Blast Injury/ Incident

History
- Type of exposure (heat, gas, chemical)
- Inhalation injury
- Time of Injury
- Past medical history/ Medications
- Other trauma
- Loss of Consciousness
- Tetanus/Immunization status

Signs and Symptoms
- Hearing loss (TM rupture)
- Ocular burns/vision changes
- Multiple trauma/ penetrating trauma
- Hypotension/ shock
- Airway compromise/distress could be indicated by hoarseness/ wheezing
- Pneumothorax/ hemothorax
- Traumatic amputation (tourniquet)

Differential
- Thermal / Chemical / Electrical Burn Injury
  - Superficial
    - (1st Degree) red – painful (Don't include in TBSA)
  - Partial Thickness
    - (2nd Degree) blistering
  - Full Thickness
    - (3rd Degree) painless/charred or leathery skin
- Radiation injury

Nature of Device: Agent/ Amount. Industrial Explosion. Terrorist Incident. Improvised Explosive Device.
Method of Delivery: Incendiary/ Explosive
Nature of Environment: Open / Closed.
Distance from Device: Intervening protective barrier. Other environmental hazards,
Evaluate for: Blunt Trauma/ Crush Injury/ Compartment Syndrome/ Traumatic Brain Injury/ Concussion/ Tympanic Membrane Rupture/ Abdominal hemorrhage or Evisceration, Blast Lung Injury and Penetrating Trauma.

Scene Safety/ Quantify number and Triage Patients/ Load and Go with Assessment/ Treatment Enroute

Call for help/ additional resources
Stage until scene safe

Accidental/ Intentional Explosions
(See Pearls)

- Triage Protocol UP 2 ***as indicated***
- Age Appropriate Airway Protocol(s) AR 1, 2, 3, 5, 6 ***as indicated***
- Multiple Trauma Protocol TB 6 ***if indicated***
- IV and IO Access Protocol UP 6 ***if indicated***
- P — Cardiac Monitor ***if indicated***
- Thermal Burn Protocol TB 9
  Chemical and Electrical Burn Protocol TB 2 ***if indicated***
- Crush Injury Protocol TB 3 ***if indicated***
- Radiation Incident Protocol TB 7 ***if indicated***
- Decontamination Procedure USP 2 ***if indicated***
- Pain Control Protocol UP 11 ***if indicated***

Blast Lung Injury — YES → Age Appropriate Airway Protocol(s) AR 4, 7 ***as indicated***

NO

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan

Notify Destination or Contact Medical Control

Blast Injury/ Incident

Pearls

- **Types of Blast Injury:**
  - Primary Blast Injury: From the blast pressure (air) wave.
  - Secondary Blast Injury: Impaled objects. Debris which becomes missiles/ shrapnel.
  - Tertiary Blast Injury: Patient falling or being thrown/ pinned by debris.
  - Most Common Cause of Death: Secondary Blast Injuries.
- **Triage of Blast Injury patients:**
  - Blast Injury patients with burn injuries should be triaged using the Thermal Burn/ Chemical and Electrical Burn Protocol Guidelines for Critical/ Serious/ Minor Trauma and Burns and the Trauma and Burn: EMS Triage and Destination Plan.
  - Patients may be hard of hearing due to tympanic membrane rupture.
- **Care of Blast Injury Patients:**
  - Patients may suffer multi-system injuries including blunt and penetrating trauma, shrapnel, barotrauma, burns, and toxic chemical exposure.
  - Consider airway burns, which should prompt early and aggressive airway management as indicated.
  - Cover open chest wounds with semi-occlusive dressing or commercial chest seal product.
  - Use Lactated Ringers (if available) for all Critical or Serious Burns.
  - Minimize IV fluids resuscitation in patients with no signs of shock or poor perfusion.
- **Blast Lung Injury:**
  - Blast Lung Injury is characterized by respiratory difficulty and hypoxia. Can occur (rarely) in patients without external thoracic trauma. More likely to occur in an enclosed space or in close proximity to explosion.
  - Symptoms: Dyspnea, hemoptysis, cough, chest pain, wheezing, and hemodynamic instability.
  - Signs: Apnea, tachypnea, hypopnea, hypoxia, cyanosis, and diminished breath sounds.
  - Air embolism should be considered and patient transported in left-lateral decubitus position.
  - Blast Lung Injury patients may require early intubation but positive pressure ventilation may worsen the injury, avoid hyperventilation, which can cause further injury.
  - Air transport may worsen lung injury, monitor oxygenation and ventilation closely. Tension pneumothorax may occur requiring chest decompression. Be judicious with fluids as volume overload may worsen lung injury.
- **Accidental Explosions or Intentional Explosions:**
  - **All explosions or blasts should be considered intentional until determined otherwise.**
  - **Greatest concern is potential threat for a secondary device.**
  - Attempt to determine the source of the blast to include any potential threat for aerosolization of hazardous materials.
  - Evaluate scene safety including the source of the blast, which may continue to spill explosive liquids or gases.
  - Consider structural collapse, environmental hazard, and fire.
  - Conditions that led to the initial explosion may reoccur and lead to a second explosion.
  - Patients who physically able, typically will attempt to move as far away from the explosive source.
  - Evaluate surroundings for suspicious items; unattended back packs or packages, or unattended vehicles.
  - **If patient(s) is unconscious or there is fatalities and you are evaluating patient(s) for signs of life:**
    - **Before moving, note if there are wires coming from the patient(s), or if it appears the patient(s) is lying on a package/ pack, or bulky item. If so, do not move the patient(s), quickly back away and immediately notify a law enforcement officer.**
  - If there are no indications the patient is connected to a triggering mechanism for a secondary device, expeditiously remove the patient(s) from the scene and begin transport to the hospital.
  - Protect the airway and cervical spine, however beyond the primary survey, care and a more detailed assessment should be deferred until rapid transport begins.
  - If there are signs the patient was carrying the source of the blast, notify law enforcement immediately, and most likely a law enforcement officer will accompany your patient to the hospital.

Chemical and Electrical Burn

History
- Type of exposure (heat, gas, chemical)
- Inhalation injury
- Time of Injury
- Past medical history/ Medications
- Other trauma
- Loss of Consciousness
- Tetanus/Immunization status

Signs and Symptoms
- Burns, pain, swelling
- Ocular burns/ vision changes
- Loss of consciousness
- Hypotension/ shock
- Compartment syndrome
- Airway compromise/ distress could be indicated by hoarseness/ wheezing
- Electrical burn may be misleading with small contact/ external burn and major internal injury – burn/ trauma center transport isrecommended

Differential
- Thermal / Chemical / Electrical Burn Injury
  - Superficial
    - (1st Degree) red – painful
    - (Don't include in TBSA)
  - Partial Thickness
    - (2nd Degree) blistering
  - Full Thickness
    - (3rd Degree) painless/charred or leathery skin
- Radiation injury
- Blast injury

Assure Chemical Source is NOT Hazardous to Responders.
Assure Electrical Source is NO longer in contact with patient before touching patient.

Assess Burn/ Concomitant Injury Severity

< 5% TBSA 2nd/3rd Degree Burn	**5-15% TBSA 2nd/3rd Degree Burn**	**>15% TBSA 2nd/3rd Degree Burn**
No inhalation injury, Not Intubated, Normotensive GCS 14 or Greater Minor Burn	Suspected inhalation injury or requiring intubation for airway stabilization Hypotension or GCS 13 or Less (When reasonably accessible, transport to a Burn Center) Serious Burn	Burns with Multiple Trauma Burns with definitive airway compromise (When reasonably accessible, transport to a Burn Center) Critical Burn

Age Appropriate
Airway Protocol(s) AR 1, 2, 3, 4, 5, 6, 7
if indicated

IV or IO Access Protocol UP 6
Consider 2 IV sites if ≥ 15 % TBSA

Thermal Burn Protocol TB 9

Pain Control Protocol UP 11
if indicated

Identify Contact Points

Eye Involvement
Irrigate Involved Eye(s) with Normal Saline + for 30 minutes
Continue irrigation during transport

Chemical Exposure/ Burn
Flush Contact Area with Normal Saline for 15 minutes
Continue irrigation during transport

Decontamination Procedure USP 2
if indicated

Age Appropriate Cardiac Protocol(s)
if indicated

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan

Notify Destination or Contact Medical Control

Chemical and Electrical Burn

Pearls

- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro**
- **Green, Yellow, and Red in burn severity do not apply to the Start/ JumpStart Triage System.**
- **Refer to Rule of Nines.**
- **Transport and Destination:**
  - **In general, chemical and electrical burns should be transported to a burn center.**
  - **Burn center should be initial destination choice unless EMS system access is limited by time and/ or distance.**
  - **When EMS transport to burn center is limited, transport to and stabilization at local center is appropriate.**
- **Chemical Burns:**
  - Refer to Decontamination Procedure.
  - With dry powders/ substances, gently brush or wipe off prior to irrigation. Do not aerosolize by brushing too vigorously.
  - Normal Saline or Sterile Water is preferred, however if not available, do not delay irrigation and use tap water. Other water sources may be used based on availability.
  - Flush the area as soon as possible with the cleanest, most readily available water or saline solution and use copious amounts of fluids.
  - Flush contact area for a minimum of 15 minutes and continue until arrival at receiving facility.
  - Hydrofluoric acid burns:
    - Monitor ECG for peaked T waves, which can be sign of hypocalcemia.
  - Eye involvement:
    - Irrigation is recommended for a minimum of 30 minutes and continue until arrival at receiving facility.
- **Electrical Burns:**
  - **Remember the extent of the obvious external burn from an electrical source does not always reflect more extensive internal damage. Small external injury may have large internal injury.**
  - **Do not refer to wounds as an entry and exit wound**.
  - **DO NOT contact patient until you are certain the source of the electrical shock is disconnected.**
  - Attempt to locate contact points (generally there will be two or more.) A point where the patient contacted the source and a point(s) where the patient is grounded.
  - Sites will generally be full thickness (3rd).
  - Cardiac Monitor: Anticipate ventricular or atrial irregularity including VT, VF, atrial fibrillation, and/ or heart blocks.
  - Attempt to identify the nature of the electrical source (AC or DC), the amount of voltage, and the amperage the patient may have been exposed to during the electrical shock.
  - **Lightning strike:**
    - Lightning strike victims are amenable to airway, breathing, cardiac compressions, as well as early defibrillation.
    - **Use concept of reverse triage with multiple casualties. Resuscitate lightning strikes as the priority.**
    - Lightning strike victims found alive do not often deteriorate quickly.

Crush Syndrome Trauma

History
- Entrapped and crushed under heavy load > 30 minutes
- Extremity / body crushed
- Building collapse, trench collapse, industrial accident, pinned under heavy equipment

Signs and Symptoms
- Hypotension
- Hypothermia
- Abnormal ECG findings
- Pain
- Anxiety

Differential
- Entrapment without crush syndrome
- Vascular injury with perfusion deficit
- Compartment syndrome
- Altered mental status

Age Appropriate Airway Protocol(s) AR 1 - 7 ***as indicated***

B 12 Lead ECG Procedure

IV or IO Access Protocol UP 6

P Cardiac Monitor

Multiple Trauma Protocol TB 6 ***if indicated***

Thermal Burn Protocol TB 9
Chemical and Electrical Burn Protocol TB 2 ***if indicated***

Pain Control Protocol UP 11 ***as indicated***

Age Specific Blood Pressure indicating possible shock

Age 0 – 28 days: SBP < 60
Ages ≥ 1 month: SBP < 70
Age 1 – 9: SBP < 70 + (2*x* Age)

Ages 10 – 64: SBP < 90
Ages ≥ 65: SBP < 100

All ages:
Shock Index HR > SBP

P
Consider
Midazolam 0.5 – 2 mg IV / IO
Midazolam 2 mg IN
Repeat as needed

Maximum 5 mg
Pediatric: 0.1 – 0.2 mg / kg
IV / IO / IN
Pediatric Maximum 2 mg
Over 2 – 3 minutes as needed

Entrapped < 2 hours

A
Normal Saline Infusion
1 Liter per hour IV / IO
Pediatric:
3 x maintenance fluid rate

Entrapped > 2 hours

A
Decrease Normal Saline Infusion
500 mL per hour IV / IO
Pediatric:
Maintenance fluid rate

Abnormal ECG
Peaked T Waves
QRS ≥ 0.12 seconds
QT ≥ 0.46 seconds
Loss of P wave
Or
Hemodynamically Unstable
Or
Asystole / PEA / VF / VT

P
Calcium Gluconate 2 g IV / IO
Or
(Calcium Chloride 1 g IV / IO)
Pediatric: 20 mg / kg IV / IO
Over 2- 3 minutes

Albuterol Nebulizer
2.5 – 5 mg
May repeat x 3

Sodium Bicarbonate
100 mEq IV / IO
Pediatric: 1 mEq / kg IV / IO

Exit to Age Appropriate Cardiac Arrest Protocol AC 3 / PC 4 Arrhythmia Protocol(s) ***if indicated***

Rapid Transport to appropriate destination using Trauma and Burn: EMS Triage and Destination Plan

Notify Destination or Contact Medical Control

Crush Syndrome Trauma

Crush injuries may release large amount of potassium, myoglobin, and lactic acid into the blood when released from entrapment.

