

Section 10

SECTION: Pediatric Trauma Emergencies

REVISED: 07/2021

1.	Injury – Abdomen (Abdominal Trauma)	Protocol 10 - 1
2.	Injury – Burns – Thermal	Protocol 10 - 2
3.	Injury – Electrical Injuries	Protocol 10 - 3
4.	Injury – Head	Protocol 10 - 4
5.	Injury – Child Abuse	Protocol 10 - 5
6.	Injury – Traumatic Cardiac Arrest <small>(Added 07/2021)</small>	Protocol 10 - 6

Section

10

Continued

PEDIATRIC TRAUMA EMERGENCIES

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Protocol 10-1

SECTION: Pediatric Trauma Emergencies

PROTOCOL TITLE: Injury – Abdomen
(*Abdominal Trauma*)

REVISED: 06/2017

OVERVIEW:

Blunt and penetrating traumas are major causes of morbidity and mortality in the United States. Pediatric abdominal anatomy differs from adults in several unique ways. There is significantly less protection due to thinner muscle walls and less fat. Ribs protecting the thoracic abdomen have increased flexibility more easily allowing the ribs to injure the abdominal organs. Solid organs within the pediatric abdomen have a larger surface area thus a greater area is exposed for potential injury. The organ attachments are also more elastic, increasing the chances of tearing and shearing injuries. Lastly, the bladder extends to the umbilicus in the pediatric patient, increasing its chance for injury. When performing a focused abdominal assessment, be organized, efficient, and thorough. Initial abdominal examinations only identify injury about 65% of the time; secondary exams are needed when there is a high index of suspicion for abdominal trauma. A proper abdominal examination involves exposing the entire abdomen from the nipple line to the groin and using a standard examination sequence of inspection, auscultation, percussion, and palpation.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> • Time of injury • Mechanism: blunt vs penetrating • Loss of consciousness • Damage to structure, vehicle • Location in structure or vehicle • Speed, details of MVC • Restraints, protective devices • Medical history • Medications • Evidence of multi-system trauma 	<ul style="list-style-type: none"> • Pain, swelling, bleeding • Deformity, lesions • Altered mental status, unconsciousness • Respiratory distress, failure • Hypotension, shock • Arrest • Significant mechanism of injury 	<ul style="list-style-type: none"> • Intra-abdominal bleeding • Pelvis fracture • Abuse

	EMR	EMT	A	I	P
1. Maintain scene and provider safety.	•	•	•	•	•
2. Perform general patient management.	•	•	•	•	•
3. Administer supplemental oxygen to maintain SPO_2 94 - 99%. If need to assist ventilations with BVM, maintain C-spine precautions.	•	•	•	•	•
4. Identify mechanism of injury.	•	•	•	•	•

ABDOMINAL TRAUMA

Protocol 10-1

Continued

ABDOMINAL TRAUMA

	EMR	EMT	A	I	P
5. Establish large bore IV's of normal saline. Titrate to an appropriate systolic blood pressure: a. Birth to 1 month - 60 mmHg b. 1 month to 1 year - > 70 mmHg c. Greater than 1 year - 70 + [2 x Age (years)]			•	•	•
6. Treat pain if indicated. Refer to <u>Pediatric Pain Management protocol</u> .			•	•	•
7. Consider <u>ONDANSETRON (ZOFTRAN)</u> 0.1mg / kg slow IVP over 2 – 5 minutes, max 4.0 mg per dose as needed per <u>Pediatric Nausea and vomiting protocol</u> .			•	•	•
8. Transport to the appropriate hospital per <u>Trauma Triage Scheme</u> and reassess as indicated.		•	•	•	•

Impaled objects

Stabilize impaled objects in place with bulky dressings.

Severe hemorrhage from open penetrating injury

Control bleeding with well-aimed direct pressure directly on the bleeding source. Once controlled apply dry, sterile dressing.

Evisceration with protruding abdominal contents

Loosely wrap any protruding abdominal contents with a sterile dressing moistened with Normal Saline and cover in entirety with an occlusive dressing over top.

