



# National Model EMS Clinical Guidelines

## Abstract

These guidelines will be maintained by NASEMSO to facilitate the creation of state and local EMS system clinical guidelines, protocols or operating procedures. System medical directors and other leaders are invited to harvest content as will be useful. These guidelines are either evidence-based or consensus-based and have been formatted for use by field EMS professionals.

NASEMSO Medical Directors Council

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## Introduction

*The Future of Emergency Care: Emergency Medical Services at the Crossroads*, an Institute of Medicine report published in 2007, states “NHTSA, in partnership with professional organizations, should convene a panel of individuals with multidisciplinary expertise to develop evidence-based model prehospital care protocols for the treatment, triage, and transport of patients.” The National Highway Transportation Safety Administration, Office of EMS (NHTSA OEMS) has embraced this recommendation with the development of the Evidence-Based Guideline Project.

The National Association of State EMS Officials (NASEMSO) recognizes the need for national EMS clinical guidelines to help state EMS systems ensure a more standardized approach to the practice of patient care now, and as experience dictates adoption of future practices. Model EMS clinical guidelines promote uniformity in prehospital care which, in turn, promotes more consistently skilled practice as EMS providers move across healthcare systems. They also provide a standard to EMS Medical Directors upon which to base practice. Supported by grant funding from NHTSA OEMS and the Health Resources and Services Administration (HRSA), NASEMSO authorized its Medical Directors Council to partner with national stakeholder organizations with expertise in EMS medical direction and subject matter experts to create a unified set of patient care guidelines. For the aspects of clinical care where evidence-based guidelines derived in accordance with the national evidence-based guideline model process were not available, consensus-based clinical guidelines were developed utilizing currently available research.

The NASEMSO Model EMS Clinical Guidelines are not mandatory nor are they meant to be all-inclusive or to determine local scope of practice. The focus of these guidelines is solely patient-centric. As such, they are designed to provide a resource to clinical practice, maximize patient care, safety, and outcomes regardless of the existing resources and capabilities within an EMS system. They are a set of clinical guidelines that can be used as is or adapted for use on a state, regional or local level to enhance patient care and benchmark performance of EMS practice. Emergency care and EMS delivery is, by nature, inherently dynamic. NASEMSO supports the evolution of the model EMS clinical guidelines as new EMS research and evidence-based patient care measures emerge in the future.

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## Purpose and Notes

These guidelines are intended to help state EMS systems ensure a more standardized approach to the practice of patient care, and to encompass evidence-based guidelines as they are developed.

The long-term goal is to develop a full range of evidence-based prehospital care clinical guidelines. However, until there is a sufficient body of evidence to fully support this goal, there is a need for this interim expert, consensus-based step.

The National Model EMS Clinical Guidelines can fill a significant gap in uniform clinical guidance for EMS patient care, while also providing input to the evidence-based guideline (EBG) development process.

These guidelines will be maintained by the Medical Director Council of the National Association of State EMS Officials (NASEMSO) and will be reviewed and updated periodically. As EBG material is developed, it will be substituted for the consensus-based guidelines now comprising the majority of the content of this document. In the interim, additional consensus-based guidelines will also be added as the need is identified. For guidelines to be considered for inclusion, they must be presented in the format followed by all guidelines in the document.

**Universal Care and Poisoning/Overdose Universal Care** guidelines are included to reduce the need for extensive reiteration of basic assessment and other considerations in every guideline.

The appendices contain material such as neurologic status assessment and burn assessment tools to which many guidelines refer to increase consistency in internal standardization and to reduce duplication.

While some specific guidelines have been included for pediatric patients, considerations of patient age and size (pediatric, geriatric and bariatric) have been interwoven in the guidelines throughout the document.

**Where IV access and drug routing is specified, it is intended to include IO access and drug routing when IV access and drug routing is not possible.**

Generic medication names are utilized throughout the guidelines. A complete list of these, along with respective brand names, may be found in Appendix III “Medications”.

NEMSIS - Accurate and quality data collection is crucial to the advancement of EMS and a critical element of EMS research. The National EMS Information System (NEMSIS) has the unique ability to unify EMS data on a national scope to fulfill this need. Each guideline, therefore, is also listed by the closest NEMSIS Version 3 Label and Code corresponding to it, listed in parentheses below the guideline name.

## Target Audience

While this material is intended to be integrated into an EMS system’s operational guidance materials by its medical director and other leaders, it is written with the intention that it will be consumed by field EMS practitioners.

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To the degree possible, it has been assembled in a format useful for guidance and quick reference so that leaders may adopt it in whole or in part, harvesting and integrating as they deem appropriate to the format of their guideline, protocol, or procedure materials.