Albuterol is not limited to Paramedics in Crush syndrome however since the purpose of this block of medications is to treat and prevent ekg changes associated with Crush syndrome, a paramedic will need to monitor the rhythm strip carefully for dynamic changes

Pearls

- **Recommended exam: Mental Status, Musculoskeletal, Neuro**
- **Scene safety is of paramount importance as typical scenes may pose hazards to rescuers. Call for appropriate resources.**
- **Crush Injury is a localized crush injury with systemic signs and symptoms causing muscle breakdown and release of potentially toxic muscle cell components and electrolytes into the circulation.**
- **Crush syndrome typically manifests after 1 – 4 hours of crush injury.**
- **Fluid resuscitation strategy:**
  If possible, administer IV / IO fluids prior to release of crushed body part, especially with crush > 1 hour.
  If access to patient and initiation of IV / IO fluids occurs after 2 hours, give 2 liters of IV fluids in adults and 20 mL/kg of IV fluids in pediatrics, and then begin > 2 hour dosing regimen.
- **If not able to perform IV / IO fluid resuscitation immediately, place tourniquet on crushed limb until IV / IO fluids can be initiated (even if tourniquet is not being used for hemorrhage control).**

- **Pediatric IV Fluid maintenance rate:**
  4 mL for the first 10 kg of weight +
  2 mL for the second 10 kg of weight +
  1 mL for every additional kg in weight after 20 kg

Example: 28 kg pediatric	
First 10 kg:	4 mL/kg/hr = 40 mL/hr
Second 10 kg:	2 mL/kg/hr = 20 mL/hr
Final 8 Kg:	1 mL/kg//hr = 8 mL/hr
	Total: 68 mL/hr rate

- **Consider all possible causes of shock and treat per appropriate protocol.**
- **Majority of decompensation in pediatrics is airway or respiratory related.**
- **Decreasing heart rate and hypotension occur late in children and are signs of impending cardiac arrest.**
- **Shock may be present with a normal blood pressure initially or even elevated.**
- **Shock often is present with normal vital signs and may develop insidiously. Tachycardia may be the only sign.**
- **Patients may become hypothermic even in warm environments. Maintain warmth.**
- Hyperkalemia from crush syndrome can produce ECG changes described in protocol, but may also be a bizarre, wide complex rhythm. Wide complex rhythms should also be treated using the VF/ Pulseless VT Protocol if indicated (AC 9 VF Pulseless VT Protocol and/ or PC 7 Pediatric VF Pulseless VT Protocol).

Extremity Trauma

History
- Type of injury
- Mechanism: crush/ penetrating/ amputation
- Time of injury
- Open vs. closed wound / fracture
- Wound contamination
- Medical history
- Medications

Signs and Symptoms
- Pain and/ or swelling
- Deformity
- Altered sensation/ motor function
- Diminished pulse/ capillary refill
- Decreased extremity temperature

Differential
- Abrasion
- Contusion
- Laceration
- Sprain
- Dislocation
- Fracture
- Amputation

	Wound care Control Hemorrhage with Direct Pressure Splinting as indicated
	Consider **Topical Hemostatic Agent/ Dressing** ***if available***
	Wound Care WTP 4 Tourniquet Procedure WTP 7 ***if indicated***
A	IV or IO Access Protocol UP 6 ***if indicated***
	Age Appropriate Airway Protocol(s) AR 1, 2, 3, 4, 5, 6, 7 ***if indicated***
	Multiple Trauma Protocol TB 6 ***if indicated***
	Age Appropriate Hypotension/ Shock Protocol AM 5/ PM 3 ***if indicated***
	Pain Protocol UP 11 ***if indicated***
	Crush Syndrome Protocol TB 3 ***as indicated***

Amputation and/ or Suspected Open Fracture → YES

NO

	Monitor and Reassess

Notify Destination or Contact Medical Control

Open Fracture
or
Amputated Part with Bone Fracture
- Best outcomes in patients who receive antibiotics within 60 minutes of injury

	• Clean amputated part • Wrap part in sterile dressing soaked in normal saline or lactated ringers • Place part/ dressing in air tight container. • Place container on ice if available.
A	**Rocephin 1g IV / IO** **Pediatric > 1 year : 50 mg / kg IV / IO** **Max 1gm** --- **Zosyn 3.375/4.5g IV/IO** **** One of above is Required ****

Pearls
- **Recommended Exam: Mental Status, Extremity, Neuro, Perfusion**
- Peripheral neurovascular status is important to assess and document, as well as time of assessment.
- In amputations, time is critical. Transport and notify medical control immediately, so that the appropriate destination can be determined.
- Hip dislocations as well as knee and elbow fracture/ dislocations have a high incidence of vascular compromise.
- Urgently transport any injury with neurological or vascular compromise.
- Blood loss may be concealed or not apparent with extremity injuries.
- Lacerations optimally should be evaluated for repair within 6 hours from the time of injury.
- **Multiple casualty incident: Tourniquet Procedure may be considered first instead of direct pressure.**

Head Trauma

History
- Time of injury
- Mechanism (blunt vs. penetrating)
- Loss of consciousness
- Bleeding
- Past medical history
- Medications
- Evidence for multi-trauma

Signs and Symptoms
- Pain, swelling, bleeding
- Altered mental status
- Unconscious
- Respiratory distress/ failure
- Vomiting
- Major traumatic mechanism of injury
- Seizure

Differential
- Skull fracture
- Brain injury (Concussion, Contusion, Hemorrhage)
- Epidural hematoma
- Subdural hematoma
- Subarachnoid hemorrhage
- Spinal injury
- Abuse

Prevent hypoxia, hypotension, and hyperventilation

A single episode of hypoxia, hypotension, and hyperventilation increases mortality

Hyperventilation:
Hyperventilation is NOT recommended in patients who require BVM, BIAD, or ETT.

Maintain ventilation rate to target EtCO2 of 35 – 45 mmHg
See Pearls

Age Specific Blood Pressure indicating possible shock

Age 0 – 28 days: SBP < 60
Ages ≥ 1 month: SBP < 70
Age 1 – 9: SBP < 70 + (2*x* Age)

Ages 10 – 64: SBP < 90
Ages ≥ 65: SBP < 110

All ages Shock Index:
SI = HR ÷ SBP

Use Shock Index, Pediatric Adjusted (SIPA)for children <12 (see pearls)

Age Appropriate
Airway Protocol(s) AR 1, 2, 3, 5, 6
if indicated

Obtain and Record GCS

All patients

Titrate **target SpO2 100%**

Monitor HR, BP and O2 every 3-5 minutes

Blood Glucose Analysis Procedure

B Maintain EtCO2 35 – 45 mmHg

A IV or IO Access - UP 6
if indicated

P Cardiac Monitor

Altered Mental Status - UP 4
if indicated

Multiple Trauma - TB 6
if indicated

Age Appropriate
Hypotension/ Shock - AM 5/ PM 3
if indicated

Seizure - UP 13
if indicated

Spinal Motion Restriction Protocol TB 8
Procedure WTP 2
if indicated

Pain Control - UP 11
if indicated

Monitor and Reassess

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan

Notify Destination or Contact Medical Control

A

Evidence of moderate TBI:
GCS <12 or GCS initially 15 and dropping
Objective evidence of head trauma (hematoma, laceration, etc)

TXA 1 - 2 g over 1 minute IV

Peds: Age 1 and above only
15 mg/kg IV - Max 1 gram

P

Signs of Impending Herniation:

If GCS 8 or less
Unilateral or Dilated/Fixed Pupil And / Or
Posturing, Seizures And / Or
Cushing's Triad
(widened pulse pressure bradycardia, and irregular respirations)

3% Hypertonic Saline Infusion

Adult: 250 mL IV / IO
Over 20 minutes

Pediatric: 5 mL / kg IV / IO
Over 20 minutes

Levetiracetam (Keppra)

Adult: 1 gram IV / IO
over 5 minutes

Peds: 15 mg/kg IV / IO
over 5 minutes
Max 1 gram

*** Don't Forget to check a Blood Glucose
Low BSG can mimic head injuries ***

Head Trauma

Eye Opening Response	Verbal Response	Motor Response
4 = Spontaneous	5 = Oriented	6 = Obeys commands
3 = To verbal stimuli	4 = Confused	5 = Localizes pain
2 = To pain	3 = Inappropriate words	4 = Withdraws from pain
1 = None	2 = Incoherent	3 = Flexion to pain or decorticate
	1 = None	2 = Extension to pain or decerebrate
		1 = None

Age	HR	SBP	SIPA cutoff value
1–3 years	70–110	90–110	1.2
4–6 years	65–110	90–110	1.2
7–12 years	60–100	100–120	1.0
>12 years	55–90	100–135	0.9

SIPA, shock index, pediatric age-adjusted; HR, heart rate; SBP, systolic blood pressure.

3% Hypertonic Saline is reserved for severe head injuries GCS <8 – Hypertonic saline is not to be used outside of head trauma. If 3% Hypertonic Saline is unavailable may utilize 100mEq of 8.4% Sodium Bicarb. 2 Amps of Bicarb is equivalent to 200cc of 3% Hypertonic Saline

Pearls

- **Recommended Exam: Mental Status, HEENT, Heart, Lungs, Abdomen, Extremities, Back, Neuro**
- **Hypoxia:**
  - **Single episode of hypoxia can worsen head injury and double mortality.**
  - **Titrate SpO_2 as close to 100% as possible.**
- **Hyperventilation in head injury requiring advanced airway:**
  - **Hyperventilation lowers CO2 and causes vasoconstriction leading to increased intracranial pressure (ICP).**
  - **Hyperventilation is not recommended and can worsen the brain injury.**
  - **In patients requiring BVM, BIAD, or endotracheal tube, titrate ventilation rate to $EtCO_2$ between 35 - 45 mmHg.**
  - **Recommended ventilation rates with advanced airways:**
    - **Infant/ Toddler: 25 breaths / minute**
    - **Children: 20 Breaths / minute**
    - **Adolescents/ Adults: 10 – 12 Breaths / minute**
- **Hypotension:**
  - **Episodes of hypotension can worsen head injury and increase mortality:**
    - **In adults, minimal SBP is at least 90 - 100 mmHg.**
    - **In pediatrics, minimal SBP is at least > 70 + (2 x the age in years).**
  - **Usually indicates shock unrelated to the head injury and should be aggressively treated, otherwise limit fluid administration.**
- **GCS**
  - **Key performance measure used in the EMS Acute Trauma Care Toolkit.**
  - **Serial assessments of GCS with ongoing assessments should be performed.**
- **Do not place in Trendelenburg position as this may increase ICP and worsen blood pressure.**
- **Poorly fitted cervical collars may also increase ICP when applied too tightly.**
- **In areas with short transport times, Drug Assisted Airway protocol is not recommended for patients who are spontaneously breathing and who have oxygen saturations of ≥ 90% with supplemental oxygen including BIAD/ BVM.**
- **Increased intracranial pressure (ICP) may cause hypertension and bradycardia (Cushing's Response).**
- Consider Restraints if necessary for patient's and/ or personnel's protection per the Restraints: Physical Procedure USP 5.
- **Concussions:**
  - Traumatic brain injuries involving any of a number of symptoms including confusion, loss of consciousness, vomiting, or headache.
  - Any prolonged confusion or mental status abnormality which does not return to normal within 15 minutes or any documented loss of consciousness should be evaluated by a physician ASAP.
  - **EMS Providers should not make return-to-play decisions when evaluating an athlete with suspected concussion. This is outside the scope of practice.**

Multiple Trauma

History
- Time and mechanism of injury
- Damage to structure or vehicle
- Location in structure or vehicle
- Others injured or dead
- Speed and details of MVC
- Restraints/ protective equipment
- Past medical history
- Medications

Signs and Symptoms
- Pain, swelling
- Deformity, lesions, bleeding
- Altered mental status or unconscious
- Hypotension or shock
- Arrest

Differential (Life threatening)
- Uncontrolled hemorrhage
- Airway obstruction/ deformity
- Chest:
- Tension pneumothorax
  Flail chest/ Open chest wound
  Pericardial tamponade/ Hemothorax
- Head Trauma Protocol TB 5
- Intra-abdominal bleeding
- Pelvis/ Femur/ Extremity fracture
- Spine fracture/ Cord injury
- Hypothermia

Age Appropriate
Airway Protocol(s) AR 1 - 7
as indicated

P Chest Decompression Procedure WTP 1
if indicated

Control External Hemorrhage
Procedure(s) WTP 4, 5, 7
Consider Pelvic Binding
Splint Fractures Procedure WTP 3

IV or IO Access Protocol UP 6

Spinal Motion Restriction Procedure WTP 2
Spinal Motion Restriction Protocol TB 8
if indicated

Obtain and Record GCS

Tranexamic acid (TXA)/ Blood Product Indicators:
V/S parameters for blunt or penetrating trauma:

Adult:
- **SBP ≤ 70 mmHg**
  or
- **SBP ≤ 90 mmHg + HR ≥ 110**
- **Age ≥ 65**
  SBP < 100 mmHg + HR > 100

Peds:
- **SBP < {70 + 2(Age)}**

**** Visual evidence of large volume blood loss and/or Suspected solid organ injury with internal hemorrhage ****

VS / Perfusion Abnormal / Shock? YES → Age Appropriate Hypotension/ Shock Protocol AM 5/ PM 3 ***if indicated***