PEARLS:

1. The amount of external bleeding is not an indicator of the potential severity of internal bleeding associated with an underlying trauma.
2. Abdominal eviscerations are a surgical emergency. The protruding organ requires careful cleaning and evaluation prior to reinsertion. Do not attempt to reinsert the organs in the pre-hospital setting.
3. Impaled objects in the abdomen often tamponade internal hemorrhage, and removing them may trigger significant internal bleeding. Remember that any bump against the object moves the distal end in the organ and worsens damage.

Protocol 10-2

SECTION: Pediatric Trauma Emergencies

PROTOCOL TITLE: Injury – Burns – Thermal

REVISED: 06/2017

OVERVIEW:

Burns are a devastating form of trauma associated with high mortality rates, lengthy rehabilitation, cosmetic disfigurement, and permanent physical disabilities. Thermal, chemical, electrical, (nuclear) radiation or solar sources may cause burns. Burns can affect more than just the skin. Burns are classified by degree, 1° (superficial) some reddening to skin, 2° (partial thickness) has blistering and deep reddening to the skin, and 3° (full thickness) causes damage to all skin layers and is either charred / black or white / leathery with little or no pain at the site. The patient's palm equals 1% of body surface area when determining the area affected. Scald injuries are more common in younger children while flame injuries are more common in older children and account for the most fatalities. Smoke inhalation is the most common cause of death in the first hour after a burn injury. Children who have burn injuries are at a greater risk than adults for shock and hypothermia because of their proportionately large body surface.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> Type of exposure (heat, gas, chemical) Inhalation injury Time of injury Past medical history Medications Other trauma 	<ul style="list-style-type: none"> Burns, pain, swelling Dizziness Loss of consciousness Hypotension/ shock Airway compromise, distress Singed facial or nasal hair Hoarseness, wheezing 	<ul style="list-style-type: none"> Superficial (1°), red and painful Partial thickness (2°), blistering Full thickness (3°), painless and charred leathery skin Chemical, Thermal, Radiation

	EMR	EMT	A	I	P
1. Stop the burning process:	•	•	•	•	•
a. Thermal burns: Lavage the burned area with sterile water or saline to cool skin. Do not attempt to wipe off semisolids (grease, tar, wax, etc.) Do not apply ice. Dry the body when the burn area is greater than or equal to 10% TBSA to prevent hypothermia.	•	•	•	•	•
b. Dry chemical burns: Brush off dry powder, then lavage with copious amounts of tepid water (sterile, if possible) for 20 minutes. Continue en route to the hospital.	•	•	•	•	•
c. Liquid chemical burns: Lavage the burned area with copious amounts of tepid water (sterile, if possible) for 20 minutes. Continue en route to the hospital.	•	•	•	•	•
2. Support life-threatening problems.	•	•	•	•	•
3. Perform general patient management.	•	•	•	•	•

BURNS

Protocol 10-2

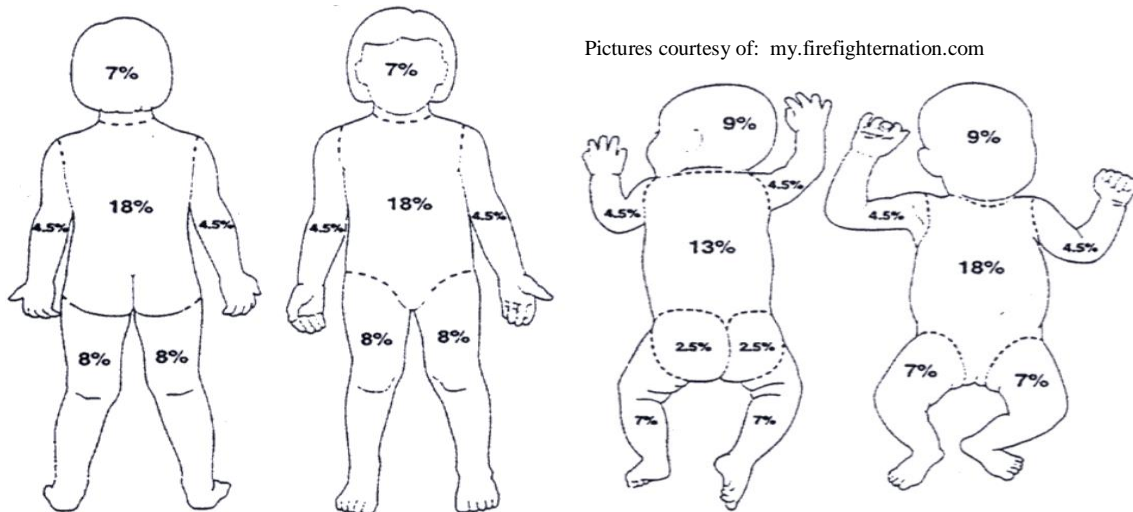
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BURNS