## Acknowledgements

The authors of this document are NASEMSO Medical Director Council members partnered with representatives of seven EMS medical director stakeholder organizations. The stakeholder organizations are the American Academy of Emergency Medicine (AAEM), the American Academy of Pediatrics (AAP), the American College of Emergency Physicians (ACEP), the American College of Osteopathic Emergency Physicians (ACOEP), the American College of Surgeons Committee on Trauma (ACS-COT), the Air Medical Physician Association (AMPA), and the National Association of EMS Physicians (NAEMSP).

# Universal Care

## Universal Care Guideline

(9914075 – Universal Patient Care/Initial Patient Contact)

### **Patient Care Goals**

Facilitate appropriate initial assessment and management of any EMS patient and link to appropriate specific guidelines as dictated by the findings within the universal care guideline

### **Patient Presentation**

#### **Inclusion Criteria**

All patient encounters with and care delivery by EMS personnel

#### **Exclusion Criteria**

None

### **Patient Management**

#### **Assessment**

1. Assess scene safety: evaluate for hazards to EMS personnel, patient, bystanders
  - a. Determine number of patients
  - b. Determine mechanism of injury
  - c. Request additional resources if needed. Weigh the benefits of waiting for additional resources against rapid transport to definitive care
  - d. Consider declaration of mass casualty incident if needed
2. Use appropriate personal protective equipment
3. Consider cervical spine stabilization if trauma
4. Primary Survey (**Airway, Breathing, Circulation** is cited below. There are specific circumstances where **Circulation, Airway, Breathing** may be recommended by direct medical oversight)
  - a. Airway: assess for patency and open the airway as indicated
    - i. Patient is unable to maintain airway patency—open airway
      1. Head tilt chin lift
      2. Jaw thrust
      3. Suction
      4. Consider use of the appropriate airway management adjuncts and devices: oral airway, nasal airway, blind insertion or supraglottic airway device, laryngeal mask airway, endotracheal tube
    - ii. Obstructed airway: go to **Prehospital Airway Management/Confirmation/Obstruction/Failed Airway** guideline
  - b. Breathing:
    - i. Evaluate rate, breath sounds, accessory muscle use, retractions, patient positioning
    - ii. Administer oxygen as appropriate with a goal of  $\geq 94\%$  oxygen saturation for most acutely ill patients



- iii. Apnea (not breathing): go to **Prehospital Airway Management/Confirmation/Obstruction/Failed Airway** guideline
  - c. Circulation:
    - i. Assess pulse
      - 1. If none: go to **Cardiac Arrest (VF/VT/Asystole/PEA)** guideline
      - 2. Assess rate and quality of carotid and radial pulses
    - ii. Evaluate perfusion by assessing skin color and temperature
      - 1. Evaluate capillary refill
      - 2. Control any major external bleeding. See also **Extremity Trauma/External Hemorrhage Management** guideline
  - d. Disability
    - i. Evaluate patient responsiveness: AVPU scale (Alert, Verbal, Pain, Unresponsive; see **6. Obtain baseline vital signs a.**, below)
    - ii. Evaluate gross motor and sensory function in all extremities
    - iii. Evaluate blood glucose in patients with altered mental status
    - iv. If acute stroke suspected, go to **Suspected Stroke/Transient Ischemic Attack** guideline
  - e. Expose patient as appropriate to complaint
    - i. Be considerate of patient modesty
    - ii. Keep patient warm
5. Secondary Survey
- The performance of the secondary survey should not delay transport in critical patients. See also secondary survey specific to individual complaints in other protocols. Secondary surveys should be tailored to patient presentation and chief complaint. The following are suggested considerations for secondary survey assessment:
- a. Head:
    - i. Pupils
    - ii. Naso-oropharynx
    - iii. Skull and scalp
  - b. Neck
    - i. Jugular venous distension
    - ii. Tracheal position
  - c. Chest
    - i. Retractions
    - ii. Breath sounds
    - iii. Chest wall deformity
  - d. Abdomen/Back
    - i. Flank/abdominal tenderness or bruising
    - ii. Abdominal distension
  - e. Extremities
    - i. Edema
    - ii. Pulses
    - iii. Deformity
  - f. Neurologic
    - i. Mental status/orientation
    - ii. Motor/sensory