NO

Head Injury Protocol TB 5 ***if indicated***

Altered Mental Status Protocol UP 4 ***if indicated***

Pain Control Protocol UP 11 ***if indicated***

Extremity Trauma Protocol TB 4 ***if indicated***

Crush Syndrome Protocol TB 3 ***if indicated***

Repeat Assessment Adult Procedure

Monitor and Reassess

A **Tranexamic acid (TXA) 1 - 2 g IV / IO**

Peds: 15 mg/kg IV/IO over 10 minutes
Maximum 1 gm
if indicated

P

If Suspected Hemorrhagic Shock

Low Titer O+ Whole Blood Administration
Procedure WTP-9

Whole Blood 1 Unit (500 mL) IV / IO
May repeat x1 if indicated

Peds: Whole Blood 10 ml/kg IV / IO
May repeat x1 if indicated

Followed by
2 g Calcium Gluconate IV / IO
If Calcium Gluconate unavailable:
1 g Calcium Chloride over 3-5 minutes

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan
Limit Scene Time ≤ 15 minutes
Provide Early Notification

Notify Destination or Contact Medical Control

Multiple Trauma

TXA (Tranexamic Acid):

1) Indicated for ages 1 or greater in trauma patients with signs/symptoms of suspicion of internal hemorrhage and anticipation of blood transfusion.
2) Indication includes BP <100 systolic, HR > 110, altered LOC, pale, diaphoretic.
3) Contraindications include time greater than 3 hours from onset of injury, shock with other measures (tourniquet, direct pressure, and minimal fluid loss), nontraumatic shock, and non-hemorrhage shock. Additional contraindications evidence / hx of intravascular clotting (DVT, PE, stroke).
4) Patient must be transported to a trauma center if possible - pending weather conditions.
5) Loading dose TXA -Peds 15 mg/kg IV - Max 1 gram - Adults 1-2 grams slow push over 1 min

Pearls

- **Recommended Exam: Mental Status, Skin, HEENT, Heart, Lung, Abdomen, Extremities, Back, Neuro**
- **Items in Red Text are key performance measures used in the EMS Acute Trauma Care Toolkit**
- **Scene time should not be delayed for procedures and all should be performed during rapid transport of unstable patients.**
- **Ask all patients if they are taking any anticoagulants and report during facility transition of care.**
- **Airway:**
  - **BVM and BIAD are acceptable for airway management to maintain SpO_2 of 92 – 98%.**
  - **Endotracheal intubation, if performed, should be completed during transport and should not delay scene time.**
- **Breathing:**
  - **Consider Chest Decompression with signs of shock and/ or injury to torso with evidence of tension pneumothorax.**
- **Circulation:**
  - **Control external hemorrhage and prevent hypothermia by keeping patient warm.**
  - **IV or IO access should be established during rapid transport of unstable patients.**
- **Head Injury with multiple trauma (Refer to Head Trauma Protocol TB 5):**
  - **Higher SBP targets are needed to maintain cerebral perfusion pressure.**
  - **Single episodes of Hypotension and/ or hypoxia are associated with worse outcomes in head injured patients.**
  - **Adult SBP target is ≥ 100 mmHg.**
  - **Pediatric SPB target is ≥ 70 + 2(Age) mmHg.**
- **Trauma Triad of Death:**
  - **Metabolic acidosis/ Coagulopathy/ Hypothermia**
- **Address by appropriate resuscitation measures and keeping patient warm, regardless of ambient temperature, which helps to treat metabolic acidosis, coagulopathy, and hypothermia.**
- **Tranexamic Acid (TXA):**
  - **Agencies utilizing Tranexamic acid (TXA) must submit letters from the their receiving trauma centers for approval by the OEMS Medical Director.**
  - **Receiving trauma centers must agree to continue Tranexamic acid (TXA) therapy with repeat dosing.**
  - **Tranexamic acid (TXA) is NOT indicated and should NOT be administered where trauma occurred > 3 hours prior to EMS arrival.**
- **Trauma in Pregnancy:**
  - Providing optimal care for the mother = optimal care for the fetus.
  - After 20 weeks gestation (fundus at or above umbilicus) transport patient on left side with 10 – 20° of elevation.
- **Geriatric Trauma:**
  - **Age ≥ 65: SBP < 110 mmHg or HR > SBP may indicate shock.**
  - Evaluate with a high index of suspicion, occult injuries difficult to recognize and with unexpected patient decompensation.
  - Risk of death with trauma increases after age 55.
  - Low impact mechanisms, such as ground level falls might result in severe injury especially in age over 65.
- See Regional Trauma Guidelines when declaring Trauma Activation.
- Maintain high-index of suspicion for domestic violence or abuse, pediatric non-accidental trauma, or geriatric abuse.
- **Refer to your Regional Trauma Guidelines when declaring Trauma Activation.**
- Severe bleeding from an extremity, not rapidly controlled with direct pressure, needs application of a tourniquet.
- Maintain high-index of suspicion for domestic violence or abuse, pediatric non-accidental trauma, or geriatric abuse.

Radiation Incident

History
- Type of exposure (heat, gas, chemical)
- Inhalation injury
- Time of Injury
- Past medical history/ Medications
- Other trauma
- Loss of Consciousness
- Tetanus/Immunization status

Signs and Symptoms
- Burns, pain, swelling
- Dizziness
- Loss of consciousness
- Hypotension/shock
- Airway compromise/ distress could be indicated by hoarseness/ wheezing
- Hypotension
- Thermal or Chemical Injury

Differential
- Thermal / Chemical / Electrical Burn Injury
  - Superficial
    - (1st Degree) red – painful (Don't include in TBSA)
  - Partial Thickness
    - (2nd Degree) blistering
  - Full Thickness
    - (3rd Degree) painless/charred or leathery skin

Scene Safety / Quantify number and Triage Patients/ Load and Go with Assessment/ Treatment Enroute

Assess Burn/ Concomitant Injury Severity

Minor Burn | Serious Burn | Critical Burn

< 5% TBSA 2nd/3rd Degree Burn
No inhalation injury, Not Intubated, Normotensive
GCS 14 or Greater

5-15% TBSA 2nd/3rd Degree Burn
Suspected inhalation injury or requiring intubation for airway stabilization
Hypotension or GCS 13 or Less
(When reasonably accessible, transport to a Burn Center)

>15% TBSA 2nd/3rd Degree Burn
Burns with Multiple Trauma
Burns with definitive airway compromise
(When reasonably accessible, transport to a Burn Center)

Age Appropriate
Airway Protocol(s) AR 1, 2, 3, 4, 5, 6, 7
if indicated

Eye Involvement
Irrigate Involved Eye(s) with Normal Saline for 15 – 30 minutes
May repeat as needed

Flush Contact Area with Normal Saline for 15 minutes

Decontamination Procedure USP 2
if indicated

IV and IO Access Protocol UP 6
if indicated

Age Appropriate Cardiac Protocol(s)
as indicated

Thermal Burn Protocol TB 9
if indicated

Rapid Transport to appropriate destination using
Trauma and Burn:
EMS Triage and Destination Plan

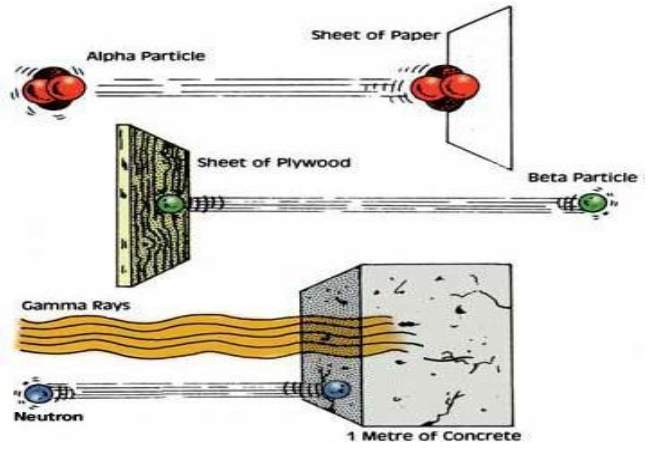
Notify Destination or Contact Medical Control

Collateral Injury: Most all injuries immediately seen will be a result of collateral injury, such as heat from the blast, trauma from concussion, treat collateral injury based on typical care for the type of injury displayed.·

Qualify: Determine exposure type; external irradiation, external contamination with radioactive material, internal contamination with radioactive material.·

Quantify: Determine exposure (generally measured in Grays/Gy). *Information may be available from those on site who have monitoring equipment, do not delay transport to acquire this information.*

Radiation Incident



Time Phases of Radiation Injury
(Exposure Dose vs Clinical Outcome)

Exposure Dose (Gy)	Prodrome Severity	Manifest Illness - Symptom Severity			Prognosis
		Hematologic	Gastrointestinal	Neurologic	
0.5 to 1.0	+	+	0	0	Survival almost certain
1.0 to 2.0	+/++	+	0	0	Survival >90 percent
2.0 to 3.5	++	++	0	0	Probable survival
3.5 to 5.5	+++	+++	+	0	Death in 50% at 3.5 to 6 wks
5.5 to 7.5	+++	+++	++	0	Death probable in 2-3 wks
7.5 to 10	+++	+++	+++	0*	Death probable in 1-2.5 wks
10 to 20	+++	+++	+++	+++	Death certain in 5-12 days
> 20	+++	+++	+++	+++**	Death certain in 2-5 days

Abbreviations: Gy: dose in Grey;
0: no effects; +: mild; ++: moderate; +++: severe or marked

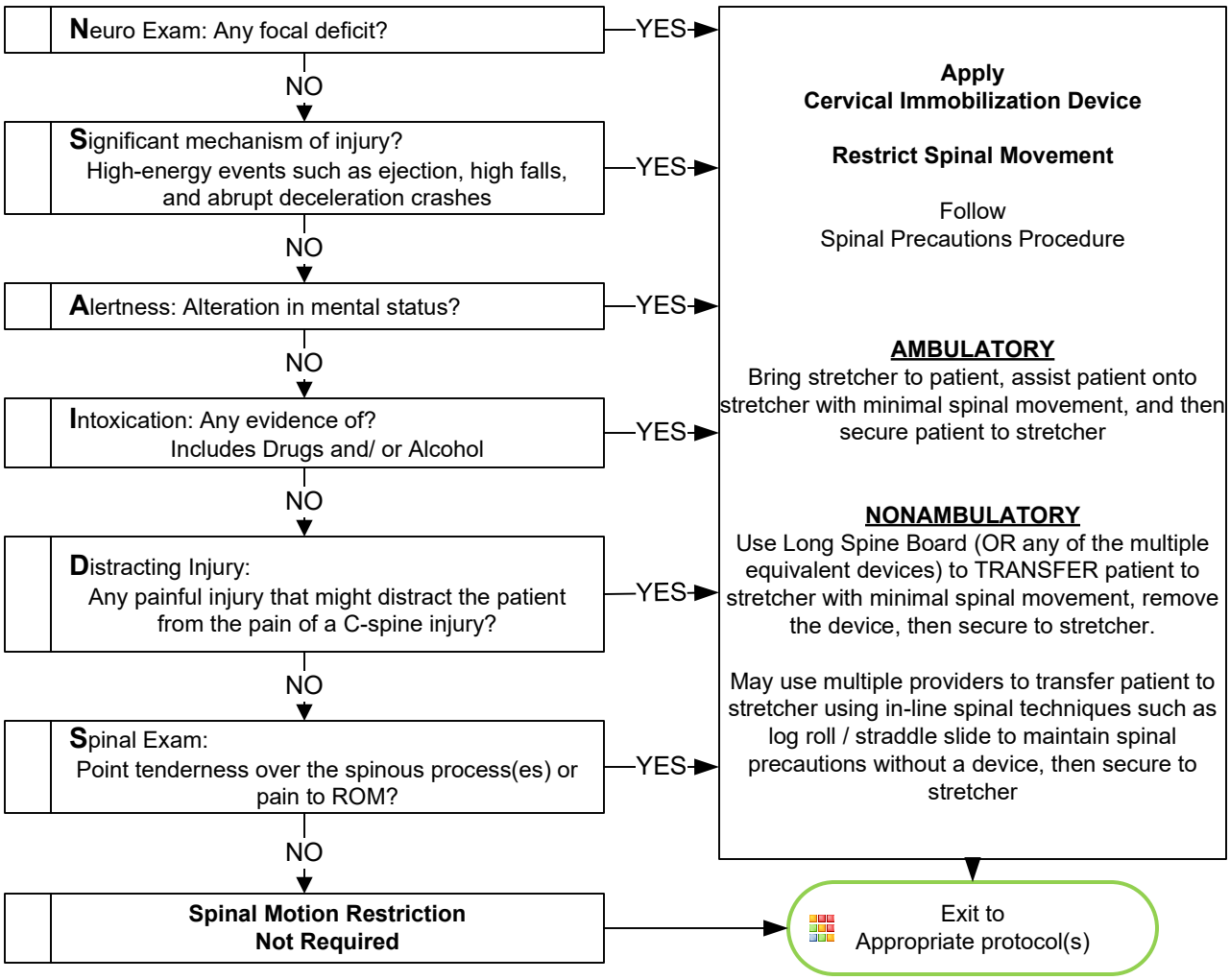
* Hypotension
** Also cardiovascular collapse, fever, shock

Modified from : Waselenko, JK, MacVittie, TJ, Blakely, WF, et al. Medical management of the acute radiation syndrome: Recommendations of the strategic national stockpile radiation working group. Ann Int Med 2004; 140:1039.