	EMR	EMT	A	I	P
4. Administer oxygen, via non-rebreather mask, at 10 - 15 L / min. as necessary. Use humidified oxygen if suspected inhalation injury and when available.	•	•	•	•	•
5. If the patient is in critical respiratory distress, consider early placement of an advanced airway. <i>*Endotracheal Intubation / cricothyrotomy are reserved as Paramedic only.</i>		•	•	•	•
6. Remove clothing from around burned area, but do not remove/peel off skin or tissue. Remove and secure all jewelry and tight fitting clothing.	•	•	•	•	•
7. Assess the extent of the burn using <u>the rule of nines</u> and the degree of burn severity.	•	•	•	•	•
8. Cover the burned area with a clean, dry dressing. Wet dressing may be used if the burned TBSA is less than 10%.	•	•	•	•	•
9. If a partial or full thickness burn involves more than 20% TBSA, establish an IV of NS or LR (if available). Infuse the fluid amounts listed as below. If the patient develops signs and symptoms of fluid overload respiratory distress (dyspnea, crackles, rhonchi, decreasing SpO ₂), slow the IV to KVO. a. For patients 5 years and younger, start at 125mL/hr. b. For patients 6-13 years, start at 250mL/hr. c. For patients 14 years and older, start rate at 500 mL/hr.			•	•	•
10. For pain control, refer to the <u>Pediatric Pain Management protocol</u> .	•	•	•	•	•
11. Perform ongoing assessment as indicated and transport major burns to Level 1 Burn Center. Transport minor burns to appropriate facility.		•	•	•	•

****Normal Saline or Lactated Ringers are fluids of choice in burn patients****

Excessive fluid resuscitation can lead to compartment syndromes.



PEARLS:

1. Remove patient's clothing as appropriate. Remove rings, bracelets and other constricting items in areas of burn, if possible.
2. Critical burns: burns over $> 25\%$ TBSA, 2° burns $> 10\%$ TBSA, 2° and 3° burns to the face, eyes, hands, or feet, electrical burns, respiratory burns, deep chemical burns, burns with extremes of age or chronic disease, and burns with associated major traumatic injury. These patients should be transported directly to a VCU Pediatric Emergency department, if possible.
3. Have a high index of suspicion and a low intubation threshold when treating burn patients with possible airway involvement. Early intubation is recommended in significant inhalation injuries.
4. Circumferential burns to extremities are dangerous due to potential vascular compromise secondary to soft tissue swelling.
5. Burn patients are prone to hypothermia – never cool burns that involve $> 15\%$ TBSA.
6. Never overlook the possibility of multi-system trauma.
7. Burns are extremely painful. Strongly consider pain management medications as needed.
8. Assess for potential child abuse and follow appropriate reporting mechanism as needed.
9. Keep the child warm and protect from hypothermia. Be cautious with cool dressings.

Protocol

10-2

Continued

BURNS

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Protocol 10-3

SECTION: Pediatric Trauma Emergencies

PROTOCOL TITLE: Injury – Electrical Injuries

REVISED: 06/2017

OVERVIEW:

The vast majority of electrical injuries are caused by generated electricity, such as that encountered in power lines and household outlets. Relative to the external damage caused by electrical injuries, internal damage is often more severe, and can include damage to muscles, blood vessels, organs, and nerves. Damaged muscle releases myoglobin and potassium, which can precipitate in the kidneys and cause acute renal failure.