6. Obtain baseline vital signs
  - a. An initial full set of vital signs is required: pulse, blood pressure, respiratory rate, neurologic status assessment. Neurologic status assessment (see **Appendix VI**) involves establishing a baseline and then trending any change in patient neurologic status. Glasgow Coma Score (GCS) is frequently used, but there are often errors in applying and calculating this score. With this in consideration, Glasgow Coma Score may not be more valid than a simpler field approach. Either AVPU (Alert, Verbal, Painful, Unresponsive – see below) or only the motor component of the GCS may more effectively serve in this capacity
  - b. Patients with cardiac or respiratory complaints
    - i. Pulse oximetry
    - ii. 12-lead EKG should be obtained early in patients with cardiac complaints
    - iii. Continuous cardiac monitoring, if available
    - iv. Consider waveform capnography
  - c. Patient with altered mental status
    - i. Assess blood glucose
    - ii. Consider waveform capnography
  - d. Stable patients should have at least two sets of pertinent vital signs. Ideally, one set should be taken shortly before arrival at receiving facility
  - e. Critical patients should have pertinent vital signs frequently monitored
7. Obtain OPQRST history:
  - a. O: onset of symptoms
  - b. P: provocation – location; any exacerbating or alleviating factors
  - c. Q: quality of pain
  - d. R: radiation of pain
  - e. S: severity of symptoms - pain scale
  - f. T: time of onset and circumstances around onset
8. Obtain SAMPLE history:
  - a. S: symptoms
  - b. A: allergies - medication, environmental, and foods
  - c. M: medications - both prescription and over-the-counter; bring all containers to hospital if possible
  - d. P: past medical history
    - i. look for medical alert tags, portable medical records, advance directives
    - ii. look for medical devices/implants: some common ones may be dialysis shunt, insulin pump, pacemaker, central venous access port, gastric tubes, urinary catheter
  - e. L: last oral intake
  - f. E: events leading up to the 911 call. In patient with syncope, seizure, altered mental status, or acute stroke, consider bringing witness to the hospital or obtain their contact phone number to provide to ED care team

**Treatment and Interventions:**

1. Oxygen supplementation if needed to reach target of  $\geq 94\%$
2. Place appropriate monitoring equipment as dictated by assessment. These may include
  - a. Continuous pulse oximetry
  - b. Cardiac rhythm monitoring

- c. Waveform capnography
- d. Carbon monoxide assessment
- 3. Establish vascular access if indicated or in patients who are at risk for clinical deterioration
- 4. Monitor pain scale if appropriate
- 5. Reassess patient

#### **Patient safety considerations**

- 1. Routine use of lights and sirens is not warranted
- 2. Be aware of legal issues and patient rights as they pertain to and impact patient care, e.g. patients with functional needs or children with special healthcare needs
- 3. Be aware of potential need to adjust management based on patient age and/or comorbidities, including medication dosages
- 4. The maximum weight-based dose of medication administered to a pediatric patient should not exceed the maximum adult dose except where specifically stated in a patient care guideline
- 5. Direct medical oversight should be contacted when mandated or as needed

#### **Notes/Educational Pearls**

##### **Key considerations**

- 1. Pediatrics: use a weight-based assessment tool (length-based tape or other system) to estimate patient weight and guide medication therapy and adjunct choice. Although the defined age varies by state, the pediatric population is generally defined by those patients who weigh up to 40 kg or up to 14 years of age, whichever comes first
- 2. Geriatrics: although the defined age varies by state, the geriatric population is generally defined as those patients who are 65 years old or more. In these patients, as well as all adult patients, reduced medication dosages may apply to patients with renal disease (i.e. on dialysis or a diagnosis of chronic renal insufficiency) or hepatic disease (i.e. severe cirrhosis or end-stage liver disease)
- 3. Co-morbidities: reduced medication dosages may apply to patients with renal disease (i.e. on dialysis or a diagnosis of chronic renal insufficiency) or hepatic disease (i.e. severe cirrhosis or end-stage liver disease)
- 4. Vital signs:
  - a. Oxygen  
Goal oxygen saturation is  $\geq 94\%$ . Supplemental oxygen administration is warranted to patients with oxygen saturations below this level and titrated based upon clinical condition, clinical response, and geographic location and altitude
  - b. Normal vital signs—see chart
    - i. Hypotension is considered a systolic blood pressure less than the lower limit on the chart
    - ii. Tachycardia is considered a pulse above the upper limit on the chart
    - iii. Bradycardia is considered a pulse below the lower limit on the chart
    - iv. Tachypnea is considered a respiratory rate above the upper limit on the chart
    - v. Bradypnea is considered a respiratory rate below the lower limit on the chart
- 5. Secondary survey may not be completed if patient has critical primary survey problems
- 6. In critical patients, proactive patient management should occur simultaneously with assessment. Ideally, one provider should be assigned to exclusively monitor and facilitate

patient-focused care. Treatment and Interventions should be initiated as soon as practicable, but should not impede extrication or delay transport to definitive care