Pearls

- **The three primary methods of protection from radiation sources:**
  - **Limiting time of exposure**
  - **Distance from**
  - **Shielding from the source**
- Dealing with a patient with a radiation exposure can be a frightening experience. Do not ignore the ABC's, a dead but decontaminated patient is not a good outcome. Refer to the Decontamination Procedure USP 2 for more information.
- Normal Saline or Sterile Water is preferred, however if not available, do not delay irrigation using tap water. Other water sources may be used based on availability. Flush the area as soon as possible with the cleanest, most readily available water or saline solution using copious amounts of fluids.
- **Three methods of exposure:**
  - External irradiation
  - External contamination
  - Internal contamination
- **Two classes of radiation:**
  - Ionizing radiation (greater energy) is the most dangerous and is generally in one of three states:
    - Alpha Particles, Beta Particles and Gamma Rays.
  - Non-ionizing (lower energy) examples include microwaves, radios, lasers and visible light.
- Radiation burns with early presentation are unlikely, it is more likely this is a combination event with either thermal or chemical burn being presented as well as a radiation exposure. When the burn is from a radiation source, it indicates the patient has been exposed to a significant source, (> 250 rem).
- Patients experiencing radiation poisoning are not contagious. Cross contamination is only a threat with external and internal contamination.
- Typical ionizing radiation sources in the civilian setting include soil density probes used with roadway builders and medical uses such as x-ray sources as well as radiation therapy. Sources used in the production of nuclear energy and spent fuel are rarely exposure threats as is military sources used in weaponry. Nevertheless, these sources are generally highly radioactive and in the unlikely event they are the source, consequences could be significant and the patient's outcome could be grave.
- Dirty bomb ingredients generally include previously used radioactive material and are usually combined with a conventional explosive device to spread and distribute the contaminated material.
- Refer to Decontamination Procedure USP 2/ WMD and Nerve Agent Protocol TE 8 for contamination events.
- If there is a time lag between the time of exposure and the encounter with EMS, key clinical symptom evaluation includes: nausea/ vomiting, hypothermia/ hyperthermia, diarrhea, neurological/ cognitive deficits, headache, and hypotension.
- This event may require an activation of the National Radiation Injury Treatment Network (RITN). UNC Hospitals, Atrium Health Wake Forest Baptist and Duke are the RITN hospitals, with burns managed at UNC and Wake Forest.

Selective Spinal Motion Restriction



Pearls

- **Recommended Exam: Mental Status, Skin, Neck, Heart, Lungs, Abdomen, Back, Extremities, Neuro**
- **Patients meeting all the above criteria do not require spinal motion restriction. However, patients who fail one or more criteria above require spinal motion restriction, but does NOT require use of the long spine board for immobilization.**
- **Long spine boards are NOT considered standard of care in most cases of potential spinal injury. Spinal motion restriction with cervical collar, and securing patient to cot, while padding all void areas is appropriate.**
- **True spinal immobilization is not possible. Spine protection and spinal motion restriction do not equal long spine board.**
- **Spinal motion restriction is always utilized in at-risk patients. This includes cervical collar, securing to stretcher, minimizing movement/ transfers. and maintenance of in-line spine stabilization during any necessary movement/ transfers. This includes the elderly, or others with body or spine habitus preventing them from lying flat.**
- **Consider spinal motion restriction in patients with arthritis, cancer, dialysis, and underlying spine or bone disease.**
- Range of motion (ROM) is tested by touching chin to chest (look down), extending neck (look up), and turning head from side to side (chin to each shoulder) only in patients without posterior cervical mid-line pain. ROM should NOT be assessed if patient has midline spinal tenderness. Patient's range of motion should not be assisted, they must be able to complete alone.
- **EMR may participate in spinal motion restriction** per Agency Medical Director.
- **<u>Immobilization on a long spine board is not necessary where:</u>**
  Penetrating trauma to the head, neck or torso with no signs and/ or symptoms of spinal injury.
- **<u>Concerning mechanisms that may result in spinal column injury:</u>**
  Fall from ≥ 3 feet and/ or ≥ 5 stairs or steps. Ground level falls in patients ≥ 65 years of age.
  MVC ≥ 30 mph, rollover, and/or ejection
  Motorcycle, bicycle, other mobile device, or pedestrian-vehicle crash
  Diving or axial load to spine
  Electric shock

Thermal Burn

History
- Type of exposure (heat, gas, chemical)
- Inhalation injury
- Time of Injury
- Past medical history/ Medications
- Other trauma
- Loss of Consciousness
- Tetanus/Immunization status

Signs and Symptoms
- Burns, pain, swelling
- Dizziness
- Loss of consciousness
- Hypotension/shock
- Airway compromise/ distress could be indicated by hoarseness/ wheezing

Differential
- Thermal / Chemical / Electrical Burn Injury
  - Superficial
    - (1st Degree) red – painful (Don't include in TBSA)
  - Partial Thickness
    - (2nd Degree) blistering
  - Full Thickness
    - (3rd Degree) painless/charred or leathery skin
- Radiation injury
- Blast injury

Assess Burn/ Concomitant Injury Severity

< 5% TBSA 2nd/3rd Degree Burn
No inhalation injury, Not Intubated, Normotensive
GCS 14 or Greater
Minor Burn

5-15% TBSA 2nd/3rd Degree Burn
Suspected inhalation injury or requiring intubation for airway stabilization
Hypotension or GCS 13 or Less
(When reasonably accessible, transport to a Burn Center)
Serious Burn

>15% TBSA 2nd/3rd Degree Burn
Burns with Multiple Trauma
Burns with definitive airway compromise
(When reasonably accessible, transport to a Burn Center)
Critical Burn

- Airway Protocol(s) AR 1, 2, 3, 5, 6 ***as indicated***
- Multiple Trauma Protocol TB 6 ***if indicated***
- Remove Rings, Bracelets, Constricting Items
- Dry Clean Sheet or Dressings
- IV or IO Access Protocol UP 6
  Consider 2 IV sites if ≥ 15 % TBSA

TBSA estimate at ≥ 20%

NO → **A** **Lactated Ringers or Normal Saline**
0.25 mL/kg *X* (TBSA%)/hr

YES → **A** **Lactated Ringers or Normal Saline**
Age: ≤ 5 = 125 mL/hr
Age: 6–14 = 250 mL/hr
Age: ≥ 15 = 500 mL/hr

- Pain Control Protocol UP 11 ***if indicated***
- Carbon Monoxide/ Cyanide Protocol TE 2 ***if indicated***
- Monitor and Reassess
- **Rapid Transport** to appropriate destination using Trauma and Burn: EMS Triage and Destination Plan

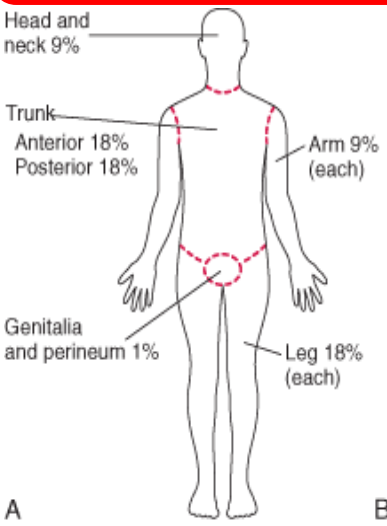
Formula example:
70 kg patient with 15% TBSA

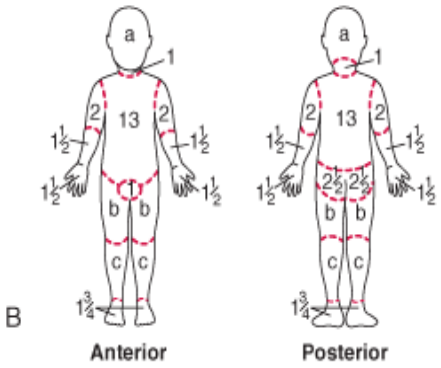
0.25 *x* 70 kg = 17.5
17.5 *x* 15 = 263 mL/hr

Notify Destination or Contact Medical Control

1. Lactated Ringers preferred over Normal Saline. Use if available, if not change over once available.

Thermal Burn





Relative percentage of body surface area (% BSA) affected by growth

	Age				
Body Part	0 yr	1 yr	5 yr	10 yr	15 yr
a = 1/2 of head	9 1/2	8 1/2	6 1/2	5 1/2	4 1/2
b = 1/2 of 1 thigh	2 3/4	3 1/4	4	4 1/4	4 1/2
c = 1/2 of 1 lower leg	2 1/2	2 1/2	2 3/4	3	3 1/4

Rule of Nines

- Rarely find a complete isolated body part that is injured as described in the Rule of Nines.
- More likely, it will be portions of one area, portions of another, and an approximation will be needed.
- For the purpose of determining the extent of serious injury, differentiate the area with minimal or 1st degree burn(superficial) from those of partial (2nd) or full (3rd) thickness burns.
- **For the purpose of determining Total Body Surface Area (TBSA) of burn, include only Partial (2nd) and Full Thickness (3rd) burns.** Report the observation of other superficial (1st degree) burns but do not include those burns in your TBSA estimate.
- Some texts will refer to 4th 5th and 6th degree burns. There is significant debate regarding the actual value of identifying a burn injury beyond that of the superficial, partial and full thickness burn at least at the level of emergent and primary care. For our work, all are included in Full Thickness burns

Estimate spotty areas of burn by using the size of the patient's palm as 1 %

Pearls

- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro**
- **Green, Yellow, and Red In burn severity do not apply to the Start/ JumpStart Triage System.**
- **Airway considerations:**
  - **For systems performing RSI, Rocuronium is preferred agent (succinylcholine can be used in the first 24-hours)**
  - **Singed nasal hairs, facial burns, and/ or carbonaceous sputum are NOT absolute indications for intubation in a burn patient.**
  - **Utilizing non-rebreather face mask as well as NIPPV procedure are acceptable as tolerated.**
- **Critical or Serious Burns:**
  - **> 5-15% total body surface area (TBSA) 2nd or 3rd degree burns**
  - **3rd (full thickness) degree burns > 5% TBSA for any age group**
  - **Circumferential burns of extremities**
  - **Electrical or lightning injuries**
  - **Suspicion of abuse or neglect**
  - **Inhalation injury**
  - **Chemical burns**
  - **Burns of face, hands, perineum, or feet**
  - **Require direct transport to a Burn Center. Local facility should be utilized only if distance to Burn Center is excessive or critical interventions such as airway management are not available in the field.**
- Burn patients are trauma patients, evaluate for multisystem trauma.
- Assure whatever has caused the burn is no longer contacting the injury. (Stop the burning process!)
- Circumferential burns to extremities are dangerous due to potential vascular compromise secondary to soft tissue swelling.
- Burn patients are prone to hypothermia - never apply ice or cool the burn, must maintain normal body temperature.
- Evaluate the possibility of geriatric abuse with burn injuries in the elderly.
- Do not administer IM pain injections to a burn patient. IM dosing is variable in burn patients and may result in over or under dose.

Traumatic Arrest

Criteria for Death / No Resuscitation
Review DNR / MOST Form

- YES →
  - Decomposition
  - Rigor mortis
  - Dependent lividity
  - Blunt Force Trauma Injury incompatible with life
  - Downtime ≥ 15 minutes with <u>penetrating</u> trauma with asystole
  - Downtime ≥ 5 minutes with <u>blunt</u> trauma with asystole
  - DNR/ MOST Form
  - Do not begin resuscitation
  - Follow Deceased Persons Policy
- NO → Blunt Arrest / Penetrating Arrest

Blunt Arrest

YES → **Apnea** (NO → Team Focused CPR)

YES → **Pulseless** (NO → Team Focused CPR)

YES → **Asystole or Wide Complex PEA < 40** (NO → Team Focused CPR)

YES → Do not begin resuscitation. Follow Deceased Persons Policy

Penetrating Arrest

YES → **Apnea** (NO → Team Focused CPR)

YES → **Pulseless** (NO → Team Focused CPR)

YES → **Asystole or Wide Complex PEA < 40** (NO → Team Focused CPR)

YES → **Additional Assessments**

→ **Witnessed Arrest and transport time to trauma center <15 min (consider CPR and immediate transport)**
- YES → Team Focused CPR
- NO → **Pupil Reflexes**
  - YES → Team Focused CPR
  - NO → **Spontaneoius Body Movement**
    - YES → Team Focused CPR
    - NO → Do not begin resuscitation. Follow Deceased Persons Policy

Treatment

- Team Focused CPR Protocol AC 11
- Airway Protocol(s) AR 1, 2, 3, 5, 6 ***if indicated***
- Control External Hemorrhage Procedure(s) WTP 4, 5, 7
- Consider Pelvic Binding
- Splint Suspected Fractures Procedure WTP 3
- P: Chest Decompression-Needle Procedure ***if indicated***
- **Spinal Motion Restriction Procedure WTP 2 And Protocol TB 8 *If indicated***
- IV / IO Access Protocol UP 6

P:
Consider Whole Blood

Adult: 1 unit (500 mL) IV / IO
Pediatric: 10 mL / kg IV / IO
May Repeat x1 if indicated

Followed by:
2g Calcium Gluconate IV / IO
Peds: 50 mg / kg IV / IO

Rapid Transport to appropriate destination using
<u>Trauma and Burn:</u>
<u>EMS Triage and Destination Plan</u>
Limit Scene Time ≤ 15 minutes
Provide Early Notification

Notify Destination or Contact Medical Control

Traumatic Arrest

Pearls.

