# Pediatric Trauma

- Abdominal-Hip-Pelvic
- Bites and Envenomations
- Burns
- Chest Trauma
- Crush Injury
- Extremity Trauma
- Eye Trauma
- Head Trauma
- Hemorrhagic Shock
- Spinal Motion Restriction
- Taser
- Trauma Alert
- Trauma Transport
- Traumatic Cardiac Arrest

General Approach to Trauma

Updates & Revisions

# Abdominal/Hip/Pelvic Trauma

Table of Contents

Mechanism or Signs/Symptoms consistent with abdominal/hip/pelvic trauma

Consider possibility of distracting injury for C-spine Immobilization

Full Trauma ALS Assessment & Treatment

Control hemorrhage with direct pressure, hemostatic agent, tourniquet.

Pelvic Binder for any one of the following:
1. Unstable pelvic fracture
2. Hypotension with suspected pelvic fracture
3. Mechanism consistent with possible injury + hemorrhagic shock with no other source of hemorrhage

Airway Management per protocol

Cardiac Monitor/Continuous Pulse Oximetry/EtCO2

Obtain two large bore IV Access. If IV unobtainable use IO (unaffected extremity)

Manage hypotension 20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg (reassess lung sounds). Permissive Hypotension for penetrating trauma.

**Abdominal Trauma**

**Penetrating Trauma**: Stabilize impaled object. Control bleeding around object with manual direct pressure.

**Evisceration**: Do not attempt to replace or move the protruding tissue. Cover it with a moist sterile dressing then with a dry sterile dressing.

**Hip/Pelvic Fracture Suspected**

Pain control: 1 mcg/kg of fentanyl (max 100 mcg/dose). May repeat in 5 min if needed. Hold if hypotensive for age

Pelvic Binder for any one of the following:
1. Unstable pelvic fracture
2. Hypotension with suspected pelvic fracture
3. Mechanism consistent with possible injury + hemorrhagic shock with no other source of hemorrhage

**Confirmed Pregnancy > 20 weeks?**

Administer supplemental Oxygen *(regardless of O2 sat)*

Treat & Transport in left lateral decubitus or manually shift & displace uterus to the left *(maintain spinal immobilization if indicated)*

Transport to State Approved Trauma Center to avoid delay in definitive care

PEARLS

- In **penetrating trauma (only)**, give only enough fluids to maintain a BP high enough for adequate perfusion (no more than 1 L NS in adults). This concept of ´permissive hypotensionµ is specific to penetrating trauma and is practiced to prevent coagulopathy during initial fluid resuscitation.
- Supine Hypotension usually occurs in the third trimester and is a result of the gravid uterus compressing the inferior vena c ava. A simple position change can improve blood flow. Use 4-6 inches of padding under the patient·s right side to maintain normal anatomical alignment if spinal immobilization is indicated. This can be achieved by placing padding underneath the spine board.
- Maintain a high index of suspicion for intra-abdominal injury for patients with abdominal abrasions. These are also considered seatbelt signs and meet local alert criteria.
- Pregnant patients >20 weeks involved in an MVC greater than 35mph (even without complaint) meets local alert criteria.

# Bites and Envenomations

Table of Contents



Signs/Symptoms consistent with a bite or envenomation?

- Irrigate/cleanse wound with Normal Saline
- Remove stinger if wasp or bee (if easily removable)
- Mark initial erythematous and/or edematous margins with pen and include time
- Immobilize the affected part
- Remove jewelry of affected extremity
- If possible bring photo of what caused the bite to assist with identification

Manage airway if signs of airway obstruction develop

Manage hypotension 20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg (reassess lung sounds)

- Utilize HandTevy for Vasopressor dosing

or

- Epinephrine Spritzer 1mL q2 min. max 10mL

Treat pain and severe muscle spasms

- For pain (>1 y/o) mcg/kg Fentanyl max of 100 mcg slow IV/IO push, hold if hypotensive for age (may repeat once; cumulative max 200 mcg)
- For muscle spasms (>1 y/o): 0.1 mcg/kg IN/IV/IO Versed (max 2.5mg). Hold if hypotensive for age, head trauma, or respiratory compromise

Transport snake envenomations to a State Approved Trauma Center

PEARLS

- Local signs/symptoms- pain and swelling, numbness, tingling, vomiting, cramps, bruising
- Systemic signs/symptoms- metallic taste, hypotension, altered mental status, widespread bleeding, shock
- Initial appearance of the bite may be deceiving as to the severity of the envenomation
- Do not utilize ice or tourniquets to the affected limb
- Remember that snakes can still cause envenomations after death; avoid touching
- Dog/cat bites- significant rabies risk and can progress to infection rapidly
- Spider bites- Black Widow can progress to muscular pain and severe abdominal pain; Brown Recluse - can progress to tissue necrosis over the next few days.
- Push Dose Epinephrine in Pediatrics ´ Epinephrine Spritzerµ is not the same dosing as Adults, since it is weight based. Example: take the Pediatric cardiac arrest dose up to 1ml (0.01mg/kg of the 1:10,000 Epi) and dilute in 9ml NS syringe. Administer 1 ml q 2minute= 0.5mcg/kg/min Epinephrine.

# Burn Injuries

Table of Contents

Burn Injury

**Burn Center Criteria:**
- Partial Thickness (2nd Degree) burns greater then 10% TBSA
- Any Full Thickness (3rd Degree) Burn
- Burns that involve the face, hands, feet, genitalia, perineum, or major joints
- Electrical burns and lightning injuries
- Chemical burns
- Suspicion/Signs of inhalation injury

Stop Burning Process, Remove Clothing, Removing jewelry and constrictive items

**Pain Management:**
- (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise
- Use with caution in inhalation injuries

## Electrical Burns

- Turn off electrical source
- Assess for wounds and neurovascular status
- Obtain 12-lead ECG and place on continuous cardiac monitoring
- Spinal immobilization if high voltage electrical injuries (>1000 Volts, excluding Taser) or lightning injury

## Thermal Burns

- Remove or cool heat source (do not attempt to remove clothes stuck on with tar)
- All wounds to be covered in dry sterile dressing.

