, right upper abdomen
- Bruise to right thigh
- GCS=13, 121/53-150-35-36.9-92% on RA
Primary Survey

- Utilize a color-coded pediatric resuscitation equipment system
- Continuous monitoring with ongoing re-assessment
- Initiate transfer and transport early
- Call pediatric experts for advice
Primary Assessment

- A-Airway (with C-spine precautions)
  - Indications for early intubation:
    - Airway obstruction, unrelieved by simple maneuvers
    - Apnea
    - Cardiac arrest
    - Decreasing LOC
    - Severe maxillofacial trauma
    - Inhalation injury
Focus on Oxygenation

- Bag-valve-mask
  - Ensure a tight seal
  - High flow oxygen
  - Jaw-thrust and chin lift
  - Oral airway or nasal airway
Airway differences

- Tongue is larger in proportion to mouth
- Pharynx is smaller
- Epiglottis is larger and floppier
- Larynx is more anterior and superior
- Narrowest at cricoid
- Trachea narrow and less rigid
Primary Assessment

- **Breathing**
  - Supplemental oxygen
  - Assess tube placement
    - Right mainstem intubations are very common
  - Insert NG
    - Decompress the stomach to assist with easier ventilation
Primary Assessment

- Circulation
  - Start 1-2 lines and draw lab (Type and cross)
  - Consider IO if unable to obtain an IV
  - Give 20ml/kg bolus of crystalloid
  - Use warmed fluids
  - Prepare to give 10 ml/kg blood if not improving after 2 fluid boluses
  - Assess for and control obvious bleeding
Primary Assessment

- Disability
  - Brief neurologic exam
  - Spontaneous movement
  - Responsive to voice
  - GCS or Pediatric GCS
  - AVPU

PEDiATRIC GLASGOW COMA SCALE (PGCS)

<table>
<thead>
<tr>
<th>EYE OPENING</th>
<th>&gt; 1 Year</th>
<th>&lt; 1 Year</th>
<th>Score</th>
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<tbody>
<tr>
<td>Spontaneously</td>
<td>Spontaneously</td>
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<td></td>
</tr>
<tr>
<td>To verbal command</td>
<td>To shout</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>To pain</td>
<td>To pain</td>
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<td></td>
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<tr>
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<table>
<thead>
<tr>
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<tr>
<td>Obey</td>
<td>Spontaneous</td>
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<td>Localizes pain</td>
<td>Localizes pain</td>
<td>5</td>
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</tr>
<tr>
<td>Flexion-withdrawal</td>
<td>Flexion-withdrawal</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Flexion-abnormal (decorticate rigidity)</td>
<td>Flexion-abnormal (decorticate rigidity)</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Extension (decerebrate rigidity)</td>
<td>Extension (decerebrate rigidity)</td>
<td>2</td>
<td></td>
</tr>
<tr>
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<td>No response</td>
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<table>
<thead>
<tr>
<th>VERBAL RESPONSE</th>
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<th>2-5 Years</th>
<th>0-23 months</th>
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<td>Oriented</td>
<td>Appropriate words/phrases</td>
<td>Smiles/coos appropriately</td>
<td>5</td>
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<tr>
<td>Disoriented/confused</td>
<td>Inappropriate words</td>
<td>Cries and is consolable</td>
<td>4</td>
</tr>
<tr>
<td>Inappropriate words</td>
<td>Persistent cries and screams</td>
<td>Persistent inappropriate crying and/or screaming</td>
<td>3</td>
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<tr>
<td>Incomprehensible sounds</td>
<td>Grunts</td>
<td>Grunts, agitated, and restless</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td>No response</td>
<td>No response</td>
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</tr>
</tbody>
</table>

TOTAL PEDiATRIC GLASGOW COMA SCORE (3-15):
Primary Assessment

- Expose and Environmental Control
  - Assess all body surfaces
  - Keep patient warm
  - Look for obvious deformities
Diagnostic Imaging Prior to Transport

- 9th edition ATLS recommends only chest and pelvis radiographs for blunt trauma prior to transport
- C-spine should remain immobilized and protected
Back to the Case

- Airway
  - Patent, no obvious injury or obstruction

- Breathing
  - Shallow, grunting respirations
  - Mild perioral cyanosis
  - O2 saturation 92% on RA-improves to 97% with O2 at 10L via face mask
Back to the Case

- **Circulation**
  - Tachycardic at 150
  - Abdomen tender in RUQ, mildly distended, diffuse guarding, abrasion noted

- **Disability**
  - GCS=13, Patient is verbal

- **Exposure**
  - Closed deformity to right femur
Head Injuries

- Large craniums
- Short, weak neck
- Leading cause of death from traumatic causes