- **Recommended Exam: Mental Status, Skin, HEENT, Heart, Lung, Abdomen, Extremities, Back, Neuro**
- **Items in Red Text are key performance measures used in the EMS Acute Trauma Care Toolkit.**
- **Scene time should not be delayed for procedures and all should be performed during rapid transport.**
- **First arriving EMS personnel should make the assessment concerning agonal respirations, pulselessness, asystole or PEA < 40, pupillary reflexes, and spontaneous body movements.**
- **Withholding resuscitative efforts with blunt and penetrating trauma victims who meet criteria, is appropriate.**
- **Airway:**
  - **Airway is a priority in traumatic arrest.**
  - **BVM and BIAD are acceptable for airway management.**
  - **Endotracheal intubation, if performed, should be completed during transport and should not extend scene time.**
- **Breathing:**
  - **Consider Chest Decompression in both blunt and penetrating trauma.**
  - **Needle Chest Decompression permissible at the AEMT level only involving TRAUMATIC PULSELESS ARREST.**
- **Circulation:**
  - **Control external hemorrhage, including use of tourniquets, and prevent hypothermia by keeping patient warm.**
  - **IV or IO access should be established during rapid transport of unstable patients.**
  - **If transport time to Trauma Center is < 15 minutes, use of ECG monitor may delay resuscitation and transport.**
  - **Rhythm determination is more helpful in rural settings, or where transport to nearest facility is > 15 minutes. Omit from algorithm where appropriate.**
  - **Organized rhythms, for purpose of protocol, include Ventricular Tachycardia, Ventricular Fibrillation, and PEA.**
  - **Wide, bizarre rhythms (Idioventricular and severely bradycardic rhythms < 40 BPM), are not organized rhythms.**
- **Trauma Triad of Death:**
  - **Metabolic acidosis/ Coagulopathy/ Hypothermia**
  - **Performance of appropriate resuscitation measures and keeping patient warm, regardless of ambient temperature, helps to treat metabolic acidosis, coagulopathy, and hypothermia.**
- **Efforts should be directed at high quality and continuous compressions with limited interruptions and early defibrillation when indicated.**
- **DO NOT HYPERVENTILATE: If no advanced airway (BIAD, ETT) compressions to ventilations are 30:2. If advanced airway in place ventilate 10 – 12 breaths per minute.**
- **ALS procedures should optimally be performed during rapid transport.**
- **Time considerations:**
  - **From the time cardiac arrest is identified, if CPR is performed ≥ 15 minutes with no ROSC, consider termination of resuscitation on scene.**
  - **From the time cardiac arrest is identified, if transport time to closest Trauma Center is > 15 minutes consider termination of resuscitation on scene.**
- Lightning strike, drowning, or in situations causing hypothermia, resuscitation should be initiated.
- Where multiple lightning strike victims are found, use Reverse Triage: Begin CPR in apneic/ pulseless victims.
- Agencies utilizing Targeted Temperature Management Protocol should not cool the trauma patient, but rather make every effort to maintain warmth.

Bites and Envenomations

History
- Type of bite/ sting
- Description/ photo for identification
- Time, location, size of bite/ sting
- Previous reaction to bite/ sting
- Domestic vs. Wild
- Tetanus and Rabies risk
- Immunocompromised patient

Signs and Symptoms
- Rash, skin break, wound
- Pain, soft tissue swelling, redness
- Blood oozing from the bite wound
- Evidence of infection
- Shortness of breath, wheezing
- Allergic reaction, hives, itching
- Hypotension or shock

Differential
- Animal bite
- Human bite
- Snake bite (poisonous)
- Spider bite (poisonous)
- Insect sting / bite (bee, wasp, ant, tick)
- Infection risk
- Rabies risk
- Tetanus risk

Call for help/ additional resources
Stage until scene safe

General Wound Care Procedure

Immobilize Injury

Remove any constricting clothing/ bands/ jewelry

IV or IO Access Protocol UP 6 ***if indicated***

Age Appropriate Trauma Protocol(s) TB 4, 5, 6 ***if indicated***

Age Appropriate Allergic Reaction/ Anaphylaxis Protocol AM 1/ PM 1 ***if indicated***

Age Appropriate Hypotension/ Shock Protocol AM 5 / PM 3 ***if indicated***

Pain Control Protocol UP 11 ***if indicated***

Extremity Trauma Protocol TB 4 ***if indicated***

Contact Carolinas Poison Control 1-800-222-1222

Identification of Animal

Spider Bite/ Bee or Wasp Sting *Venomous*

Keep bite at level of heart ***if able***

Apply Ice Packs

P

Muscle Spasm
Midazolam 2.5 mg IV / IO / IN
Over 2 to 3 minutes
Maximum 10 mg

Pediatrics:
Midazolam 0.2 mg / kg
IV / IO / IM / IN
Over 2 to 3 minutes
Maximum 5 mg

Snake Bite *Venomous*

Keep bite at level of heart ***if able***

Remove any constricting clothing/ bands

DO NOT apply ICE

Mark Margin of Swelling / Redness and Time

Mammal Bite

Transport

NO → Contact and Document contact with Animal Control Officer

YES

Monitor and Reassess

Notify Destination or Contact Medical Control

Bites and Envenomations

Pearls

- **Recommended Exam: Mental Status, Skin, Extremities (Location of injury), and a complete Neck, Lung, Heart, Abdomen, Back, and Neuro exam if systemic effects are noted**
- **Immunocompromised patients are at an increased risk for infection: diabetes, chemotherapy, transplant patients.**
- **Consider contacting the North Carolina Poison Control Center for guidance (1-800-222-1222).**
- **Do not put responders in danger attempting to capture an animal or insect for identification purposes.**
- **Evidence of infection: swelling, redness, drainage, fever, red streaks proximal to wound.**
- **Human bites:**
  Human bites have higher infection rates than animal bites due to normal mouth bacteria.
  Hand and foot bites have highest rates of infection.
- **Dog/ Cat/ Carnivore bites:**
  Carnivore bites are much more likely to become infected and all have risk of Rabies exposure.
  Cat bites may progress to infection rapidly due to a specific bacteria (Pasteurella multicoda).
- **Snake bites:**
  Poisonous snakes in this area are generally of the pit viper family: rattlesnake and copperhead.
  Coral snake bites are rare: Very little pain but very toxic. "Red on yellow - kill a fellow, red on black - venom lack."
  Amount of envenomation is variable, generally worse with larger snakes and early in spring.
  Snake bites are treated based on signs and symptoms and progression.
  It is not important to attempt to identify the type of snake and attempts may endanger providers.
  Do not bring a snake to the facility for identification as accidental bites to providers may occur.
- **Spider bites:**
  Black Widow spider bites tend to be minimally painful, but over a few hours, muscular pain and severe abdominal pain may develop (spider is black with red hourglass on belly).
  Brown Recluse spider bites are minimally painful to painless. Little reaction is noted initially but tissue necrosis at the site of the bite develops over the next few days (brown spider with fiddle shape on back).
- **Animal bite(s) in subjects declining transport to a medical facility for evaluation:**
  NCGS 130A-196 requires that all animal bites be reported to the local health department even if the bite is by the owner's animal, and even if accidental.
  Reporting requirements can be satisfied by reporting to local animal control official.

Carbon Monoxide/ Cyanide

History
- Smoke inhalation
- Ingestion of cyanide
- Eating large quantity of fruit pits
- Industrial exposure
- Trauma
- Reason: Suicide, criminal, accidental
- Past Medical History
- Time/ Duration of exposure

Signs and Symptoms
- AMS
- Malaise, weakness, flu like illness
- Dyspnea
- GI Symptoms; N/V; cramping
- Dizziness
- Seizures
- Syncope
- Reddened skin
- Chest pain

Differential
- Diabetic related
- Infection
- MI
- Anaphylaxis
- Renal failure/ dialysis problem
- Head injury/ trauma
- Co-ingestant or exposures

	Immediately Remove from Exposure
	Appropriate Airway Protocol(s) 1 - 7 ***as indicated***
	High Flow Oxygen
	Blood Glucose Analysis Procedure
B	12 Lead ECG Procedure
	IV or IO Access Protocol UP 6
P	Cardiac Monitor/ CO Monitor
	Altered Mental Status Protocol UP 4 ***if indicated***
	Age Appropriate Diabetic Protocol AM 2/ PM 2 ***if indicated***
	Age Appropriate Multiple Trauma Protocol TB 6 Head Injury TB 5 ***if indicated***
	Age Appropriate Hypotension/ Shock Protocol AM 5/ PM 3 ***if indicated***

Contact Carolinas Poison Control 1-800-222-1222

High Suspicion of Cyanide

YES → P **Hydroxocobalamin 70 mg / kg IV / IO Maximum 5 g** ***If available***

NO

	Continue Care Continue High Flow Oxygen
	Monitor and Reasses

Notify Destination or Contact Medical Control

Pearls
- **Recommended exam: Neuro, Skin, Heart, Lungs, Abdomen, Extremities**
- **Scene safety is priority.**
- Consider CO and Cyanide with any product of combustion.
- Normal environmental CO level does not exclude CO poisoning.
- Symptoms present with lower CO levels in pregnancy, children, and the elderly.
- Continue high flow oxygen regardless of pulse ox readings.

Drowning

History
- Submersion in water regardless of depth
- Possible history of trauma
- Slammed into shore wave break
- Duration of submersion/ immersion
- Temperature of water or possibility of hypothermia

Signs and Symptoms
- Unresponsive
- Mental status changes
- Decreased or absent vital signs
- Foaming/ Vomiting
- Coughing, Wheezing, Rales, Rhonchi, Stridor
- Apnea

Differential
- Trauma
- Pre-existing medical problem
  - Hypoglycemia
  - Cardiac Dysrhythmia
- Pressure injury (SCUBA diving)
  - Barotrauma
  - Decompression sickness
- Post-immersion syndrome

Awake and Alert

- Supplemental Oxygen ***as tolerated***
- Spinal Motions Restriction Procedure/ Protocol TB 8 ***if indicated***
- Remove wet clothing Dry/ Warm Patient
- Monitor and Reassess
- **Encourage transport and evaluation even if asymptomatic or with minimal symptoms** *Asymptomatic drowning patients (refusing transport) should be instructed to seek medical care/call 911 if they develop any symptoms within 6 hours*
- IV or IO Access Protocol UP 6 ***if indicated***
- P Cardiac Monitor ***as indicated***

Awake but with AMS

- **5 Breaths via BVM**/ mouth-to-mouth ***as tolerated***
- Supplemental Oxygen ***as tolerated***
- Age Appropriate Airway Protocol(s) 1 - 7 ***as indicated***
- Spinal Motion Restriction Procedure/ Protocol TB 8 ***if indicated***
- Altered Mental Status Protocol UP 4 ***as indicated***
- Remove wet clothing Dry/ Warm Patient
- IV or IO Access Protocol UP 6
- P Cardiac Monitor

Age Appropriate Airway Protocol(s) AR 1 - 7 ***as indicated***

Unresponsive

- **5 Breaths via BVM**/ mouth-to-mouth ***as tolerated***

Pulse
- YES → Age Appropriate Airway Protocol(s) 1 - 7 ***as indicated***
- NO → Exit to Age Appropriate Cardiac Arrest Protocol(s) AC 3/ PC 4

Airway Protocol(s) AR 1 - 7
Spinal Motion Restriction Protocol TB 8 ***as indicated***

Dive Accident / Barotrauma
Divers Alert Network
1-919-684-9111

Notify Destination or Contact Medical Control

Pearls
- **Recommended Exam: Respiratory, Mental status, Trauma Survey, Skin, Neuro**
- **Drowning is the process of experiencing respiratory impairment (any respiratory symptom) from submersion/ immersion in a liquid.**
- **Begin with BVM ventilations, if patient does not tolerate, then apply appropriate mode of supplemental oxygen.**
- **Ensure scene safety. Drowning is a leading cause of death among would-be rescuers.**
- **When feasible, only appropriately trained and certified rescuers should remove patients from areas of danger.**
- **Regardless of water temperature – resuscitate all patients with known submersion time of ≤ 25 minutes.**
- **Regardless of water temperature – If submersion time ≥ 1 hour consider moving to recovery phase instead of rescue.**
- **Foam is usually present in airway and may be copious, DO NOT waste time attempting to suction. Ventilate with BVM through foam (suction water and vomit only when present.)**
- **Cardiac arrest in drowning is caused by hypoxia, airway and ventilation are equally important to high-quality CPR.**
- **Encourage transport of all symptomatic patients (cough, foam, dyspnea, abnormal lung sounds, hypoxia) due to potential worsening over the next 6 hours.**
- Predicting prognosis in prehospital setting is difficult and does not correlate with mental status. Unless obvious death, transport.
- Hypothermia is often associated with drowning and submersion injuries even with warm ambient conditions.
- Drowning patient typically has <1 – 3 mL/kg of water in lungs (does not require suction) Primary treatment is reversal of hypoxia.
- Spinal motion restriction is usually unnecessary. When indicated it should not interrupt ventilation, oxygenation and/ or CPR.