  Partial thickness (2nd degree) burns >10% TBSA, full thickness (3rd degree) burns, and electrical/chemical burns also require a dry, sterile burn sheet
- Assess for Signs of Inhalation Injury & manage difficult airway if indicated*

***Signs of Inhalation Injury:**
- Stridor
- Soot or debris in airway or around nostrils
- Burned nasal hairs
- Facial burns

- Consider CO or Cyanide Toxicity and consult appropriate protocols

**Fluid Management**
- Less then 5 years at 125mL per hour
- 5-15 years at 250mL per hour for the first two hours
- >16 years 1L of IV Fluid bolus

## Chemical Burns

- Remove all clothing and place in a biohazard bag

**Stop the Burning Process:**
- If a caustic liquid is involved, flush with copious amounts of water
- If a dry chemical is involved, brush it off, then flush with copious amounts of water
- Do not use water for elemental metals (sodium, potassium, lithium) and phenol: Remove obvious metallic fragments from skin and cover the burn with mineral oil or cooking oil. As a last resort use extremely large amounts of soap and water with continuous irrigation until all phenols are removed
- For chemical burns to the eye immediately and continuously flush the eye with normal saline throughout treatment and transport
- Cover all wounds with dry, sterile burn dressing

**For inhaled toxins with wheezing:**
- Albuterol (Proventil) 2.5 mg/3 ml and Ipratropium Bromide 0.02% (Atrovent) 0.5mg/2.5 ml via nebulizer (Max 3 Doses)

**If wheezing persists after albuterol/atrovent or feeling of burning in the airway:**
- Sodium Bicarbonate (4.2%) 5 ml via nebulizer

Transport to closest appropriate facility. If patient meets Burn Center criteria then transport to Burn Center

# Burn Injuries

Table of Contents



**Protocol:**
Stop Burning Process, Remove clothing, jewelry, constrictive items

Thermal Burns:
- Remove or cool heat source (do not attempt to remove clothes stuck with tar)
- All wounds to be covered in dry sterile dressing. Partial thickness (2nd degree) burns >10% TBSA, full thickness (3rd degree) burns, and electrical/ chemical burns require a dry, sterile burn sheet
- Assess for signs of inhalation injury (stridor, soot/debris in airway, facial burns, burned nasal hairs)
- See Pediatric fluid and pain management section below**
- Consider CO and Cyanide Toxicity (see protocol)
- Consider Cyanokit for serious smoke inhalation victims (altered, hypotension, respiratory failure, dysrhythmias)

Electrical Burns:
- Turn off electrical source
- Assess for wounds and neurovascular status
- Obtain 12-lead ECG and place on continuous cardiac monitoring
- Spinal immobilization if high voltage electrical injuries (>1000 Volts, excluding Taser) or lightning injury

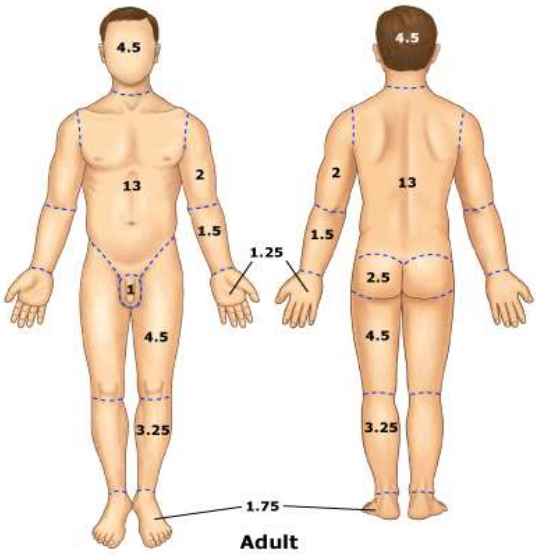
Chemical Burns:
- Remove all clothing and place in a biohazard bag
- If a caustic liquid is involved, flush with copious amounts of water
- If a dry chemical is involved, brush it off, then flush with copious amounts of water
- Do not use water for elemental metals (sodium, potassium, lithium) and phenol: Remove obvious metallic fragments from skin and cover the burn with mineral oil or cooking oil. As a last resort use extremely large amounts of soap and water with continuous irrigation until all phenols are removed
- For chemical burns to the eye immediately and continuously flush the eye with normal saline throughout treatment and transport
- Cover all wounds with dry, sterile burn dressing
- For inhaled toxins with wheezing: Albuterol (Proventil) 2.5 mg/3 ml and Ipratropium Bromide 0.02% (Atrovent) 0.5mg/2.5 ml via nebulizer (Max 3 Doses)
- If wheezing persist after albuterol/atrovent or feeling of burning in the airway: Sodium Bicarbonate (4.2%) 5 ml via nebulizer

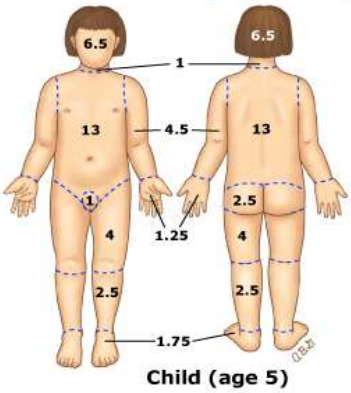
**~~Transport to closest appropriate facility. If patient meets Burn Center criteria then transport to Burn Center~~**

