**Initial Management of Major Pediatric Trauma Patients**

**Pediatric Practice Management Guideline**

**Effective:** 12/2013

**Contact:** SMRTAC Coordinator

**Last Reviewed:** 6/2016

**Purpose**

To provide a consistent approach to the care of injured children including age appropriate initial assessment, intervention, and early identification of children that would benefit from an early transfer to a pediatric trauma center.

**Definitions**

1. **Pediatric trauma patient** – any patient age \( \leq 14 \) suffering an injury.
2. **Major trauma patient** – any patient who sustains injuries significant enough to cause a threat to life or limb.
3. **Initial assessment** – a systematic process of assessment, recognition of life threatening injuries and provision of timely and appropriate interventions and consists of primary and secondary survey utilizing the principles of Advanced Trauma Life Support (ATLS) or Comprehensive Advanced Life Support (CALS).

**Policy Statements**

Consideration of age-related differences in anatomy and physiology in children is paramount in providing pediatric trauma care. Basic principles to consider when caring for injured children include:

1. Children have narrow airways which can occlude easily with edema. Close monitoring and frequent re-evaluation of airway status is important. Keep a low threshold for initiating endotracheal intubation as provider comfort allows.
2. Infants and toddlers have large occiputs so to avoid airway compromise and inappropriate C-spine alignment, when supine place padding under the child's back to compensate. (See appendix 1)
3. Children will not become hypotensive until 25-30% of the blood volume is lost. Persistent tachycardia and delayed capillary refill are early indicators of shock.
4. All medications and most interventions are weight based in children so a weight should be established early in the trauma resuscitation.
5. Use of a length-based resuscitation tape (Broselow™) – (LBRT) - can be used to estimate a weight and expedite care by providing appropriate sized equipment and medication dosages for the child.
6. Children are very susceptible to heat loss so measures to avoid hypothermia must be instituted.
7. Hypoglycemia is common in children; therefore it is important to monitor blood glucose levels closely.
8. Consider early transfer of significantly injured children to the nearest Pediatric Trauma Center using the most appropriate mode of transport.
9. A reference guide including normal pediatric vital signs for all age groups can be found on the SMRTAC website. (See appendix 2)
10. A list of suggested pediatric equipment can be found on the SMRTAC website https://smrtac.org/committees/pediatrics/

Procedure Statements

1. Primary Survey - Airway
   a. Assess airway patency while simultaneously providing cervical spine stabilization
   b. Consider endotracheal intubation for definitive airway control as indicated.
   c. ETT size per LBRT or 16 + age in years/ 4 (example- child age four: 16+4 (age) /4= 20/4= ETT size 5.0)
   d. If unable to establish definitive airway consider use of size appropriate rescue airway

2. Primary Survey – Breathing
   a. Assess breathing adequacy by evaluating respiratory rate, depth and symmetry, skin color, work of breathing, breath sounds, and chest wall integrity.
   b. Assess for evidence of tension pneumothorax, flail chest, other pneumothoracies, pulmonary contusion, or rib fracture.
   c. Administer oxygen.

3. Primary Survey – Circulation
   a. Assess for signs of shock as evidenced by:
      i. Persistent tachycardia for age
      ii. Capillary refill > 2 seconds
      iii. Cool, mottled extremities
      iv. Pallor
      v. Narrowed pulse pressure
      vi. Decreased level of consciousness
      vii. Sunken fontanelle in infants
   b. Control any uncontrolled external bleeding.
   c. Initiate fluid resuscitation to replace volume lost
      i. Establish 2 IV’s using the largest bore the vessel can accommodate.
      ii. Obtain IO access if peripheral access cannot be rapidly achieved.
      iii. Administer fluid bolus of 20 cc/ kg of crystalloid (may repeat 2-3 times)
      iv. If signs of shock persist, administer 10 cc/kg warmed packed cells (type specific or O-negative).

4. Primary Survey – Disability
   a. Determine level of consciousness
   b. Calculate Glasgow Coma Score noting any areas where points are lost
i. For pre-verbal children use an age appropriate scale (see appendix 3)

c. Assess pupils for size and reactivity to light

d. Infants assess fontanelle

5. Primary Survey – Exposure
   a. Remove all clothing including diapers to ensure complete exposure.
   b. Prevent heat loss by increasing ambient room temperature, keeping patient covered, using convective heating blankets, and warming fluids and blood for administration.