Hyperthermia

History
- Age, very young and old
- Exposure to increased temperatures and / or humidity
- Past medical history / Medications
- Time and duration of exposure
- Poor PO intake, extreme exertion
- Fatigue and / or muscle cramping

Signs and Symptoms
- Altered mental status / coma
- Hot, dry or sweaty skin
- Hypotension or shock
- Seizures
- Nausea

Differential
- Fever (Infection)
- Dehydration
- Medications
- Hyperthyroidism (Thyroid Storm)
- Delirium tremens (DT's)
- Heat cramps, exhaustion, stroke
- CNS lesions or tumors

Temperature Measurement Procedure
if available

Temperature Measurement should NOT delay treatment of hyperthermia

- Remove from heat source to cool environment
- Cooling measures
- Remove tight clothing
- Blood Glucose Analysis Procedure
- Age Appropriate Diabetic Protocol AM 2/ PM 2 ***as indicated***

Heat Stroke

Classic Heat Stroke
- Not common type
- Hot and Dry
- Altered Mental Status

Exertional Heat Stroke
- **Most common type**
- Wet with prior sweating
- Altered Mental Status

Assess Symptom Severity

HEAT CRAMPS
Normal to elevated body temperature
Warm, moist skin
Weakness, Muscle cramping

- PO Fluids as tolerated
- Monitor and Reassess

HEAT EXHAUSTION
Elevated body temperature
Cool, moist skin
Weakness, Anxious, Tachypnea

HEAT STROKE
Fever, usually > 104°F (40°C)
Hot, dry skin
Hypotension, AMS / Coma

- Age Appropriate Airway Protocol(s) AR 1 - 7 ***as indicated***
- Altered Mental Status Protocol UP 4 ***as indicated***
- Active cooling measures Target Temp < 102.5° F (39°C)
- **B** 12 Lead ECG Procedure
- IV or IO Access Protocol UP 6
- **P** Cardiac Monitor
- **A** **Normal Saline Bolus**
  500 mL IV / IO
  Repeat to effect SBP > 90
  Maximum 2 L
  PED: Bolus 20 mL/kg IV / IO
  Repeat to effect Age appropriate
  SBP ≥ 70 + 2 *x* Age
  Maximum 60 mL/kg
- Age Appropriate Hypotension/ Shock Protocol AM 5/ PM 3 ***as indicated***
- Monitor and Reassess

Notify Destination or Contact Medical Control

Hyperthermia

Pearls

- **Recommended Exam: Mental Status, Skin, HEENT, Heart, Lungs, Neuro**
- **Extremes of age are more prone to heat emergencies (i.e. very young and very old).**
- **Temperature measurement:**
  - **Obtain and document patient temperature if able.**
  - **Many thermometers and routes of measurement are available.**
  - **Order of preference for route of measurement: Rectal > oral > temporal > axillary.**
- Heat illness is predisposed by use of: tricyclic antidepressants, phenothiazines, anticholinergic medications, and alcohol.
- Cocaine, Amphetamines, and Salicylates may elevate body temperatures.
- Intense shivering may occur as patient is cooled.
- **Heat Cramps:**
  - Consists of benign muscle cramping secondary to dehydration and is not associated with an elevated temperature.
- **Heat Exhaustion:**
  - Consists of dehydration, salt depletion, dizziness, fever, mental status changes, headache, cramping, nausea and vomiting.
  - Vital signs usually consist of tachycardia, hypotension, and an elevated temperature.
- **Heat Stroke:**
  - Consists of dehydration, tachycardia, hypotension, temperature ≥ 104°F (40°C), and an altered mental status.
  - Sweating generally disappears as body temperature rises above 104°F (40°C).
  - The young and elderly are more prone to be dry with no sweating.
  - **Exertional Heat Stroke:**
  - **In exertional heat stroke (athletes, hard labor), the patient may have sweated profusely and be wet on exam.**
  - **Rapid cooling takes precedence over transport as early cooling decreases morbidity and mortality.**
  - **If available, immerse in an ice water bath for 20 minutes. Monitor rectal temperature and remove patient when temperature reaches 102.5°F (39°C). Your goal is to decrease rectal temperature below 104°F (40°C) with target of 102.5°F (39°C) within 15 minutes. Stirring the water aids in cooling.**
  - **Nearly 66% of all exertional heat strokes occur in high school athletes during the month of August.**
  - **In NC, it is mandatory that all high school field houses have a dunk tank and available ice and water.**
  - **Other methods include cold wet towels below and above the body or spraying cold water over body continuously.**
- **Neuroleptic Malignant Syndrome (NMS):**
  - Neuroleptic Malignant Syndrome is a hyperthermic emergency which is not related to heat exposure.
  - It occurs after taking neuroleptic antipsychotic medications.
  - This is a rare but often lethal syndrome characterized by muscular rigidity, AMS, tachycardia and hyperthermia.
  - **Drugs Associated with Neuroleptic Malignant Syndrome:**
  - Prochlorperazine (Compazine), promethazine (Phenergan), clozapine (Clozaril), risperidone (Risperdal) metoclopramide (Reglan), amoxapine (Ascendin), and lithium.
  - **Management of NMS:**
  - Supportive care with attention to hypotension and volume depletion.
  - Use benzodiazepines such as diazepam or midazolam for seizures and/ or muscular rigidity.

Hypothermia/ Frostbite

History
- Age, very young and old
- Exposure to decreased temperatures but may occur in normal temperatures
- Past medical history / Medications
- Drug use: Alcohol, barbituates
- Infections/ Sepsis
- Length of exposure/ Wetness/ Wind chill

Signs and Symptoms
- Altered mental status/ coma
- Cold, clammy
- Shivering
- Extremity pain or sensory abnormality
- Bradycardia
- Hypotension or shock

Differential
- Sepsis
- Environmental exposure
- Hypothyroidism
- Hypoglycemia
- CNS dysfunction
  - Stroke
  - Head injury
  - Spinal cord injury

Temperature Measurement Procedure ***if available***

Temperature Measurement should NOT delay treatment of hypothermia

Remove wet clothing
Dry/ Warm Patient

Passive warming measures

Blood Glucose Analysis Procedure

Age Appropriate
Diabetic Protocol AM 2/ PM 2
as indicated

Hypothermia / Frost Bite

Systemic Hypothermia

Localized Cold Injury

Awake with / without AMS

Unresponsive

General Wound Care

DO NOT Rub Skin to warm
DO NOT Massage
Skin to warm

DO NOT allow refreezing

Age Appropriate
Airway Protocol(s) AR 1 - 7
as indicated

YES — Pulse

NO

Exit to
Age Appropriate
Cardiac Protocol(s)
See Pearls

Altered Mental Status
Protocol UP 4
as indicated

Active warming measures

B 12 Lead ECG Procedure

IV or IO Access Protocol UP 6

A
Normal Saline Bolus
500 mL IV / IO
Repeat to titrate SBP > 90 mmHg
Maximum 2 L
Pediatric: 20 mL / kg IV / IO
Repeat to titrate Age Appropriate
SBP ≥ 70 + 2 x Age
Maximum 60 mL / kg

P Cardiac Monitor

Age Appropriate
Hypotension/ Shock
Protocol AM 5/ PM 3
Multiple Trauma Protocol TB 6
as indicated

Monitor and Reassess

Notify Destination or Contact Medical Control

Hypothermia/ Frostbite

Pearls

- **Recommended Exam: Mental Status, Heart, Lungs, Abdomen, Extremities, Neuro**
- **NO PATIENT IS DEAD UNTIL WARM AND DEAD (Body temperature ≥ 93.2° F, 32° C.)**
- **Temperature measurement:**
  - **Obtain and document patient temperature if able.**
  - **Many thermometers and routes of measurement are available.**
  - **Order of preference for route of measurement: Rectal > oral > temporal > axillary.**
  - **Many thermometers do not register temperature below 93.2° F.**
- **Hypothermia categories:**
  - Mild 90 – 95° F (32 – 35° C)
  - Moderate 82 – 90° F (28 – 32° C)
  - Severe < 82° F (< 28° C)
- **Mechanisms of hypothermia:**
  - Radiation: Heat loss to surrounding objects via infrared energy (60% of most heat loss.)
  - Convection: Direct transfer of heat to the surrounding air.
  - Conduction: Direct transfer of heat to direct contact with cooler objects (important in submersion.)
  - Evaporation: Vaporization of water from sweat or other body water losses.
- Contributing factors of hypothermia: Extremes of age, malnutrition, alcohol or other drug use.
- If the temperature is unable to be measured, treat the patient based on the suspected temperature.
- **CPR:**
  - **Severe hypothermia may cause cardiac instability and rough handling of the patient theoretically can cause ventricular fibrillation. This has not been demonstrated or confirmed by current evidence. Intubation and CPR techniques should not be with-held due to this concern.**
  - **Intubation can cause ventricular fibrillation, so it should be done gently by the most experienced provider(s).**
  - **Below 86°F (30° C) antiarrhythmics may not work and if given, should be given at increased time intervals. Contact medical control for direction. Epinephrine can be administered.**
  - **Below 86° F (30°C) pacing should not utilized.**
  - **Consider withholding CPR if patient has organized rhythm or has other signs of life. Contact Medical Control.**
  - **If the patient is below 86° F (30° C) then defibrillate 1 time if defibrillation is required. Deferring further attempts until more warming occurs is controversial. Contact medical control for direction.**
  - **Hypothermia may produce severe bradycardia so take at least 60 seconds to palpate a pulse.**
- **Active Warming:**
  - Remove from cold environment and into warm environment protected from wind and wet conditions.
  - Remove wet clothing and provide warm blankets/ warming blankets.
  - Hot packs can be activated and placed in the armpit and groin area if available. Care should be taken not to place the packs directly against the patient's skin.

Marine Envenomation/ Injury

History
- Type of bite/ sting
- Identification of organism
- Previous reaction to marine organism
- Immunocompromised
- Household pet

Signs and Symptoms
- Intense localized pain
- Increased oral secretions
- Nausea/ vomiting
- Abdominal cramping
- Allergic reaction / anaphylaxis

Differential
- Jellyfish sting
- Sea Urchin sting
- Sting ray barb
- Coral sting
- Swimmers itch
- Cone Shell sting
- Fish bite
- Lion Fish sting

Call for help/ additional resources
Stage until scene safe

Contact
Carolinas Poison Control
1-800-222-1222
Or
Agency Specific Number

- General Wound Care Procedure
- IV or IO Access Protocol UP 6 ***if indicated***
- P Cardiac Monitor ***if indicated***
- Drowning Protocol TE 3 ***if indicated***
- Age Appropriate Allergy/ Anaphylaxis Protocol AM 1/ PM 1 ***if indicated***
- Age Appropriate Hypotension/ Shock Protocol AM 5/ PM 3 ***if indicated***
- Pain Control Protocol UP 11 ***if indicated***

Identification of Sea Creature

Jelly Fish
Anemone
Man-O-War

- Immobilize injury
- Lift away tentacles
  Do Not brush or rub
- Immerse in Hot Water
  110 – 114°F (43 - 46°C)
  if available
- Apply Vinegar Rinse
  If available
  Otherwise wash with clean seawater
  DO NOT
  use fresh water or ice

Sting Ray
Lion Fish
Urchin / Starfish

- Immobilize injury
- Remove Barb or Spine
  If large Barb in thorax or abdomen stabilize object
- Immerse in Hot Water
  110 – 114°F (43 - 46°C)
  if available

Large Organism

- Immobilize injury
- Multiple Trauma Protocol TB 6 ***if indicated***
- Extremity Trauma Protocol TB 4 ***if indicated***