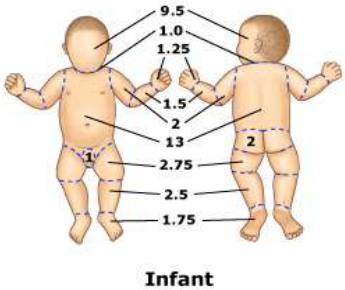
**Burn Center Criteria:**
- Partial Thickness (2nd Degree) burns greater then 10% TBSA
- Full Thickness (3rd Degree) Burn
- Burns that involve the face, hands, feet, genitalia, perineum, or major joints
- Electrical burns and lightning injuries
- Chemical burns
- Suspicion/Signs of inhalation injury

**Pain Management:**
- (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise
- Use with caution in inhalation injuries

**Pediatric Burn Fluid Rates**
Burns exceeding 10% (2nd or 3rd degree) BSA, begin fluid resuscitation with IV 0.9% NaCl or LR:
- Less then 5 years at 150mL per hour
- 5-15 years at 250mL per hour for the first two hours
- 16 years and older 1L of IV Fluid bolus



# Chest Trauma

Table of Contents

Mechanism or Signs/Symptoms consistent with Chest Trauma

Full Trauma ALS Assessment & Treatment

Seal any open chest wounds by taping 3 sides with an occlusive dressing or commercially approved device

Remove temporarily to vent air if respiratory status worsens

Stabilize any impaled objects

Needle Decompression only for Tension Pneumothorax

Tension Pneumothorax
Absent, unilateral breath sounds and SBP <50 with
Altered Mental Status
**Barcode sign/lack of lung sliding on Ultrasound*

Assess breath sounds frequently

Continuous cardiac monitoring to observe for signs of cardiac contusion

Observe for signs of impending respiratory failure

- Hypoxia (O2 sat <90) not improved by 100% O2
- Poor ventilatory effort, monitor ETCO2
- Altered or decreased level of conscious
- Inability to maintain a patent airway

Pain Management: (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise

Transport to closest appropriate facility

PEARLS

- Ddx: rib fractures, pneumothorax, pulmonary contusion, cardiac contusion, arrhythmias, cardiac tamponade, aortic transection, sternal and clavicular fractures

# Crush Injury/Syndrome

Table of Contents



***Large Muscle Group*:**
- Lower extremity including the thigh(s) and/or pelvic girdle
- Upper extremity including the pectoral girdle

Isolated extremity injury pattern consistent with crush injury

Full Trauma ALS Assessment & Treatment

Control hemorrhage with direct pressure, hemostatic agent, tourniquet

Airway Management per protocol

Cardiac Monitor/Continuous Pulse Oximetry/EtCO2/12-Lead ECG

Obtain two large bore IV Access **prior to extrication**. If IV unobtainable use IO (unaffected extremity)

If unable to obtain IV/IO access prior to extrication consider tourniquet application PRIOR to extrication if concern for crush syndrome (hypotension, entrapment >1 hour with large muscle group) regardless of hemorrhage control. Tourniquet must completely occlude venous and arterial flow. After extrication immediately establish vascular access, remove tourniquet and be prepared to treat crush syndrome

Patient **still** entrapped with large muscle group*

20cc/kg regardless of BP prior to extrication if feasible. Administer additional boluses 10cc/kg for Peds to maintain BP appropriate for Peds. Total max of 40ml/kg (assess lung sounds)

Entrapment >1 hour

Sodium Bicarbonate 1 mEq/kg slow IV/IO push (max 50mEq)

Signs of Hyperkalemia**

Albuterol (Proventil) 2.5 mg/3 ml (can repeat x 3)
Sodium bicarbonate 1 mEq/kg IV/IO (max 50mEq) (if not already given)
Calcium Chloride 20mg/kg IV/IO (1g max) over 2-3 minutes

****Signs of Hyperkalemia****
- Peaked T-Waves on ECG
- Absent p Waves
- Widened QRS
- Hypotension (SBP <90)

Pain Control

(>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise

Transport to closest appropriate facility

# Crush Injury/Syndrome

Table of Contents



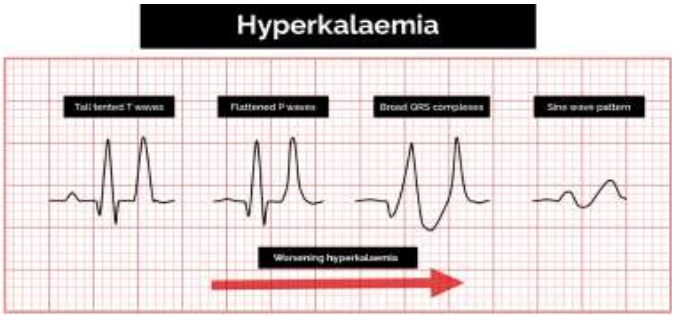
- Secure airway/Spinal immobilization if indicated
- Supplemental 100% oxygen if any respiratory symptoms or 02 <94% or signs of shock
- Control active bleeding with direct pressure, hemostatic gauze packing and/or tourniquet, as indicated
- Assess Disability – neurologic status/record Glasgow coma score
- Head to toe examination to assess for injuries
- Apply physical restraints if needed to ensure patient/crew safety
- Prevent loss of body heat
- Advanced airway/ventilatory management as needed
- Perform cardiac monitoring
- Record & monitor continuous 02 saturation and end-tidal capnography
- Fentanyl (Sublimaze) (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise
- Obtain 2 large bore IV·s. Obtain IO if unable to obtain IV Access
- If patient still entrapped with large muscle group involvement begin rapid administration of 20cc/kg regardless of BP prior to extrication. May administer two additional boluses (max 60cc/kg) to maintain age appropriate BP. Reassess lung sounds for fluid overload after every bolus.
- If entrapment time is greater the 1 hour administer sodium bicarbonate 1 mEq/Kg IV/IO (max 50 mEq)
- Perform diagnostic 12 lead
- Treat signs of hyperkalemia: Hypotension, EKG with Peaked T waves, absent p waves, or widened QRS
- Albuterol (Proventil) 2.5 mg/3 ml (may repeat x 3 if signs still persist)
- Sodium bicarbonate 1 mEq/kg IV/IO (max 50mEq), if not given before.
- Calcium chloride: 20mg/kg IV/IO with a max of 1g
- Administer TXA and/or Ceftriaxone when indicated