Electrical current as low as 20 mA can cause respiratory arrest and as little as 50 mA can cause ventricular fibrillation. Although long-bone fractures and spinal injuries can occur due to falls after electrocution, they can additionally occur due to severe tetanic muscle spasms with high amplitude electrocutions. Before treating any patient with an electrical injury, ensure your personal safety. Do not touch the patient, if the patient is still in contact with the electrical source.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> Lightning or electrical exposure Single or multiple victims Trauma secondary to fall from high wire or MVC into line Duration of exposure Voltage and current (AC / DC) 	<ul style="list-style-type: none"> Burns Pain Entry and exit wounds Hypotension and shock Cardiac and / or respiratory arrest 	<ul style="list-style-type: none"> Cardiac arrest Respiratory arrest Seizure Burns Multisystem trauma

	EMR	EMT	A	I	P
1. Perform general patient management.	•	•	•	•	•
2. Support life-threatening problems.	•	•	•	•	•
3. Administer oxygen to maintain <u>SPO₂</u> 94 - 99%. Consider supporting respirations with a BVM.	•	•	•	•	•
4. Determine extent of any burn injuries. Refer to the <u>Pediatric Burns protocol</u> . Avoid initiating IVs in areas of burn unless absolutely necessary.		•	•	•	•
5. Place patient on cardiac monitor; obtain / interpret <u>12 Lead ECG</u> . Refer to the appropriate <u>Pediatric Cardiac Care protocol</u> for dysrhythmias.		•	•	•	•
6. Establish an IV of normal saline to titrate an appropriate BP: <ul style="list-style-type: none"> a. Birth to 1 month - > 60 mmHg b. 1 month to 1 year - > 70 mmHg c. Greater than 1 year - 70 + [2 x Age (years)] 			•	•	•

ELECTRICAL INJURIES

Protocol 10-3

Continued

ELECTRICAL INJURIES

	EMR	EMT	A	I	P
7. Consider administration of pain management per <i>Pediatric Pain Management protocol</i> .			•	•	•
8. Transport to an appropriate facility and perform ongoing assessment as indicated.		•	•	•	•

PEARLS:

1. Ventricular fibrillation and asystole are the common presenting dysrhythmias associated with electrical injuries.
2. Injuries are often hidden. The most severe injuries will occur internally in the muscles, vessels, organs, and nerves.
3. Do not overlook other trauma (i.e., falls).
4. Lightning is a massive DC shock most often leading to asystole as a dysrhythmia.
5. In lightning injuries, most of the current will travel over the body surface producing flash burns over the body that appears as freckles.

Protocol 10-4

SECTION: Pediatric Trauma Emergencies

PROTOCOL TITLE: Injury – Head Injury

REVISED: 06/2017

OVERVIEW:

Brain injury and its accompanying pathologic processes continue to be the leading cause of mortality associated with trauma. Whether the injury is due to a blunt or penetrating mechanism, bleeding or swelling of the brain and surrounding tissue may lead to an increase in pressure within the cranial cavity, otherwise known as intracranial pressure, (ICP). If pressure within the skull is not controlled, neurologic changes may produce signs and symptoms ranging from headache to coma with loss of protective reflexes. Blunt force trauma may result in scalp injury, skull fracture, and meningeal and brain tissue injury. Penetrating trauma may produce focal or diffuse injury, depending on the velocity of the penetrating object. Although the pre-hospital provider cannot reverse the brain tissue damage from the initial / primary brain injury that has already occurred, they can play a major role in preventing or limiting the processes that exacerbate and lead to a secondary brain injury. The pre-hospital provider's goal is to focus on reversing any hypoxia, hypotension, hypercarbia, acidosis, or increasing intracranial pressure.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> • Time of injury • Mechanism: blunt vs penetrating • Loss of consciousness • Bleeding • Past medical history • Medications • Evidence of multi-system trauma 	<ul style="list-style-type: none"> • Pain, swelling, bleeding • Altered mental status, unconsciousness • Respiratory distress, failure • Vomiting • Seizure • Major traumatic mechanism of injury 	<ul style="list-style-type: none"> • Skull fracture • Brain injury (concussion, contusion, hemorrhage, or laceration) • Epidural hematoma • Subdural hematoma • Subarachnoid hemorrhage • Spinal injury • Abuse

	EMR	EMT	A	I	P
1. Perform general patient management and baseline GCS.	•	•	•	•	•
2. Support life-threatening problems associated with airway, breathing, and circulation. Obtain mechanism or injury.	•	•	•	•	•
3. Administer oxygen to maintain SPO_2 94 - 99%. Consider supporting respirations with a BVM. If signs of hypoventilation are present, ventilate with BVM at an age appropriate rate.	•	•	•	•	•
4. Monitor <u>capnography</u> if BVM or intubated/alternative airway. Attempt to maintain between 35 - 45 mm Hg.		•	•	•	•