- Monitor and Reassess

Notify Destination or Contact Medical Control

Marine Envenomation/ Injury

Pearls

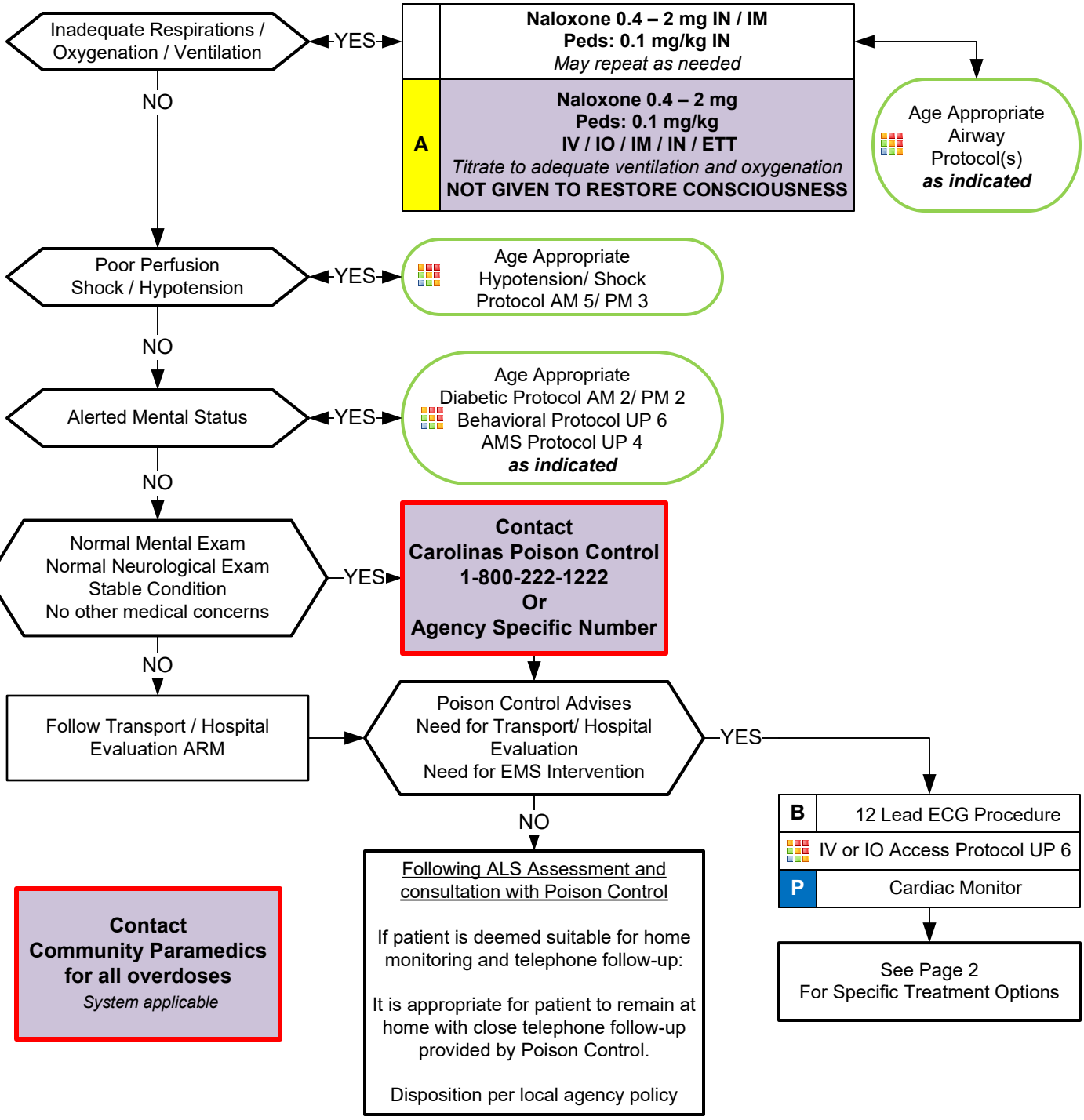
- **Ensure your safety: Avoid the organism or fragments of the organism as they may impart further sting or injury.**
- **Priority is removal of the patient from the water to prevent drowning.**
- **Coral:**
  - Coral is covered by various living organisms which are easily dislodged from the structure.
  - Victim may swim into coral causing small cuts and abrasions and the coral may enter into cuts, causing little if any symptoms initially, but later causing inflammation, pain and/ or infection.
  - The next 24 – 48 hours may reveal an inflammatory reaction with swelling, redness, itching, tenderness, and ulceration.
  - Treatment is flushing with large amounts of fresh water or soapy water then repeating.
- **Jelly Fish/ Anemone/ Man-O-War:**
  - Wash the area with fresh seawater to remove tentacles and nematocysts.
  - Do not apply fresh water or ice as this will cause nematocysts firing as well.
  - Recent evidence does not demonstrate a clear choice of any solution that neutralizes nematocysts.
  - Vinegar (immersion for 30 seconds), 50:50 mixture of Baking Soda and Seawater, and even meat tenderizer may have similar effects.
  - Immersion in warm water for 20 minutes, 110 – 114°F (43 - 46°C), is effective in pain control.
  - Shaving cream may be useful in removing the tentacles and nematocysts with a sharp edge (card).
  - Stimulation of the nematocysts by pressure or rubbing cause the nematocyst to fire even if detached from the jellyfish.
  - Lift away tentacles as scrapping or rubbing will cause nematocysts firing.
  - Typically symptoms are immediate stinging sensation on contact, intensity increases over 10 minutes.
  - Redness and itching usually occur.
  - Papules, vesicles and pustules may be noted and ulcers may form on the skin.
  - Increased oral secretions and gastrointestinal cramping, nausea, pain, or vomiting may occur.
  - Muscle spasm, respiratory, and cardiovascular collapse may follow.
- **Lionfish:**
  - In North Carolina this would typically occur in a residence/ business as lionfish are often kept as pets in saltwater aquariums.
  - Remove any obvious protruding spines and irrigate area with copious amounts of saline.
  - The venom is heat labile so immersion in hot water, 110 – 114°F for 30 to 90 minutes is the treatment of choice but do not delay transport if indicated.
- **Stingrays:**
  - Typical injury is swimmer stepping on ray and muscular tail drives 1 – 4 barbs into victim.
  - Venom released when barb is broken.
  - Typical symptoms are immediate pain which increases over 1 – 2 hours.
  - Bleeding may be profuse due to deep puncture wound.
  - Nausea, vomiting, diarrhea, muscle cramping, and increased urination and salivation may occur.
  - Seizures, hypotension, and respiratory or cardiovascular collapse may occur.
  - Irrigate wound with saline. Extract the spine or barb unless in the abdomen or thorax, Contact Medical Control for advice.
  - Immersion in hot water, if available, for 30 to 90 minutes but do not delay transport.
- Patients can suffer cardiovascular collapse from both the venom and/ or anaphylaxis even in seemingly minor envenomation.
- Sea creature stings and bites impart moderate to severe pain.
- Arrest the envenomation by inactivation of the venom as appropriate.
- Ensure good wound care, immobilization and pain control.

Overdose/ Toxic Ingestion

History
- Ingestion or suspected ingestion of a potentially toxic substance
- Substance ingested, route, quantity
- Time of ingestion
- Reason (suicidal, accidental, criminal)
- Available medications in home
- Past medical history, medications

Signs and Symptoms
- Mental status changes
- Hypotension / hypertension
- Decreased respiratory rate
- Tachycardia, dysrhythmias
- Seizures
- S.L.U.D.G.E.
- D.U.M.B.B.E.L.S

Differential
- Tricyclic antidepressants (TCAs)
- Acetaminophen (Tylenol)
- Aspirin
- Depressants
- Stimulants
- Anticholinergic
- Cardiac medications
- Solvents, Alcohols, Cleaning agents
- Insecticides (organophosphates)



Overdose/ Toxic Ingestion

Acetaminophen
Tylenol®
APAP Containing Product

YES → **B**
If Time of Ingestion ≤ 1 Hour
Activated Charcoal 1 gm/kg PO
Maximum 50 gm
If available

NO

Aspirin
Salicylate Containing Product

YES → **B**
If Time of Ingestion ≤ 1 Hour
Activated Charcoal 1 gm/kg PO
Maximum 50 gm
If available

NO

Beta Blocker or
Calcium Channel Blocker

YES → **B**
If Time of Ingestion ≤ 1 Hour
Activated Charcoal 1 gm/kg PO
Maximum 50 gm
If available

A
Glucagon 2 – 4 mg IV / IO / IM
Peds: 0.1 mg/kg IV / IO / IM
May repeat x 1 in 15 minutes as needed

P
Calcium Gluconate 2 g IV / IO
Or
(Calcium Chloride 1 g IV / IO)
Pediatric: 20 mg / kg IV / IO
Over 2- 3 minutes

Consider
Cardiac External Pacing Procedure for Severe Cases

Age Appropriate Hypotension/ Shock
Protocol AM 5/ PM 3
if indicated

NO

Cyanide/
Carbon Monoxide

YES → Exit to
Carbon Monoxide/ Cyanide
Protocol TE 2

NO

Organophosphate
WMD/ Nerve Agent Exposure

YES → Exit to
WMD/ Nerve Agent
Protocol TE 8

NO

Tricyclic
Antidepressant

YES → **B**
If Time of Ingestion ≤ 1 Hour
Activated Charcoal 1 gm/kg PO
Maximum 50 gm
if available

P
QRS ≥ 0.12 sec or Peds: 0.09 sec
Sodium Bicarbonate
100 mEq IV / IO
Peds: 1 mEq/kg IV / IO
Repeat in 10 minutes as needed

Sodium Bicarbonate Infusion

Symptomatic Care
as needed

Monitor and Reassess

Notify Destination or
Contact Medical Control

Overdose/ Toxic Ingestion

Onslow County:

Agencies responding to 911 calls inside Onslow County (off Marine Corps Base Camp Lejeune) should notify Onslow County EMS Community Paramedics / Mobile Integrated Health Division of all overdoses. Leave-behind naloxone kit should be left on scene with patient's friend/family if appropriate for situation. Please see Disposition 8 for further guidance on opioid-related refusals.

For overdoses that occur on Marine Corps Base Camp Lejeune, follow applicable Department of Defense policy and procedures.

Pearls

- **Recommended Exam: Mental Status, Skin, HEENT, Heart, Lungs, Abdomen, Extremities, Neuro**
- **Opioids and opiates may require higher doses of Naloxone to improve respiration, in certain circumstances up to 10 mg.**
- **Time of Ingestion:**
  1. **Most important aspect is the TIME OF INGESTION, the substance(s), amount ingested, and any co-ingestants.**
  2. **Every effort should be made to elicit this information before leaving the scene.**
- **Charcoal Administration:**
  The American Academy of Clinical Toxicology DOES NOT recommend the routine use of charcoal in poisonings.
  1. **Consider Charcoal within the FIRST HOUR after ingestion. If a potentially life threatening substance is ingested or extended release agent(s) are involved and ≥ one hour from ingestion, Contact Medical Control or NC Poison Control Center for direction.**
  2. **If NG would be necessary to administer Charcoal, then DO NOT administer unless known to be adsorbed, airway secured by intubation, and ingestion is less than ONE HOUR confirmed and potentially lethal.**
  3. **Charcoal in general, should only be given to a patient who is alert and awake such that they can self-administer the medication.**
- **Do not rely on patient history of ingestion, especially in suicide attempts. Make sure patient is still not carrying hiding other medications or has any weapons.**
- **Pediatric:**
  Age specific blood pressure 0 – 28 days > 60 mmHg, 1 month - 1 year > 70 mmHg, 1 - 10 years > 70 + (2 x age)mmHg and > 10 years > 90 mmHg.
  Pediatric IV Fluid maintenance rate:
  4 mL for the first 10 kg of weight +
  2 mL for the second 10 kg of weight +
  1 mL for every additional kg in weight after 20 kg

Example: 34 kg pediatric	
First 10 kg:	4 mL/kg/hr = 40 mL/hr
Second 10 kg:	2 mL/kg/hr = 20 mL/hr
Final 14 Kg:	1 mL/kg//hr = 14 mL/hr
	Total: 74 mL/hr rate

- **Bring bottles, contents, emesis to ED.**
- **S.L.U.D.G.E: Salivation, Lacrimation, Urination, Defecation, GI distress, Emesis.**
- **D.U.M.B.B.E.L.S: Diarrhea, Urination, Miosis, Bradycardia, Bronchorrhea, Emesis, Lacrimation, Salivation.**
- **Tricyclic:** 4 major areas of toxicity: seizures, dysrhythmias, hypotension, decreased mental status or coma; rapid progression from alert mental status to death.
- **Acetaminophen:** initially normal or nausea/ vomiting. If not detected and treated, causes irreversible liver failure.
- **Aspirin**: Early signs consist of abdominal pain and vomiting. Tachypnea and altered mental status may occur later. Renal dysfunction, liver failure, and or cerebral edema among other things can take place later.
- **Depressants:** decreased HR, decreased BP, decreased temperature, decreased respirations, non-specific pupils.
- **Stimulants:** increased HR, increased BP, increased temperature, dilated pupils, seizures.
- **Anticholinergic:** increased HR, increased temperature, dilated pupils, mental status changes.
- **Cardiac Medications:** dysrhythmias and mental status changes.
- **Solvents:** nausea, coughing, vomiting, and mental status changes.
- **Insecticides:** increased or decreased HR, increased secretions, nausea, vomiting, diarrhea, pinpoint pupils.
- **Nerve Agent Antidote kits** contain 2 mg of Atropine and 600 mg of pralidoxime in an autoinjector for self administration or patient care. These kits may be available as part of the domestic preparedness for Weapons of Mass Destruction.
- **EMR and EMT may administer naloxone by IN / IM route only and may administer from EMS supply. Agency medical director may require Contact of Medical Control prior to administration and may restrict locally.**
- **When appropriate contact the North Carolina Poison Control Center for guidance, reference Policy 18.**
- Consider restraints if necessary for patient's and/or personnel's protection per the Restraint Procedure.

WMD-Nerve Agent Protocol

History
- Exposure to chemical, biologic, radiologic, or nuclear hazard
- Potential exposure to unknown substance/hazard

Signs and Symptoms
- **S**alivation
- **L**acrimation
- **U**rination; increased, loss of control
- **D**efecation / Diarrhea
- **G**I Upset; Abdominal pain / cramping
- **E**mesis
- **M**uscle Twitching
- Seizure Activity
- Respiratory Arrest

Differential
- Nerve agent exposure (e.g., VX, Sarin, Soman, etc.)
- Organophosphate exposure (pesticide)
- Vesicant exposure (e.g., Mustard Gas, etc.)
- Respiratory Irritant Exposure (e.g., Hydrogen Sulfide, Ammonia, Chlorine, etc.)

Call for help/ additional resources
Stage until scene safe

Obtain history of exposure
Observe for specific toxidromes
Initiate triage and/or decontamination as indicated.