- ***If unable to obtain IV/IO access prior to extrication consider tourniquet application PRIOR to extrication if concern for crush syndrome (hypotension, entrapment >1 hour with large muscle group) regardless of hemorrhage control. Tourniquet must completely occlude venous and arterial flow. After extrication immediately establish vascular access and be prepared to treat crush syndrome.***

- **CONTACT MEDICAL CONTROL FOR ADDITIONAL ORDERS IF NEEDED**

***Large Muscle Group*:**
- Lower extremity including the thigh(s) and/or pelvic girdle
- Upper extremity including the pectoral girdle

**Signs of Hyperkalemia**
- Peaked T-Waves on ECG
- Absent p Waves
- Widened QRS
- Hypotension (SBP <90)




**Pearls:**
Crush syndrome is a systemic illness characterized by dysrhythmias and shock that results from the release of toxins and electrolytes into the blood stream by crushed muscles. Crush syndrome typically manifests after 1-4 hours of crush injury. Treatment should be started prior to release of compression to combat hypovolemia and to dilute cellular toxins.

Hyperkalemia medications: Calcium Chlorida, Sodium Bicarbonate, Albuterol should be administered 5 min prior to extrication. These medicines will work for 30 min. If prolonged transport contact medical control for redosing.

# Extremity Trauma

Table of Contents

Extremity Trauma Noted

Remove/Cut Clothes

**Uncontrollable Hemorrhage**

Apply direct pressure/Hemostatic Gauze for active bleeding

If arterial bleed suspected, apply Tourniquet if bleeding is in an area where a tourniquet Is feasible. If not, aggressively pack the wound with hemostatic gauze
*If fracture suspected go to fracture section

**Possible Fracture or Deformity**

If no pulse is present, Attempt to place injury in anatomic position and reassess pulse

Immobilize Extremity

****Fracture Meets Definition of Open?**

Definition of Open Fracture: A suspected fracture with associated extensive soft tissue damage, suspected fracture with wounds with visible contamination, and/or a fracture with visible bone or tendon. This includes amputation.

If fracture is open administer 2g of Ceftriaxone for Peds ≥ 12 y/o or 50mg/kg (2g max) for Peds < 12 y/o reconstituted in 50-100ml NS given over 15-30 min

Contraindications include known penicillin or cephalosporin allergy

Pain Management: (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise

Transport to Closest Appropriate Facility

# Extremity Trauma

Table of Contents



**EMT:**

- Remove or cut away clothing to expose area of injury
- Control active bleeding with direct pressure, hemostatic gauze packing and/or tourniquet, as indicated. For uncontrollable hemorrhage apply tourniquet
- Check distal pulses, capillary refill, sensation/movement prior to splinting
- If pulse present, splint in position found if possible. If pulse absent, attempt to place the injury into anatomical position and reassess pulses
- Open wounds/fractures should be covered with sterile dressings and immobilized in the presenting position
- Dislocations should be immobilized to prevent any further movement of the joint
- Check distal pulses, capillary refill, and sensation after splinting

**Paramedic:**

For isolated extremity trauma pain :

- **Peds** (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise
- Peds- 50mg/kg (2g max) reconstituted in 50-100ml NS given over 15-30 min**

**Amputations (EMT/Paramedic):**

For incomplete amputations

- Attempt to stabilize with bulky pressure dressing
- Splint inline

For complete amputations

- Cleanse amputated part with sterile saline
- Wrap in sterile dressing soaked in sterile saline
- Place in plastic bag if possible
- Attempt to cool with cool pack (outside the plastic bag) during transport

**Tourniquet Application (EMT/Paramedic):**

For uncontrollable hemorrhage

- Apply tourniquet device 4-6 inches proximal to bleeding site
- Tourniquet must be at least 1 1/2 inches wide
- Do not apply over a joint
- Tighten tourniquet until bright red bleeding has stopped
- Document time of placement on the tourniquet or the patient
- Secure in place and expedite transport to SATC (State Approved Trauma Center)
- Notify receiving center of presence and location of tourniquet
- If the wound is located in an area where use of tourniquet is not feasible (groin, axilla), aggressively pack the wound with hemostatic gauze until the bleeding stops
- For limbs that remain entrapped despite all other extrication attempts contact Medical Control to arrange for on-scene medical direction.

****Ceftriaxone for Open Fractures (Paramedic)**

Definition of Open Fracture: A suspected fracture with associated extensive soft tissue damage, wounds with visible contamination, and/or visible bone or tendon. This includes amputation.

For patients ≥12 years old - 2g of ceftriaxone should be reconstituted in 50-100 ml of NS or D5W and given over a 15-30 min. For patients <12 years old- 50mg/kg of Ceftriaxone reconstituted in 50-100ml of NS of D5W given over 15-30 min.. Bag must be labeled and receiving facility notified.