6. Secondary Survey
   a. The secondary survey begins only upon completion of primary survey and initiation of all appropriate resuscitative interventions.
   b. The decision to transfer should be made early and any further assessment or diagnostic studies should not delay transfer to a higher level of care.
   c. Obtain a complete set of vital signs including central & peripheral pulses, manual blood pressure, and core temperature reading.
   d. Obtain a complete history from EMS, family, patient or others.
   e. Complete a head-to-toe physical assessment to identify all injuries.
   f. Institute ongoing cardiac and pulse oximetry monitoring.
   g. Chest x-ray and pelvis x-ray as indicated.
   h. On-going assessment should include vital signs including temperature, GCS, pupils, control of external bleeding, and urine output.
   i. Ensure adequate pain control.
   j. If decision has been made to transfer child to a higher level of care no further diagnostic studies are required. Rapid transport is critical to improved outcomes.

7. Special Pediatric Trauma Considerations
   a. Care providers need to be alert to possibility of non-accidental trauma. Physical/history findings suggestive of child abuse include:
      i. Discrepancy in the reported history and physical findings.
      ii. Bruising in infants /children unable to move on their own
      iii. Intra-cranial bleeding without history of trauma
      iv. Perioral injuries
      v. Trauma to genital or perianal area
      vi. Suspicious bruising patterns
      vii. Sharply demarcated burns in unusual areas
   b. Family centered care is paramount in the care of children
      i. Consider family presence during procedure and resuscitation.
      ii. Ensure the family is accompanied by a trained person able to provide support and answer questions.

8. Transfer to a Designated Pediatric Trauma Center is recommended if any of the following criteria are present:
   a. If patients meets level red trauma activation criteria
   b. Physiologic Criteria
      i. Decreased or deteriorating neurologic status (GCS < 14)
      ii. Respiratory distress or failure
iii. Intubation, need for ventilatory support, or need for anesthesia
iv. Shock of any type, compensated or uncompensated
v. Requiring blood transfusion
vi. Potential need for invasive monitoring, intracranial pressure monitoring, or vasoactive medications
vii. Paralysis or focal neurologic deficit
c. Anatomic Criteria
   i. Penetrating injury to torso, neck, head, or proximal to elbow or knee
   ii. Fracture of two or more long bones (femur, humerus, tibia/fibula)
   iii. Factures that may be complicated by neurovascular and/or compartment syndrome or open fractures
   iv. Suspected injury to the axial skeleton or spinal cord
   v. Traumatic amputation and crush injuries
   vi. Suspicion or documentation of a significant head injury (no need to validate with imaging prior to transfer)
      1. Hemotympanum or cerebrospinal fluid leak suggestive of basilar skull fracture
      2. Open or penetrating head injuries
      3. Depressed skull fractures
      4. GCS < 14
      5. Intracranial hemorrhage or contusion
   vii. Suspected concussive syndrome with persistent symptoms such as vomiting, confusion, and/or headache
   viii. Pelvic fracture
   ix. Blunt injury to the chest and/or abdomen
   x. Ocular injuries
   xi. Degloving injuries
d. If child meets Red Level Activation Criteria transfer should be initiated within 20 minutes and transfer should not be delayed for further diagnostic testing.
e. If injured child requires transfer to a pediatric trauma center contact to the receiving trauma surgeon or their designee should be made early.
f. Consultation with the receiving physician should be done prior to diagnostic imaging to evaluate the risk/benefit ratio of injury identification and exposure to radiation.
g. Questions regarding IV fluid rates, drug doses, and other therapeutic interventions may also be addressed with the receiving physician during the consultation.
h. Mode of transportation should be determined in a collaborative approach between transferring and receiving hospital.
i. Major burn patients should be transferred directly to a burn care facility.
j. Information to be shared with the receiving facility should include:
   i. Age
   ii. Mechanism and time of injury
   iii. Injuries identified
   iv. Vital signs
v. Interventions including volume and type of fluids given
vi. Diagnostics completed including lab results
vii. Radiology images if done

k. Per the MN State Trauma System requirement, all patients transferred to a higher level of care require a Performance Improvement review.

