

EVALUATION AND MANAGEMENT OF THE INJURED CHILD

Objective

Develop an organized, systematic approach to the assessment and initial management of the injured child

Epidemiology

Leading cause of death in children

Results in more death and disability among children older than 1 year of age than all other causes combined

Consider mechanism of injury

The presence of any of these should make you suspicious of other significant traumatic injuries

Fall from 20 feet or more

Accident with fatalities

Motor vehicle involved

Fractures in more than one extremity

Injury to more than one system

Establish priorities

Primary survey - **ABC's; initial stabilization**

Secondary survey - **head-to-toe approach after the initial stabilization is complete**

Primary survey

Airway with cervical spine stabilization

Breathing and ventilation

Circulation with hemorrhage control

Disability (neurologic screening examination)

Exposure and environment

Airway

Assume cervical spine injury - appropriate cervical spine stabilization should be in place for any suspected head or neck trauma until the cervical spine has been cleared; C-spine stabilization in children may be achieved with standard cervical collars of appropriate size; sandbags or IV bags may be used for infants; all procedures including intubation must be performed with the head and neck in alignment until the C-spine is cleared

Relieve obstruction - airway obstruction may be caused by blood and tissue with facial trauma; may be caused by the tongue and soft tissues if the child is obtunded; suction and place an oral airway if necessary; intubation may be required for unrelieved obstruction; if unable to place an endotracheal tube orally, a surgical airway (needle cricothyrotomy or emergency tracheostomy) may be required

Breathing

Supplemental oxygen

Rate and adequacy - assess adequacy of oxygenation with O₂ saturation monitor or ABG; assess adequacy of ventilation with respiratory rate, air entry, ABG; respiratory rate should be appropriate for age - *beware of low respiratory rates*; intervene with mask/bag ventilation and intubation if oxygenation and/or ventilation are inadequate

Symmetry of breath sounds - consider hemothorax or pneumothorax if breath sounds are unequal; breath sounds may be transmitted from the good side to the bad in small infants; consider CXR; tracheal deviation and hypotension may also be present if a tension pneumothorax exists

Circulation

Assess circulatory status

Hypotension is a late finding in shock; other clinical indicators include:

pulse - hypovolemia results in compensatory mechanisms to maintain cardiac output; increased sympathetic drive leads to tachycardia; capillary refill - sympathetic output as a result of hypovolemia leads to peripheral vasoconstriction and delayed capillary refill

level of consciousness - may be affected by other variables such as head trauma, sedatives; an alert patient has adequate CNS perfusion for the moment

urine output - decreases with inadequate renal perfusion

Obtain reliable venous access, type and cross-match - may be difficult to obtain venous access in children; percutaneous peripheral access should be attempted initially; if two attempts are unsuccessful, place intraosseous; if this is not possible, consider IV cutdown or central line

Diagnose and control hemorrhage - place direct pressure on obvious sources of bleeding

Shock

Usually hypovolemia

Consider hypoxia, pericardial tamponade, tension pneumothorax - consider these particularly if the child is not adequately resuscitated following several fluid boluses; consider exploratory laparotomy or thoracotomy if shock state persists and these problems have been relieved or ruled out

Infants may be hypotensive from head injury - may have large volume losses proportional to body size into scalp or intracranially

Management of shock

Fluid resuscitation - isotonic fluid boluses of 20 ml/kg with reassessment of cardiovascular status following each bolus, consider transfusion of packed red blood cells after second fluid bolus or as indicated by hemoglobin; type-specific or O negative blood can be given if time constraints prohibit complete cross-match

Pneumatic antishock garment (PASG) - available in pediatric sizes, though rarely used; not a substitute for fluid resuscitation; increases systemic vascular resistance; may be used to stabilize pelvic and lower extremity fractures

Disability

Quick overview of neurologic status, not a complete neurologic examination

Pupillary response

Level of consciousness

A - alert

V - responds to verbal stimuli

P - responds to painful stimuli

U - unresponsive

Glasgow coma scale

Eye opening response

Verbal response

Motor response

Exposure and environment

With larger surface area to body weight ratios, infants and children may have significant heat loss, particularly when undressed (appropriately) for complete examination; heat loss may be increased by fluid (e.g., blood) covering the skin; hypothermia may result in metabolic acidosis, increased oxygen consumption and vasoconstriction

Secondary survey

The primary survey must be complete and all ABC's stabilized with frequent reassessment before proceeding to the secondary survey

Vital signs

Head-to-toe examination

History

Laboratory and radiographic studies

Physical examination

Head - feel for bony abnormalities, tenderness

scalp - check for laceration or soft-tissue injury

eyes - include conjunctiva; pupillary size and reaction; fundal appearance; vision if possible

facial bones and teeth - palpate bony prominences to rule out maxillofacial trauma

Battle's sign or Raccoon eyes - suspect basilar skull fracture

hemotympanum, CSF rhinorrhea or otorrhea - suspect basilar skull fracture

Neck

subcutaneous emphysema - may indicate pneumothorax, pneumomediastinum, tracheal injury

tracheal deviation - may indicate pneumothorax

neck-vein distention - may indicate tension pneumothorax, pericardial tamponade

cervical spine - feel for bony abnormalities, tenderness that may indicate cervical spinal injury

Chest

Respiratory excursion

Asymmetry

Flail segments

Pneumothorax

Hemothorax

Cardiac tamponade

Abdomen

Liver and spleen commonly injured by blunt trauma - CT examination has replaced peritoneal lavage as diagnostic procedure of choice with suspected abdominal trauma

Serial examinations may reveal injury

Pelvis - palpate for tenderness and instability, examine perineum

Rectum - check for wall integrity, prostatic injury, occult GI hemorrhage

Extremities - palpate for bony abnormalities, tenderness

Back - log-roll patient if cervical spine not cleared

Skin

Neurologic exam - now is the time for the complete neurological exam

History

A - allergies

M - medications

P - past illness

L - last meal

E - events preceding the injury

Summary

Primary survey

- Airway with cervical spine stabilization
- Breathing and ventilation
- Circulation with hemorrhage control
- Disability (neurologic screening examination)
- Exposure and environment

Secondary survey

- Vital signs
- Head-to-toe examination
- History
- Laboratory and radiographic studies

Keys to management

- Continuously monitor and frequently reevaluate the patient
- Return frequently to the primary survey

Spinal cord injury

- Unusual in children
- May occur without radiographic findings
- Suspect with unremitting shock
- High dose steroids is the only therapy with suggestive benefits

Non-accidental trauma

- Suspect child abuse with any of the following:
 - History inconsistent with physical exam
 - Discrepancy between accounts of the injury
 - Multiple injuries in various stages of healing
- Any* suspected non-accidental trauma should be reported

Prevention

- Most pediatric trauma is preventable; our obligation is to educate the parents of our patients about ways to avoid or lessen traumatic injuries (e.g., bike helmets, seat belt use)