Contraindications include known penicillin or cephalosporin allergy. This includes allergies to the following antibiotics: penicillin, amoxicillin, Augmentin, piperacillin-tazobactam (Zosyn), ampicillin-sulbactam (Unasyn), cephalexin (Keflex), cefazolin (Ancef), ceftriaxone (Rocephin), cefepime (Maxipime), ceftazidime, cefpodoxime, cefdinir (Omnicef), cefuroxime (Cefitin or Zinacef)

# Eye Trauma

Mechanism or Signs/Symptoms consistent with eye trauma

- Full Trauma ALS Assessment & Treatment
- Stabilize any penetrating objects
- Do not remove any impaled objects
- Protective metal shield unless impaled object precludes
- Do not palpate the globe or apply pressure to the eye. Do not pad the eye with a penetrating injury
- Prevent patient from bending or straining
- If blood observed in anterior chamber, transport with HOB elevated at 60 degrees unless spinal immobilization indicated

6 months to 4 years old give 2 mg IV; ≥4 years old give 4 mg IV

(>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise

Chemical irritants & burns

Continuously flush the eye with Normal Saline throughout treatment and transport
*Continuous irrigation can be facilitated by connecting a nasal cannula to a saline bag and placing the prongs in the corner of the eyes*



PEARLS

- Vision loss, proptosis, and high ocular pressure in the setting of trauma may necessitate time sensitive procedures. Arrange for immediate transport after addressing life-threatening injuries.
- Vomiting can increase the ocular pressure. For this reason, antiemetics are beneficial in penetrating eye trauma.
- Sudden painless vision loss alone can be a sign of a retinal artery occlusion, stroke or other embolic event. Transport to a Comprehensive Stroke Center.

# Head Injury

Table of Contents

Full ALS Trauma Assessment

Apply C-collar
Consult: Spinal Motion Restriction Protocol

**Proactively** Avoid Hypotension, Hypoxia, & Hypocapnia/Hypercapnia

**Hypocapnia or Hypercapnia**

Maintain ETCO2 35mm Hg to 40 mm Hg

**Hypoxia**

Provide Supplemental O2 to maintain O2>94%

Utilize airway adjuncts as needed (NPA/OPA)

BVM with good technique to avoid aspiration (2 person technique)

Advanced airway placement (Supraglottic or ETI) for Refractory Hypoxia (<90%)

**Hypotension**

20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg

Utilize HandTevy for Epinephrine dosing

**BVM is an acceptable end point of Pediatric Airway management**
If advanced airway placement (Supraglottic or ETI) considered due to GCS < 8 or at risk for inadequate airway protection adhere to the following:

- Preoxygenation procedure
- 1 intubation attempt (video preferred)
- Ketamine 1mg/kg IV/IO (max 50mg)

**Peds**: Moderate & Severe TBI

GCS<8 and active airway management PLUS any of the following:

- Unilateral fixed or dilated pupil
- Unilateral paralysis
- Posturing
- Seizure after injury
- Skull deformity

**Acute Signs of Herniation**

3% Saline bolus at 5ml/kg (max of 250ml) IV/IO slow push and Keppra 20mg/kg (max 1g) IV/IO (may repeat once at 40mg/kg if seizure continues (max 60 mg/kg)

Elevate stretcher to 30 degrees (maintaining spinal precautions w/ reverse trendelenburg)

Temporarily increase ventilations with an ETCO2 goal of 30-35 mm Hg

PEARLS

- Airway interventions can be detrimental in patients with head injury by raising intracranial pressure, worsening hypoxia and increasing risk of aspiration. Whenever possible, manage with the least invasive maneuver to maintain O2 saturation > 94%.
- Studies show worse outcomes with even just one drop in blood pressure or O2 saturation below 90% for head injured patients. Pre-emptively apply supplemental O2, maintain normothermia, eucapnia, and an appropriate systolic blood pressure for age
- Moderate & Severe TBI Protocol is for Pediatrics only. **Treat active seizures with Versed first then administer Keppra. Keppra is used for both prevention and treatment of seizures.**
- take the Pediatric cardiac arrest dose up to 1ml (0.01mg/kg of the 1:10,000 Epi) and dilute in 9ml NS syringe. Administer 1 ml q 2minute= 0.5mcg/kg/min Epinephrine.
- DDx: Subdural Hemorrhage, Subarachnoid Hemorrhage, Epidural Hemorrhage, Ischemic Stroke, Skull Fracture, Spinal Injury, Intoxication, Non-accidental Trauma, Concussion, Contusion

# Hemorrhagic Shock

Table of Contents

## Signs of Hemorrhagic Shock

*e.g diaphoretic, cool extremities, pale, altered mental status, delayed capillary refill*
*Shock Index (for 6 years & older) > 1, Pediatric Adjusted Shock Index (for 4-6 years) >1.2*

**Age Specific BP indicating possible shock:**
0-28 days: SBP < 60
>1 month: SBP <70
1-9: SBP < 70 = (2 x Age in years)
>10: SBP < 90

Shock Index measures the severity of hypovolemic shock and is useful in detecting cardiovascular changes before hypotension occurs. It is calculated by dividing the patient·s heart rate by their systolic Blood Pressure. A Shock Index of >1.0 has been associated with poorer outcomes.

## Control Major Bleeding

2 Large Bore IV·s or 1 Tibial IO + 1 Large Bore IV

> 5 y/o: TXA 15mg/kg (1g max) in 100ml NS over 10 minutes IV/IO
If Injury occurred less than 3 hours, signs of hemorrhagic shoc, and no isolated head trauma

## Blunt Trauma

Maintain BP systolic appropriate for age

20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg
*Reassess Lung Sounds after each bolus*

Pelvic Binder for any one of the following:
1. Unstable pelvic fracture
2. Hypotension with suspected pelvic fracture
3. Mechanism consistent with possible injury + hemorrhagic shock with no other source of hemorrhage

## Penetrating Trauma

Permissive Hypotension:
Maintain SBP at lower end of range based on age

20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg
*Reassess Lung Sounds after each bolus*