HEAD INJURY

Protocol 10-4

Continued

HEAD INJURY

	EMR	EMT	A	I	P
5. Consider spinal precautions based on MOI. Avoid excessive compression around the neck by cervical collar. Assess and document PMS in all extremities before and after movement.		•	•	•	•
6. Place patient on cardiac monitor.				•	•
7. Establish an IV of normal saline, if indicated, to maintain an appropriate systolic BP: a. Birth to 1 month – 60 mmHg b. 1 month to 1 year – > 70 mmHg c. Greater than 1 year - 70 + [2 x Age (years)]			•	•	•
8. Obtain a blood glucose sample.		•	•	•	•
9. If patient is exhibiting signs of shock, refer to <u>Pediatric Shock protocol</u> .		•	•	•	•
10. Transport per <u>Trauma Triage Scheme</u> and perform ongoing assessment as indicated.		•	•	•	•

PEARLS:

1. Hyperventilation is not recommended with head-injury patients.
2. One of the most important indicators of worsening head injury is a change in LOC and / or GCS.
3. Increased ICP may cause hypertension and bradycardia (Cushing's response).
4. Hypotension usually indicates injury or shock unrelated to the head injury and should be treated aggressively.
5. A decrease of two (2) or more in the patient's GCS should be considered due to a severe head injury until proven otherwise.
6. Recognize that "normal" blood pressure is not as important as "normal for the patient" when assessing maintenance of adequate cerebral blood flow and adequate cerebral perfusion.

Glasgow Coma Scale Modified for Pediatric Patients

Eye Opening Response	<1 year
4	Spontaneous
3	To shout
2	To pain
1	None
Verbal Response	0 to 2 years
5	Babbles, coos appropriately
4	Cries but inconsolably
3	Persistent crying or screaming in pain
2	Grunts or moans to pain
1	None
Motor Response	<1 year
6	Spontaneous
5	Localizes pain
4	Withdraws to pain
3	Abnormal flexion to pain (decerebrate)
2	Abnormal extension to pain (decordicate)
1	None

HEAD INJURY

Protocol

10-4

Continued

HEAD INJURY

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Protocol 10-5

SECTION: Pediatric Trauma Patient Care

PROTOCOL TITLE: General – Neglect or Abuse Suspected

REVISED: 06/2017

OVERVIEW:

Child r abuse, which includes sexual abuse, physical abuse, and neglect, is often overlooked and under-reported. It is the ethical and legal responsibility to notify the receiving hospital of suspicions of child abuse as it may prevent serious injury and death. Proof of abuse is not needed to make the report to hospital, CPS, or social services. Patterns of abuse can reflect any form of physical and/or mental trauma, but are usually characterized by unexplained or poorly explained injuries of different ages and delay in seeking medical care. There may be sometimes be no external signs of injuries. Observation, transport, and reporting are the key responsibilities of the pre-hospital provider.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> • Time of injury • Mechanism: blunt vs penetrating • Loss of consciousness • Bleeding • Past medical history • Medications • Evidence of multi-system trauma 	<ul style="list-style-type: none"> • Pain, swelling, bleeding • Altered mental status, unconsciousness • Respiratory distress, failure • Dehydration • Fractures • Decubitus • Major traumatic mechanism of injury 	<ul style="list-style-type: none"> • Skull fracture • Brain injury (concussion, contusion, hemorrhage, or laceration) • Epidural hematoma • Subdural hematoma • Subarachnoid hemorrhage • Spinal injury

	EMR	EMT	A	I	P
1. Perform general patient management.	•	•	•	•	•
2. Support life-threatening problems; C-spine precautions.	•	•	•	•	•
3. Administer oxygen, to maintain SPO_2 94 - 99%. Support respirations as necessary with a BVM.	•	•	•	•	•
4. Observe and record objectively the surroundings and conditions of the scene and patient.	•	•	•	•	•
5. Refer to the appropriate <i>Medical or Trauma Patient Care protocol</i> for obvious injuries / illnesses.	•	•	•	•	•
6. UNDER VIRGINIA LAW, EMS PROVIDERS ARE MANDATORY REPORTERS OF SUSPECTED CHILD ABUSE. (VA code 63.2-1509) Report suspicions to the receiving facility emergency department attending physician on arrival, or report suspicions immediately to Child Protective Services. CPS Hotline: 800-552-7096.	•	•	•	•	•
7. Transport as soon as possible.		•	•	•	•