Contact
Carolinas Poison Control
1-800-222-1222
Or
Agency Specific Number

Symptom Severity

Asymptomatic

Monitor and Reassess
Every 15 minutes for symptoms
Initiate Treatment per Appropriate Arm

Minor Symptoms:
Respiratory Distress + SLUDGEM

IV or IO Access Protocol UP 6

Nerve Agent Kit IM
2 Doses Rapidly
if available

Major Symptoms:
Altered Mental Status, Seizures, Respiratory Distress, Respiratory Arrest

IV or IO Access Protocol UP 6

Nerve Agent Kit IM
3 Doses Rapidly
if available

P

Atropine 2 mg IV / IO / IM
Pediatric: See Pearls
IV / IO / IM
Repeat every 3 to 5 minutes until symptoms resolve

Pralidoxime (2PAM)
600 mg IV / IO / IM
Pediatric: 15 – 25 mg / kg
IV / IO / IM
Over 30 minutes

Seizure Protocol UP 13

CDC/ ASPR
CHEMPACK Program
NC -57 EMS containers
-43 locations

Almost all citizens within 50 miles of CHEMPACK
See Page 2 and Pearls

Multiple Patients — YES

Consider
Activation and deployment of CHEMPACK
CHEMPACK ACTIVATION:
(insert local number)

Healthcare Coalition Activation
(insert local number)

NO

Notify Destination or Contact Medical Control

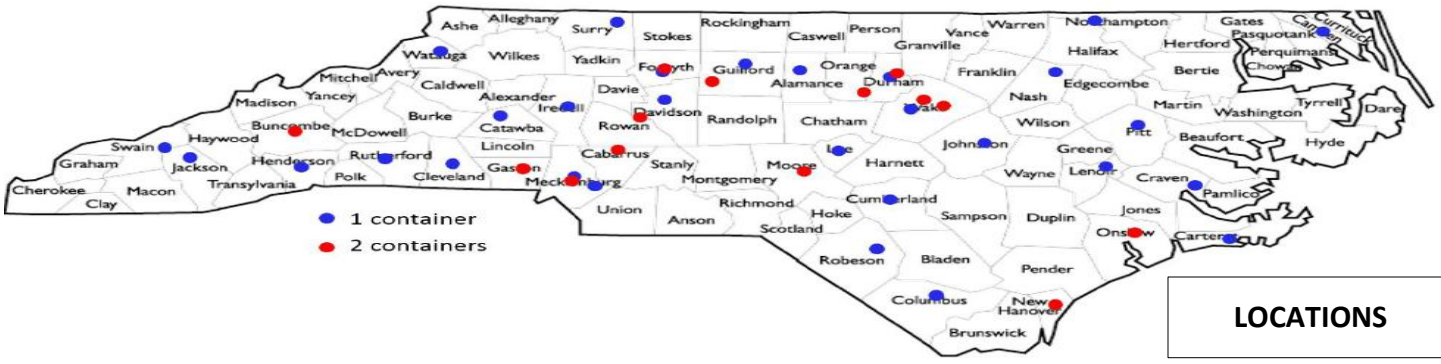
WMD-Nerve Agent Protocol

Pearls

- **Recommended Exam: Mental Status, Skin, HEENT, Heart, Lungs, Gastrointestinal, Neuro**
- **Follow local HAZMAT protocols for decontamination and use of personal protective equipment.**
- **Adult/ Pediatric Atropine Dosing Guides:**
  - **Confirmed attack: Begin with 1 Nerve Agent Kit for patients less than 7 years of age, 2 Nerve Agent Kits from 8 to 14 years of age, and 3 Nerve Agent Kits for patients 15 years of age and over.**
  - **If Triage/ MCI issues exhaust supply of Nerve Agent Kits, use pediatric atropines (if available).**
  - **Usual pediatric doses: 0.5 mg ≤ 40 pounds (18 kg), 1 mg dose if patient weighs between 40 to 90 pounds (18 to 40 kg), and 2 mg dose ≥ 90 pounds (≥ 40 kg).**
- **Each Nerve Agent Kit contains 600 mg of Pralidoxime (2-PAM) and 2 mg of Atropine.**
- **Seizure Activity: Any benzodiazepine by any route is acceptable.**
- For patients with major symptoms, there is no limit for atropine dosing.
- Carefully evaluate patients to ensure they do not have exposure to other agent(s) (e.g., narcotics, vesicants, etc.)
- The main symptom that the atropine addresses is excessive secretions, so atropine should be given until secretions improve/ dry.
- EMS personnel, public safety officers and EMR/ EMT may carry, self-administer, or administer atropine/ pralidoxime to others by protocol. Agency medical director may require Contact of Medical Control prior to administration.
- **CHEMPACK Program:**
  - For multiple patients, call for **CHEMPACK** deployment per local emergency management and healthcare coalition plans.
  - **1 EMS CHEMPACK supports 454 patients.**
  - Medication in CHEMPACK may be used regardless of expiration date.

EMS Type CHEMPACK Container
454 Person Treatment Capacity

Product	Cases	Units per case	Total Units
Mark 1 Auto-injector	5	240	1,200
-OR			
ATNAA Auto-injector	6	200	1,200
-OR-			
Atropen 2mg Auto-injector	9	136	1,224
Pralidoxime 300mg Auto-injector	5	240	1,200
-AND-			
Diazepam 10mg Auto-injector	2	300	600
Seizalam (Midazolam) 5mg/ml vial 10ml	1	100	100
Atropen 0.5mg Auto-injector	1	225	225
Atropen 1mg Auto-injector	1	225	225
Atropine Sulfate 0.4mg/ml vial 20ml	1	100	100
Pralidoxime 1gm inj. 20ml	1	276	276
Sterile Water 20ml vials	1	150	150



LOCATIONS

Toxic Exposure AHF Skin

History

- Known skin contacted by HF, vapor, or aqueous solution.
- Concentration of AHF
- Time of exposure

Signs and Symptoms

- Rapidly produces an erythematous area.
- White or gray color at the surface.
- Extreme pain.

Scene Safety / Quantify and Triage Patients / Begin Decontamination

Triage Protocol UP2 as indicated

Flush 5 minutes with copious amounts of water. Remove all clothing.

Age Appropriate Airway Protocol(s) 1, 2, 3, 4, 5, 6

A IV or IO Procedure UP 6 if indicated

P Cardiac Monitor if indicated

Rubber / Acid Resistant gloves MUST be worn when touching patient

B Apply calcium gluconate 2.5% gel on exposed area.
If pain significantly decreases or resolves within 20-30 minutes stop and observe.
OR
Immersion or compress with iced zephiran solution (0.13% benzalkonium chloride).

Exposure Level

Pain is Being Controlled

B If burn is responding to standard treatments (calcium gluconate gel or zephiran soaks) continue until pain subsides.

P Monitor cardiac rhythm closely.

Pain Is Not Controlled

P Inject Calcium Gluconate solution 2.5-5% into, around, and under all injuries.
Do not inject digits, nose flaps, or ear lobes. This will cause necrosis.
Do not use anesthetics which may hide pain perception, which is used to determine the amount of calcium gluconate to inject.
Treat injuries after injection as you would any other open wounds.

If QT interval increase by 50% of become >.50 consider Calcium Gluconate IV.

Rapid Transport to appropriate destination using
Trauma and Burn: EMS Triage and Destination Plan

Notify Destination

Toxin-Environmental Protocol Section

Toxic Exposure AHF Skin

Contact Local Haz-Mat Team / Fire Dept for decontamination.

Patient's exposed to AHF are best served at a Burn Trauma Center

Pearls

- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro**
- **RESPONDERS MUST WEAR RUBBER (NEOPRENE OR POLYVINYL CHLORIDE (PVC)) GLOVES WHEN TREATING AHF BURNS.**
- Green, Yellow, and Red In burn severity do not apply to Triage systems.
- Refer to Rule of Nines: Determine the purity of the AHF is possible.
- Do not flush more than 5 minutes the begin Calcium Gluconate Cream treatment. Remove all clothing during decontamination process to avoid residual exposure.
- Treat additional traumatic injuries per appropriate protocol.

Toxic Exposure AHF Eye

History
- Known eye contacted by HF, vapor, or aqueous solution.
- Concentration of AHF.
- Time of exposure.

Signs and Symptoms
- Severe irritation, chemical burns to eyelids and peri-ocular skin.
- Corneal opacities, pitting or ulceration, possible vision loss.
- Extreme pain.

Differential
- Sulfuric acid exposure.
- Phosphoric acid exposure.
- Other caustic exposure.

Scene Safety / Quantify and Triage Patients / Begin Decontamination

Consider Inhalation Injury. facial/head skin exposure

Triage Protocol UP2 as indicated

Flush 5 minutes with copious amounts of water. Remove all clothing.

Age Appropriate Airway Protocol(s) 1, 2, 3, 4, 5, 6

A IV or IO Procedure UP 6 if indicated

P Cardiac Monitor

Morgan Lens Available

No

P
- Irrigate each eye with 1000cc of a 1% calcium gluconate solution (no higher than 1%) for a minimum period of 15 minutes.
- Use standard IV tubing fixed to the forehead if one eye is exposed. For both eyes use a nasal cannula (designed for oxygen delivery) mounted on the nose
- Always obtain specialized medical evaluation & treatment.

Yes

P
- Place two drops of tetracaine in each eye if available. This will simplify the use of the "Morgan lens."
- Insure calcium gluconate solution is flowing before inserting Morgan lens and until removed.
- Irrigate each eye with 1000cc of a 1% calcium gluconate solution (no higher than 1%) for a minimum period of 15 minutes. **If tetracaine is used continue irrigation until evaluated by doctor.**
- Treat only effected eye(s)
- Always obtain specialized medical evaluation & treatment.

During transportation to a medical facility or while waiting for a physician to see the victim, it is extremely important to continue the calcium gluconate irrigation.

P Monitor cardiac rhythm closely.

If QT interval increase by 50% of become >.50 consider Calcium Gluconate IV.

Rapid Transport to appropriate destination using Trauma and Burn: EMS Triage and Destination Plan

Notify Destination

Toxin-Environmental Protocol Section

Toxic Exposure AHF Eye

Pearls

- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro.**
- **RESPONDERS MUST WEAR RUBBER (NEOPRENE OR POLYVINYL CHLORIDE (PVC)) GLOVES WHEN TREATING AHF BURNS.**
- Green, Yellow, and Red In burn severity do not apply to Triage systems.
- Refer to Rule of Nines: Determine the purity of the AHF is possible.
- If Eye exposure exist consider Skin, Inhalation, and Ingestion and treat as needed.

Toxic Exposure AHF Inhalation

History

- Known or suspected inhalation of HF vapor.
- Concentration of AHF
- Time of exposure

Signs and Symptoms

- Coughing
- Shortness of breath
- Mucosal bleeding
- Pulmonary edema
- Labored breathing
- Bronchial spasm
- Upper airway edema
- Cardiac arrhythmia
- Erythema (reddening), swelling of the mouth, nose, and throat

Scene Safety / Quantify and Triage Patients / Begin Decontamination

Rubber / Acid Resistant gloves MUST be worn when touching patient

Triage Protocol UP2 as indicated

No decontamination possible. Exposure to HF vapors, consider skin and eye exposure. Refer to appropriate protocol.

Age Appropriate Airway Protocol(s) 1, 2, 3, 4, 5, 6

A IV or IO Procedure UP 6 if indicated

P Cardiac Monitor if indicated

Exposure Level

Minimal or no systemic effects expected

B
- Administer oxygen by nonrebreather mask at 15 liters per minute.

P
- **Calcium Gluconate Nebulizer 2.5%** in normal saline for 15 to 20 minutes minimum.

Respiratory, skin, eyes, and systemic effects

B
- Administer oxygen by nonrebreather mask @ 15 liters per minute.
- **Albuterol Nebulizer 2.5 - 5 mg** (do not pause calcium gluconate to give)

A
- Consider CPAP.
  Methylprednisolone 125 mg IV / IO

P
- **Calcium Gluconate Nebulizer 2.5%** in normal saline continuously until medically evaluated.

P Should QT interval increase by 50% of become >.50 consider Calcium Gluconate IV.

Rapid Transport to appropriate destination using Trauma and Burn: EMS Triage and Destination Plan

Notify Destination

Toxin-Environmental Protocol Section

Toxic Exposure AHF Inhalation

- Administer oxygen by nonrebreather mask @ 15 liters per minute.
- **Calcium Gluconate Nebulizer 2.5%** in normal saline continuously until medically evaluated.
- **Albuterol Nebulizer 2.5 - 5 mg** (do not pause calcium gluconate to give)

Consider CPAP.

- **Methylprednisolone 125 mg IV / IO**

Pearls

- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro.**
- **RESPONDERS MUST WEAR RUBBER (NEOPRENE OR POLYVINYL CHLORIDE (PVC)) GLOVES WHEN TREATING AHF BURNS.**
- Green, Yellow, and Red In burn severity do not apply to Triage systems.
- Refer to Rule of Nines: Determine the purity of the AHF is possible.
- If Inhalation injury has occurred consider Skin, Eye, and Ingestion and treat as needed.

Toxic Exposure AHF Ingestion

History

- Known or suspected HF ingestion.
- Concentration of AHF
- Time of exposure

Signs and Symptom

- Reddening or bleeding of the mouth
- Difficulty swallowing
- Bronchial or pulmonary injury if aspiration if vomiting occurs.
- Systemic toxicity should be expected.
- Cardiac arrhythmia. • Death.

Scene Safety / Quantify and Triage Patients / Begin Decontamination

Triage Protocol UP2 as indicated	
Surrounding areas. Flush 5 minutes with copious amounts of water. Remove all clothing.	
Age Appropriate Airway Protocol(s) 1, 2, 3, 4, 5, 6	
A	IV or IO Procedure UP 6 if indicated
P	Cardiac Monitor if indicated

DO NOT INDUCE VOMITING!
If patient is able to swallow, give oral calcium solutions or calcium based antacids, milk or water.

P

Consider Gastric Tube Insertion Procedure

Gastric lavage with calcium solutions or antacids.

Monitor cardiac rhythm closely.

P Should QT interval increase by 50% of become >.50 consider Calcium Gluconate IV.

Rapid Transport to appropriate destination using
Trauma and Burn: EMS Triage and Destination Plan

Notify Destination

Toxin-Environmental Protocol Section

Toxic Exposure AHF Ingestion

- **Pearls**
- **Recommended Exam: Mental Status, HEENT, Neck, Heart, Lungs, Abdomen, Extremities, Back, and Neuro.**
- **RESPONDERS MUST WEAR RUBBER (NEOPRENE OR POLYVINYL CHLORIDE (PVC)) GLOVES WHEN TREATING AHF BURNS.**
- Green, Yellow, and Red In burn severity do not apply to Triage systems.
- Refer to Rule of Nines: Determine the purity of the AHF is possible.
- If Ingestion exist consider Skin, Inhalation, and Eye exposure and treat as needed.