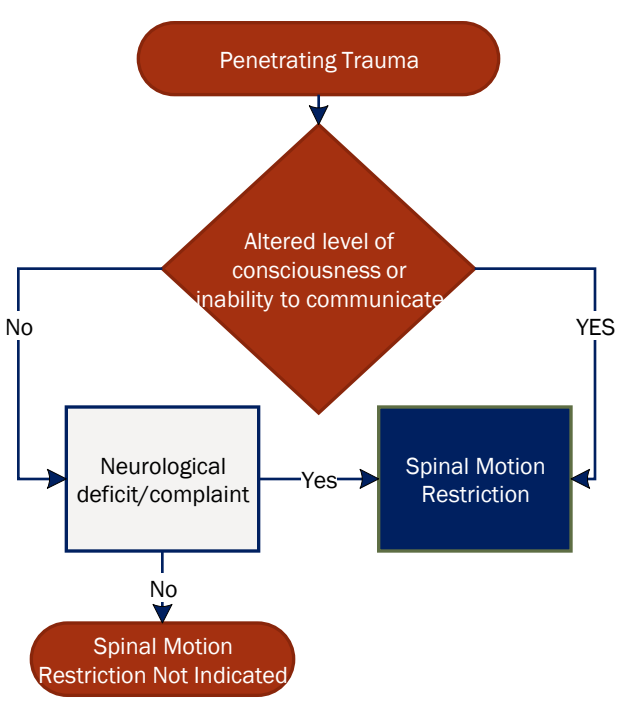
PEARLS

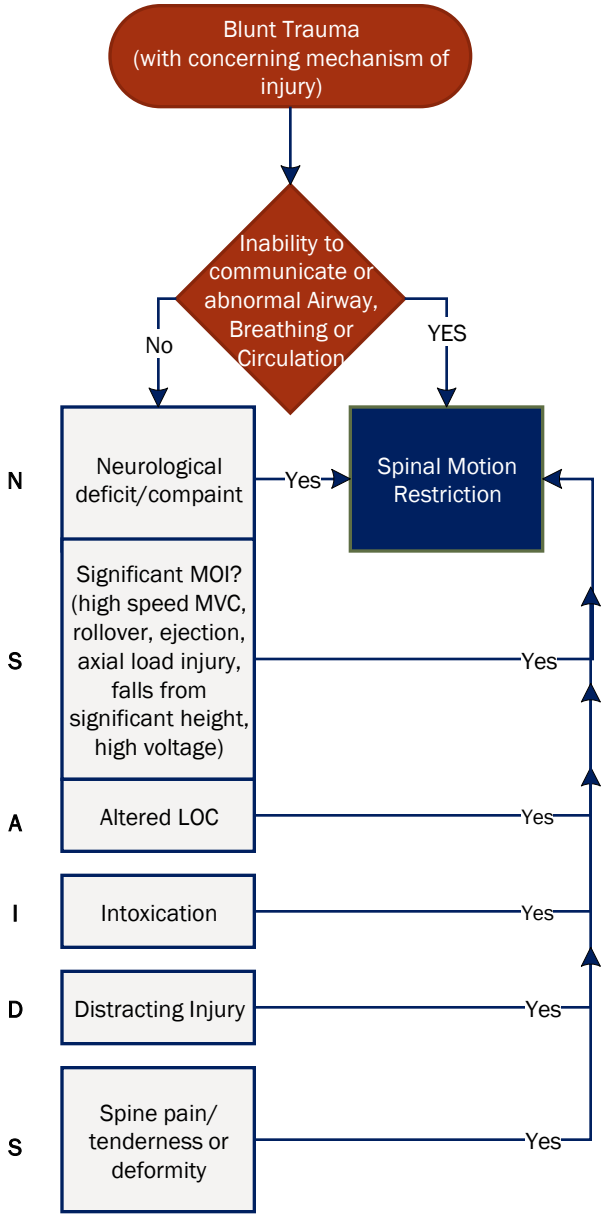
- In **penetrating** trauma, give only enough fluids to maintain a BP high enough for adequate perfusion (no more than 1 L NS in adults). This concept of ´permissive hypotensionµ is specific to penetrating trauma and is practiced to prevent coagulopathy during initial fluid resuscitation.
- If a Traumatic Brain Injury (TBI) is also suspected do not follow permissive hypotension. A single drop in blood pressure for head trauma patients significantly increases the mortality. Consult the Head Trauma Protocol.

# Spinal Motion Restriction

Table of Contents

Spinal motion restriction (SMR) should be utilized in all traumatic patients where there is a mechanism for spinal injury. It is defined as cervical collar + securing flat to the stretcher using all straps & upper torso harness + maintaining in-line stabilization during transfers. SMR is separate from backboard use. The following protocol informs the use of spinal motion restriction.




If SMR is indicated but refused by the patient:

- Advise the patient of the indication and the risks of refusing the intervention
- Clearly document refusal of SMR & maintain neutral position as best as possible
- If patient allows, apply the cervical collar

Helmets in Athletics:

- If the helmet fits properly, there isn't a need to remove. Simply remove the facemask for airway access.
- If shoulder pads are in place, the helmet must remain on. Apply Long Spine Board to maintain alignment.
- If the helmet is removed, the shoulder pads must be removed as well.

PEARLS

- The Acronym ´NSAIDSµ should be used to remember the steps in the algorithm.
- Spinal Motion Restriction does not always require the use of a long spine board for immobilization. However, the use of a Long Spine Board or equivalent device for extrication is helpful in minimizing spinal movements. A Long Spine Board is required in patients with altered mental status or hemodynamic instability.
- Use of a Long Spine Board is not required if the patient is ambulatory on scene and does not demonstrate an altered level of consciousness. However, maintain Spinal Motion Restriction if indicated by protocol.
- Long Spine Board immobilization is not necessary in penetrating trauma without signs/symptoms of spinal injury.
- If the patient is found in a position which inhibits SMR, maintain this alignment and transport.
- Neurological deficits/complaints- test motor function & sensation in both upper & lower extremities (entire extremity), ask about numbness or tingling in the extremities
- Altered or inability to communicate- includes dementia, speech or hearing impairment, language barrier and age (young children).
- A high level of suspicion should be taken with all patients with blunt head trauma. Maintain a low threshold to place a c-collar.