- Concussion
- Contusions
- Epidural hematomas
- Subdural hematomas
- Subarachnoid hemorrhages
- Skull fractures
Epidural Hematomas

- 9 year old, fell and hit head on concrete
- Epidural Hematomas
  - Initial injury may be minor
  - +LOC or absent
  - Awake initially followed by c/o HA, vomiting, nuchal rigidity
  - Contralateral hemiparesis progressing to unconsciousness
Subdural Hematoma

- 4 yo fell from second story window onto concrete
- Subdural hematomas
  - Lethargic, drowsy, irritable
  - Profound and progressive deterioration
Subarachnoid Hemorrhage

- 5 year old ejected from vehicle
- Subarachnoid hemorrhage
  - Headache
  - Restlessness
  - Nausea vomiting
Assess
• GCS=13
• No signs of increased ICP
• No signs of skull fracture or hemotympanum

Obtain chest and pelvis x-ray
Initiate transfer
Supportive therapy
Prevent hypoxia and hypotension
Cervical Spine

- Large craniums
- Short, weak neck
- C-spine fractures are rare
- Must be aware of differences in injury patterns, anatomic variances, and radiographic characteristics
Cervical Spine
Assess

- Difficult to assess neck pain due to age and competing injury
- Grossly normal peripheral neurologic exam

Actions

- Maintain c-spine protection
- Consider lateral c-spine film
Thoracic Trauma

- Compliant and pliable chest wall
  - Leads to more forces transmitted to internal organs rather than rib fractures
- Second most common cause of mortality in pediatric trauma
Thoracic Trauma
Back to the Case

Assess

- Respiration rate 30, O2 sat 99% on face mask
- Trachea midline
- Perioral cyanosis resolved
- Respiratory effort unlabored
- Review CXR-no pneumothorax or hemothorax
- Pulmonary contusion on right

Actions

- Continue with care
- Assess circulation with plan to reassess breathing
Abdominal Trauma

- Children are smaller, transferring kinetic energy over a smaller area
- Ribs are more pliable resulting in more force to upper abdominal organs
- Thinner and weaker musculature provides less protection to the intra-abdominal organs
- Infants and young children at higher risk of multiple organ injuries due to close proximity of organs
Abdominal Trauma

Liver Laceration

Splenic laceration
Abdominal Trauma

Renal laceration w/ uroma

Pancreatic Injury

- Frequently caused by handlebars to the abdomen
- Difficult to manage
  - Long term hospitalization
  - Requires TPN
  - May develop pseudocysts
Abdominal Trauma

Bowel Injury

- Frequently caused by compression of the abdomen
- Difficult to diagnose
- Require surgical intervention
Back to the Case

Assess

- After the first 20ml/kg bolus the HR remains 150 and the capillary refill is 4 seconds
- Tenderness to RUQ with RLL pulmonary contusion
- Clinical suspicion for acute liver injury

Actions

- Start the second 20ml/kg bolus
- FAST study can be considered
- Call for PRBCs or initiate MBTP
Back to the Case

Assess

- Patient remains tachycardic, pale, poorly perfused after second bolus.

Action

- Transfuse 10ml/kg of PRBCs
- Call pediatric trauma center for advice, support, transport
Back to the Case

Assess

- Repeat primary survey
  - A
    - Patent, no concerns
  - B
    - Stable, no change with good O2 saturation
  - C
    - HR 110, BP 110/50, capillary refill 2 seconds, warm extremities

Actions

- Continue IV hydration
- Have further PRBC’s ready
- Splint femur
- Give 1mcg/kg of fentanyl prn pain
- Speak with pediatric trauma center
- Complete secondary survey
- Continue to support hemodynamics
- Prepare patient for transport
Pediatric Trauma Pearls

- Follow general ATLS principles
- Call for transfer/transport as soon as possible
- Maintain oxygenation at all times
- Beware of persistent tachycardia
- Be mindful of spaces for significant hemorrhage in children
- Do not be afraid to transfuse
- Avoid hypothermia
- Be mindful of treating pain with analgesia
- Allow parents to be present whenever possible
- Be mindful of the possibility of child abuse
Child Abuse Considerations

- Discrepancies between history and injury
- Developmental milestone not consistent with mechanism
- Inappropriate caregiver response to child’s condition
- Explanation changes
- Delay in seeking treatment

- Bruises
  - Torso
  - Ears
  - Neck
  - Any bruise in child under the age of 6 months

- Social history
- Past medical history
- Provide safe environment
- Report abuse or maltreatment
References

- Kissoon, N., Dreyer, J., Walia, M. Pediatric trauma: differences in pathophysiology, injury patterns and treatment compared with adult trauma. CMAJ. 1990;142:27–34