CHILD ABUSE

Protocol

10-5

Continued

CHILD ABUSE

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SECTION: Pediatric Trauma Patient Care

PROTOCOL TITLE: General – Pediatric SMR

REVISED: 08/2019

OVERVIEW:

Mechanism of injury alone has not been shown to be a predictor for spinal injury. An appropriate patient assessment can be used to determine need for spinal motion restriction. The below is cervical spinal motion restriction selection guidelines taken from National Model Guidelines V2 and NEXUS (National Emergency X-Radiography Utilization Study).

There is limited data studying spinal motion in patients with applied cervical collars. Patient exiting out of car under their own power, with cervical collar in place, may result in the least amount of motion of the cervical spine. Cervical spinal motion restriction devices include, but are not limited to soft and hard collars.

Long back boards have not been shown to reduce spinal injury complications. Long backboards are associated with increased pain, decubitus development, and possibly decreased functional residual capacity of the lungs. Long backboards and scoop stretchers may be used for the safe movement/transfer of patients. However, if used in this way, patients should be removed from the device as soon as possible.

HPI	Signs and Symptoms	Considerations
<ul style="list-style-type: none"> • Time of injury • Mechanism of injury (blunt vs. penetrating) • Restraints/protective devices • Prior cervical spine surgery • Known vertebral disease • Medical history • Medications • Evidence of multi-system trauma 	<ul style="list-style-type: none"> • Spine pain • Limited neck mobility • Neurological deficit • Unstable/abnormal vital signs 	<ul style="list-style-type: none"> • Spinal cord injury • Fracture of vertebrae • Head injury • Neurogenic shock • Distracting injury

	EMR	EMT	A	I	P
1. Maintain scene and provider safety.	•	•	•	•	•
2. Perform general patient management.	•	•	•	•	•
3. Support life-threatening problems.	•	•	•	•	•
4. Spinal motion restriction is not recommended in patients with penetrating trauma.		•	•	•	•
5. Cervical spinal motion restriction should be used in patients meeting the below criteria.					

Protocol 10-6

Continued

PEDIATRIC SMR

<p>a. Patients 14 years of age and younger with a traumatic mechanism and any one of the following criteria:</p> <ul style="list-style-type: none"> - Torticollis - Substantial Injury - High risk MVC - Diving Incidents - Neurological Deficits - Altered Mental Status - Intoxication <p>c. Any patient where provider judgement indicates use of SMR. (backboard, strapped to stretcher, reeves etc)</p>		•	•	•	•
<p>6. Backboards may be used for movement or extrication of the patient. Patients should be removed from the backboard as soon as possible.</p>		•	•	•	•
<p>7. Transport to an appropriate facility as indicated by the Regional Field Triage Scheme if applicable, and perform ongoing assessment as indicated.</p>		•	•	•	•