# Taser

Table of Contents

Taser Device Deployed

Consult any protocol that applies to underlying conditions (i.e. Behavioral Emergencies)

| |
|---|
| Full Trauma ALS Assessment & Treatment when condition warrants |
| Turn patient supine if found in a prone position |
| Secure the Taser prongs in place if not removed by Law Enforcement |
| Do not remove the prongs if lodged in a patient and left in place by Law Enforcement unless the location prohibits a life saving procedure |
| Continuous vital sign monitoring if the patient requires chemical or physical restraints |
| Obtain EKG if complaints of chest pain, palpitations, shortness of breath, lightheadedness,or dizziness |

Patient transport in the prone position is contraindicated

Transport to closest appropriate facility



PEARLS

- All patients who have been struck by Tasers will be transported to an emergency department for evaluation. A patient may refuse treatment if they meet guidelines for refusal of care (i.e. capacity). Law enforcement may not offer a refusal on the patient's behalf.
- All patients in police custody retain the right to participate in decision making regarding their care.
- Ddx: Spinal injuries and cardiac dysrhythmias

# Trauma Alert Criteria

Table of Contents

GCS ≤ 13
*(GCS is a stand-alone criteria, even if color coded criteria not met)*

→ Activate Trauma Alert

**Red Criteria**

- Jaw thrust, continuous suctioning, assisted ventilation or intubated
- Altered mental status (includes drowsiness)
- Paralysis or Loss of Sensation
- Suspected spinal cord injury
- Faint or non-palpable carotid or femoral pulse
- SBP<50
- Open long bone fracture
- Major degloving or flap avulsion
- 2nd or 3rd degree burns >20% TBSA
- Amputation proximal to wrist or ankle
- Penetrating injury to the head, neck, torso

Any 1 of the criteria → Activate Trauma Alert

**Blue Criteria**

- Weight ≤ 11 kg or Length ≤ 33 in.
- Amnesia or Loss of consciousness
- Non-palpable radial or pedal pulses
- SBP<90
- Single closed long bone fracture (excluding ankle/wrist)

Any 2 of the criteria → Activate Trauma Alert

**Local Criteria**

- High Voltage >1000 volts
- Tourniquet in place

Any 1 of the criteria → Activate Trauma Alert

**Trauma Gray** (incorporates CDC/ACS criteria)

- Any age on anticoagulants or with cirrhosis or bleeding disorder with external manifestation of chest or abdominal trauma
- *MCC rider separated from vehicle with significant impact
- Pedestrian/Bicyclist thrown, crushed, run over with significant impact and without complaints
- Concerns for intoxication/impairment in the setting of significant trauma

→ Transport to State Approved Trauma Center to avoid delay in definitive care *(does not require alert activation)*

**Pediatric Trauma Emergencies**

PEARLS

- **Consult Medical Control** if patient meets trauma alert criteria but requests an alternate destination despite paramedic·s best efforts to provide education and explain the risks
- While efforts are made to include many of the local criteria, please note, patients may be upgraded according to the trauma center·s internal protocols. (additional **local adult trauma alert examples**: MCC or ATV>20mph or unhelmeted, blast explosion, MVC with death in same compartment, >55mph roll-over or head-on collision, MVC with >12 in intrusion in occupant compartment or >18" other site, flail chest, unstable pelvic fracture, and several of the blue criteria & gray criteria marked with an *)
- When feasible try to keep parents with children. For example transport the parent(s) to Orlando Health if the child requires Arnold Palmer level of care

# Trauma Transportation

Table of Contents



## Destination

- Meets any 1 red criteria
- Meets any 2 blue criteria alone
- Meets any 1 local criteria
- Meets Trauma Gray criteria
- Meets any 1 blue criteria with a high risk mechanism
- Multisystem injury
- Pelvic or Femur Fracture
- Complex hand or wrist fractures
- Chest wall instability
- Blunt abdominal injury (seatbelt sign or firm or distended abdomen)
- Death in the same vehicle
- Any crash > 35mph with pregnancy
- Fall from 10 foot height or more
- Ejected from vehicle
- Pedestrian/Bicyclist thrown, crushed, run over, or with significant impact (with complaints)
- Paramedic Judgement

**Pediatrics**
(15 years 364 days and younger)

→ Transport to State Approved **Pediatric** Trauma Center

Trauma Alert patients may be transported to the nearest emergency department when the following conditions exist:

- Cardiac arrest following trauma
- Unmanageable airway emergency
- Logistical failures that make transport to a SATC impossible

→ Closest emergency department

## Notification

When patients meet Trauma Alert Criteria, notify receiving center of a "Trauma Alert" (use this term to avoid any confusion)

Although there is no formal criteria, the verbiage "Trauma Red, Yellow, and Green" may be utilized to help distinguish "Alert" patients from all others.

## Mode

The route (air or ground) that enables the patient to arrive at the trauma center in the shortest time shall be used for Trauma Alert patients

When considering air transport, remember to account for transfer times. Ground transport should be utilized for Trauma Alert patients when transport times are under 20 minutes to a SATC

Cardiac arrest is a contraindication to initiating helicopter transport (except when it occurs in transition to the helicopter)

**Emergency Interfacility Transport of Trauma Victims**
Patients may occasionally require emergency interfacility transfer from an outlying hospital to a SATC. The decision for an interfacility transport is made by the treating physician at the outlying hospital, typically in coordination with the accepting physician at the SATC.

Notify the medical directors as soon as possible when a request has been made

Sending facility emergency physician should call the **closest Trauma Center** and advise of the **Trauma Alert**. EMS shall notify the receiving trauma center that the unit is enroute and provide an estimated time of arrival.