Resources/Links

- Trauma Center Association of America Pediatric Trauma Transfer Guidelines 2011
- Rural Trauma Team Development Course Manual 2011
Appendices

Appendix 1:

C-Spine Alignment

Appendix 2:

Normal Pediatric Vital Sign Ranges

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Respiratory Rate</th>
<th>Heart Rate</th>
<th>Systolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant 1 year or less</td>
<td>30-60</td>
<td>100-180</td>
<td>70-80</td>
</tr>
<tr>
<td>Toddler (1-2 years)</td>
<td>25-40</td>
<td>80-150</td>
<td>75-84</td>
</tr>
<tr>
<td>Preschooler (3-5 years)</td>
<td>20-35</td>
<td>70-120</td>
<td>80-110</td>
</tr>
<tr>
<td>School Aged (&gt;= 6 years)</td>
<td>20-30</td>
<td>60-100</td>
<td>90-120</td>
</tr>
</tbody>
</table>

References: AHA/PALS
Appendix 3:

Pediatric Glasgow Coma Scale

<table>
<thead>
<tr>
<th>Clinical Parameter</th>
<th>Infants (0-12 months)</th>
<th>Children (1-5 years)</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye Opening</td>
<td>Spontaneous</td>
<td>Spontaneous</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Response to speech</td>
<td>Response to speech</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Response to pain</td>
<td>Response to pain</td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Verbal Response</td>
<td>Coos/babbles</td>
<td>Appropriate words</td>
<td>5</td>
</tr>
<tr>
<td>Irritable</td>
<td>Inappropriate words</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Cries to pain</td>
<td>Persistent cry</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Moans to pain</td>
<td>Grunts</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
<tr>
<td>Best Motor Response</td>
<td>Normal</td>
<td>Spontaneous</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Withdraws to touch</td>
<td>Localized pain</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Withdraws from pain</td>
<td>withdrawing from pain</td>
<td>4</td>
</tr>
<tr>
<td>Flexor response</td>
<td>Flexor response</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Extensor response</td>
<td>Extensor response</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>No response</td>
<td></td>
<td>No response</td>
<td>1</td>
</tr>
</tbody>
</table>

Prepared by: SMRTAC leadership/Pediatric Subcommittee

Approvals: SMRTAC 12/19/2013, 6/9/2016

Disclaimer: This is a general guideline and is not intended as a substitute for clinical judgment or as a protocol for the management of all trauma patients.
Pediatric Trauma Assessment Algorithm

Patient meets Level Red criteria – consider early initiation of transfer to verified pediatric trauma center

- **AIRWAY**
  (with c-spine precautions)
  - Not Patent
    - Interventions
      - Open and clear airway – jaw thrust and suction
      - Consider airway adjunct
      - Consider intubation
  - Patent
  - Effective
  - Not Effective
    - Interventions
      - Assist with BVM
      - Treat life threatening injuries
        - Needle decompression
        - Cover open chest wounds
      - Consider intubation

- **BREATHING**
  - Assess respiratory rate, depth, and symmetry, skin color, work of breathing, breath sounds, and chest wall integrity
  - Not Effective
    - Interventions
      - Needle decompression
      - Cover open chest wounds
      - Consider intubation
  - Effective

- **CIRCULATION**
  - Assess for signs of shock as evidenced by tachycardia for age, cap refill > 2 seconds, cool mottled extremities, pallor, narrow pulse pressure, decreased LOC, sunken fontanel
  - Not Normal
    - Interventions
      - Control bleeding (pelvic binder, traction splints, direct pressure)
      - Vascular access x 2
      - Warmed crystalloid bolus of 20cc/kg x 2 or 3
      - If shock persists packed cells 10cc/kg
      - Periocardiocentesis
      - ATLS/CALS protocols are indicated
      - Support ABC’s
      - Avoid procedures that increase ICP
  - Not Normal
    - Needle decompression
    - Cover open chest wounds
    - Consider intubation
  - Normal

- **DISABILITY**
  - Assess level of consciousness, calculate GCS, assess pupils for size and reactivity to light, in infants assess fontanel
  - Not Normal
    - Interventions
      - Control bleeding (pelvic binder, traction splints, direct pressure)
      - Vascular access x 2
      - Warmed crystalloid bolus of 20cc/kg x 2 or 3
      - If shock persists packed cells 10cc/kg
      - Periocardiocentesis
      - ATLS/CALS protocols are indicated
      - Support ABC’s
      - Avoid procedures that increase ICP
  - Normal

- **EXPOSURE**
  - WARMING MEASURES
    - Interventions
      - Support ABC’s
      - Avoid procedures that increase ICP
    - Secondary Survey
      - Full set of vital signs and history
      - Head to toe assessment