Protocol 10-7

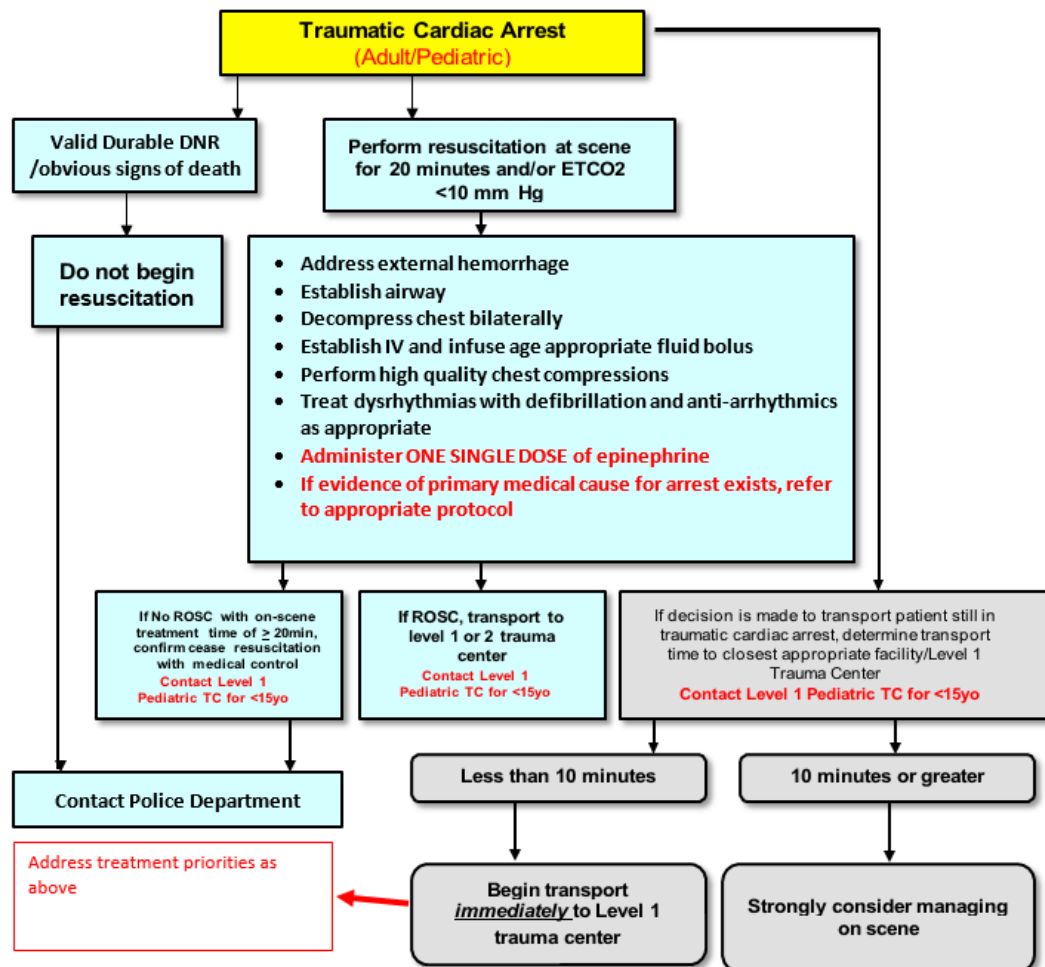
SECTION: Pediatric Trauma Patient Care

PROTOCOL TITLE: Pediatric Traumatic Arrest

EFFECTIVE: 07/2021

OVERVIEW:

Survival from traumatic cardiac arrest is poor. Ideally and preferentially, the clinical care of patients in traumatic arrests are managed in the field until ROSC or termination of efforts. The distance from the level 1 or 2 trauma center may play a role in transport decisions. Transport times greater than 15 minutes to the trauma center should be managed in the field unless extenuating circumstances exist. The following algorithm is intended to serve as a guideline in conjunction with Protocol 12-9.



PEDIATRIC TRAUMATIC ARREST

PEARLS:

1. The traditional use of 14-gauge IV catheters at the standard midclavicular line has come under scrutiny. One study showed that a 5.0 cm catheter would be unlikely to access the pleural cavity in half of adult patients in the standard position. Consider anterior mid-axillary placement for larger adults.
2. Penetrating vs. blunt traumatic cardiac arrest: Historically, one of the most important factors that should be considered in the management of traumatic cardiac arrest is the etiology of the traumatic cardiac arrest. Penetrating trauma- gunshot wounds and stab wounds in particular-have much better outcomes than blunt traumatic arrest.
3. AHA Guidelines for CPR and Emergency Cardiovascular Care makes no mention of the use of ACLS drugs in the section on cardiac arrest associated with trauma. It may impair tissue perfusion in hemorrhagic shock. If used, it should be limited to a single dose early in resuscitation for traumatic arrests.
4. Medical Direction strongly encourages providers to focus on managing external hemorrhaging, establishing an airway, needle decompression as needed, performing high quality chest compressions, and defibrillation as appropriate.
5. Priority of transport destination for traumatic arrest is:
 - Level 1 Trauma Center
 - Level 2 Trauma Center
 - Level 3 Trauma Center
 - Closest Appropriate Facility
6. Continuous scene safety and security should also be considered in transport decisions.