Overall Approach to Trauma in the Emergency Department

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Background

- Trauma is the leading cause of death and disability in children in the United States.
  - Motor vehicle accidents are one of the top two causes of death in all pediatric age groups.
- The multi-disciplinary trauma team consists of various providers who provide care to an acutely injured child.
- Trauma centers are certified by the American College of Surgeons according to the resources available.
- Trauma centers can have different adult and pediatric designations.

The Primary Survey

- The primary survey is the cornerstone of a trauma patient's evaluation with the goal of identifying and treating any life-threatening conditions.
- The primary survey consists of evaluation of the:
  - Airway maintenance with cervical spine control
  - Breathing and ventilation
  - Circulation with hemorrhage control
  - Disability (neurological assessment)
  - Exposure and environmental control
    - The patient should be exposed to evaluate for all potential injuries; however, prevention of hypothermia is crucial.

Life-threatening Injuries that May Be Identified on the Primary Survey

System	Life Threatening Injury	Treatment
Airway	Airway obstruction	Endotracheal intubation if possible. If not, needle cricothyroidotomy with jet insufflation or surgical cricothyroidotomy
Breathing	Tension pneumothorax	Needle decompression in 2nd intercostal space
	Open pneumothorax	Application of occlusive dressing that is secured on three sides
	Massive hemothorax	Placement of chest tube and hemodynamic support
	Flail chest	Respiratory support, fluid resuscitation and analgesia
	Pulmonary contusion	Respiratory support
Circulation	Cardiac tamponade	Pericardiocentesis

The Secondary Survey

- The secondary survey consists of a complete history and physical exam <mark>searching for any injuries – no matter how small</mark>.
- A detailed mechanism of injury can help predict what types of injuries a child may have sustained.
- The focused assessment with sonography for trauma (FAST) examination is a point-of-care sonographic assessment looking for signs of intra-abdominal and intrathoracic injury.
- Other adjunctive tools include laboratory work, radiographs, computed tomographic scans, and an electrocardiogram

Head Trauma

- Traumatic brain injury (TBI) is a leading cause of death and disability in children in the United States.
- Consider nonaccidental trauma, especially when there is head trauma in a non-ambulatory child, or if the story does not make sense given the developmental stage of the child.
- Signs and symptoms of increased intracranial pressure in an older child include headaches, vomiting, and altered mental status, whereas an infant may initially present with only a bulging fontanel before more overt signs develop.
- The Cushing triad (bradycardia, hypertension, and respiratory depression) signifies significant increased intracranial pressure and impending herniation.

Comparison of Risk Factors Potentially Necessitating a Head CT Scan in Children after Head Trauma

	CATCH	CHALICE	PECARN
GCS	<15 (>2h after injury)	<14 (<15 if <1-year-old)	<15
Suspected fracture*	Yes (suspected open or depressed fractures)	Yes (suspected depressed or penetrating fracture)	Yes (palpable skull fracture (only if < 2 years)
Sign of basilar skull fracture	Yes	Yes	Yes (only if >2 years)
Change in Mentation	Yes ('irritability on exam')	Yes ('abnormal drowsiness')	Yes (including 'not acting normally as per parent' if <2 years)
Loss of consciousness	No	Yes (>5 min)	Yes if >5 sec if <2 years Yes if >2 years
Headache	Yes (if worsening)	No	Yes (if severe and >2 years)
Hematoma	Yes (large, boggy)	Yes (any bruise or swelling)	Yes (if non-frontal & <2 years)
Vomiting	No	Yes (≥3 episodes)	Yes (if >2 years)
Amnesia	No	Yes	No
Concern for Non-Accidental Trauma	No	Yes	No
Seizure	No	Yes (if no history of epilepsy)	No
Focal Neurological findings	No	Yes	No
Dangerous Mechanism of Injury**	Yes (MVC, fall ≥3 feet or 5 stairs, fall off bicycle without helmet	Yes (High speed MVC (>40mph) as occupant or pedestrian, fall >3 feet, high speed projectile injury)	Yes (MVC with ejection, death or rollover, pedestrian or cyclist struck by car, high speed projectile injury, fall >3 feet (<2 years) or >5ft (>2 years)

Burns

- Burns can occur as an isolated incident or as part of a multisystem trauma.
- Burns are characterized based on their depth.
  - Superficial burns—red, painful, and do not blister (eg, most sunburns)
  - Partial-thickness burns—typically red and swollen, exquisitely painful, appear wet, and are characterized by blistering
  - Full-thickness burns—waxy or leathery appearance, are not painful to the touch, and the skin may feel dry
- Determining the amount of body surface area (BSA) affected is crucial for calculating the necessary fluid replacement.
- The Parkland formula for calculating the amount of fluid to replace in the first 24h is weight(kg) x 4mL/kg x % BSA affected with partial or full thickness burns.
- Maintenance fluid should be added in younger children.

Orthopedic Trauma

- Orthopedic trauma is the most common form of trauma in children and can occur in either the setting of multisystem trauma or, more commonly, in isolation.
- Fractures resulting in neurovascular compromise are orthopedic emergencies necessitating emergent reduction.
- Open fractures, which may be as subtle as a small break in the skin over a fracture, are orthopedic emergencies requiring orthopedic consultation, reduction of the fracture and prophylactic antibiotic drug therapy
- Compartment syndrome should be suspected in a patient who has pain out of proportion to the underlying injury and/or pain on passive stretching of muscles of an affected extremity and requires emergent consultation for a fasciotomy.