→ Transport to closest State Approved Trauma Center

If EMS crew members have not received training on, and/or are not capable of managing devices or medications that must be continued during transport, an adequately trained care provider from the transferring facility must accompany the patient during transport

PEARLS

- **Consult Medical Control** if patient meets trauma alert criteria but requests an alternate destination despite paramedic's best efforts to provide education and explain the risks.
- Maintain a high index of suspicion for the following patients: MCC or ATV>20mph or unhelmeted, blast explosion, MVC with death in same compartment, >55mph roll-over or head-on collision, MVC with >12 in" intrusion in occupant compartment or >18" other site, flail chest, unstable pelvic fracture.
- Stable non-trauma alert patients may be transported by ground even when estimated transport times greater than 20 minutes. Patient condition and operational logistics should be taken into consideration.

# Traumatic Cardiac Arrest

Table of Contents

MCI- Utilize START & JumpSTART Triage

Survey scene/MOI/MCI

Patient contact: 10 minute scene time begins

**Assess for "Signs of Life" (any one present or EMS witnessed BEGIN RESUSCITATION)**

- Spontaneous movement
- Pupillary reflexes
- Organized rhythm
- *Cardiac activity on US (as available)

**If none of the "Signs of Life" are present and/or any of the following below are present, confirm pulseless & apnea & do not proceed with resuscitation**

- Diffuse signs of rigor mortis
- Diffuse signs of decomposition of body tissues
- Dependent lividity
- Injuries incompatible with life (e.g incineration, decapitation, hemicorporectomy)

EMS Witnessed Arrest or any signs of life present?

- Uninterrupted Compressions
- Control Major Bleeding
- 3 Lead Monitor & AED
- BVM or Supraglottic & 100% O2
- C Spine immobilization
- Package and Transport
- 2 Large Bore IV's or distal femur (<10 y/o) or humeral (>10 y/o) IO + 1 Large Bore
- Utilize HandTevy for Epinephrine dosing
- 20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg
- Consider TXA 15mg/kg (1g max) in 100ml NS over 10 minutes IV/IO if PEA & loss of pulses after patient contact
- Blunt Trauma: Perform Bilateral Needle Decompression

Further Airway Management if needed

1 intubation attempt (video preferred) if refractory hypoxia despite adjuncts and inability to ventilate. **BVM is an acceptable end point in Pediatric airway management**

PEARLS

- An organized rhythm consists of narrow and regular QRS complexes
- *Resuscitation may be withheld when there is lack of cardiac activity on the US, even in the presence of an organized rhythm
- DDx: Hypovolemic shock, Tension Pneumothorax, Cardiac Tamponade, Unstable Pelvic Fracture, Hemothorax

# General Approach To Trauma

Table of Contents

Survey scene/MOI/MCI

Full ALS Trauma Assessment & Treatment when condition warrants

´Patient exposedµ apply sheets to prevent hypothermia

Consult: Spinal Motion Restriction Protocol

Calculate & document GCS score

MCI- Utilize START & JumpSTART Triage

Transport within 10 minutes of patient contact if Trauma Alert Criteria met

Do not delay transport to perform procedures on scene unless immediately needed to stabilize patient (e.g. airway management, hemorrhage control)

## A

Airway Management as needed (BVM, Supraglottic, ETI)

BVM is an acceptable end point of Pediatric Airway management

| | | |
|---|---|---|
| • Refractory Hypoxia<br>• ETCO2 >45<br>• GCS <8 | Address *HOPs prior to intubation | 1 intubation attempt allowed (video preferred)<br>Ketamine 1mg/kg IV/IO max 50 mg |

## B

Supplemental O2 if TBI, hypotensive, respiratory symptoms, pregnant > 20 weeks or O2 <94%

| | |
|---|---|
| Maintain ETCO2 level 35mm Hg to 45 mm Hg | Needle Decompression for Tension Pneumothorax & Blunt Traumatic Arrest |

## C

Control Active Bleeding

| | | | |
|---|---|---|---|
| Cardiac Monitoring | 2 Large Bore IV·s or IO | TXA 15mg/kg (1g max) in 100ml NS over 10 minutes IV/IO | Pelvic Binder if indicated |
| (>1 y/o) give 1mcg/kg IN/IV fentanyl for pain (max 50mcg). Hold if hypotensive for age, head trauma, or respiratory compromise | **Peds**: 20ml/kg of NS if hypotensive (based on age). May repeat at 10ml/kg bolus to a total max of 40ml/kg<br>**reassess lung sounds* | | |

Pediatric Trauma Emergencies

PEARLS

- **Control active bleeding FIRST**
- ´HOPsµ Killers- Hypotension, Oxygenation (hypoxia), Ph (Acidosis) increase mortality if not corrected prior to intubation.
- A complete head to toe examination is required in all trauma patients to avoid missed injuries
- Avoid Versed for combative patients with trauma as it could decrease the blood pressure. Ketamine and/or Droperidol are the preferred agents
- Permissive Hypotension-maintaining a blood pressure lower than physiologic levels in a patient with hemorrhagic shock. IV fluids are only administered to maintain a BP at the lower end of the Pediatric Systolic range. This practice helps prevent coagulo pathy. This is not to be used for a patient with head trauma or suspected TBI. Hypotension increases mortality in these patients & BP should be in the normotensive range for a Pediatric patient
- Bag Valve Mask (BVM) is an acceptable method of managing the airway
- Utilize appropriate medical protocol if concomitant trauma
- **DMIST format for Trauma Handoffs- D= Demographics M= Mechanism I= Injuries S= Signs T= Treatments**
- DDx: Hypovolemic shock, Tension Pneumothorax, Cardiac Tamponade, Pelvic Fracture, Hemothorax, Head Injury, Extremity Fracture/Dislocation, Spinal Injury, Intra-abdominal bleeding, Pulmonary Contusions

Table of Contents

# Updates & Revisions