7. Air medical transport of trauma patients should be reserved for higher acuity trauma patients where there is a significant times savings over ground transport, where the appropriate destination is not accessible by ground due to systemic or logistical issues, and for patients who meet the Centers for Disease Control and Prevention's (CDC's) anatomic, physiologic, and situational high-acuity triage criteria

#### **Pertinent Assessment Findings**

This guideline is too broad to list all possible findings

#### **Quality Improvement**

##### **Key Documentation Elements**

1. At least two full sets of vital signs should be documented for every patient
2. All patient interventions should be documented

##### **Performance Measures**

1. Abnormal vital signs should be addressed and reassessed
2. Response to therapy provided should be documented including pain scale reassessment if appropriate
3. Limit scene time for patients with time-critical illness or injury unless clinically indicated

#### **Normal Pediatric Vital Signs**

Age	Pulse	Respiratory Rate	Systolic BP
Preterm < 1 kg	120-160	30-60	36-58
Preterm 1 kg	120-160	30-60	42-66
Preterm 2 kg	120-160	30-60	50-72
Newborn	126-160	30-60	60-70
Up to 1 year	100-140	30-60	70-80
1-3 years	100-140	20-40	76-90
4-6 years	80-120	20-30	80-100
7-9 years	80-120	16-24	84-110
10-12 years	60-100	16-20	90-120
13-14 years	60-90	16-20	90-120
15 years and older	60-90	14-20	90-130

## Glasgow Coma Scale

ADULT GLASGOW COMA SCALE		PEDIATRIC GLASGOW COMA SCALE	
Eye Opening (4)		Eye Opening (4)	
Spontaneous	4	Spontaneous	4
To Speech	3	To Speech	3
To Pain	2	To Pain	2
None	1	None	1
Best Motor Response (6)		Best Motor Response (6)	
Obeys Commands	6	Spontaneous Movement	6
Localizes Pain	5	Withdraws to Touch	5
Withdraws From Pain	4	Withdraws from Pain	4
Abnormal Flexion	3	Abnormal Flexion	3
Abnormal Extension	2	Abnormal Extension	2
None	1	None	1
Verbal Response (5)		Verbal Response (5)	
Oriented	5	Coos, Babbles	5
Confused	4	Irritable Cry	4
Inappropriate	3	Cries to Pain	3
Incomprehensible	2	Moans to Pain	2
None	1	None	1
Total		Total	

## References

1. Bass R et al. Medical oversight of EMS, *Emergency Medical Services: Clinical Practice and Systems Oversight*, 2009. 382
2. Bledsoe BE, Porter RS, Cherry RA. *Paramedic Care: Principles & Practice*, Volume 3, 4<sup>th</sup> ed., 2012
3. Gill M, Steele R, Windemuth R, Green SM. A comparison of five simplified scales to the out-of-hospital Glasgow Coma Scale for the prediction of traumatic brain injury outcomes. *Academic Emergency Medicine*, 13(9): Aug 2007. 968-973
4. O'Driscoll BR, Howard LS, Davison AG on behalf of the British Thoracic Society. BTS guideline for emergency oxygen use in adult patients. *Thorax*, 63 (Suppl VI): vi1-vi68, 2008
5. Thomas SH, Brown KM, Oliver ZJ, Spaite DW, Sahni R, Weik TS, Falck-Ytter Y, Wright JL, Lang ES. An evidence-based guideline for the air medical transportation of trauma patients. *Prehospital Emergency Care*, 2014, Suppl 1: 35-44

## Revision Date

September 15, 2014

## Functional Needs

(No NEMSIS category)

### **Patient Care Goals**

To meet and maintain the additional support required for patients with functional needs during the delivery of prehospital care

### **Patient Presentation**

#### **Inclusion Criteria**

Patients who are identified by the World Health Organization's International Classification of Functioning, Disability, and Health (ICF) that have experienced a decrement in health resulting in some degree of disability. According to the U.S. Department of Health and Human Services, this includes, but is not limited to, individuals with physical, sensory, mental health, and cognitive and/or intellectual disabilities affecting their ability to function independently without assistance

#### **Exclusion Criteria**

None

### **Patient Management**

#### **Assessment**

Identify the functional need by means of information from the patient, the patient's family, bystanders, medic alert bracelets or documents, or the patient's adjunct assistance devices

The physical examination should not be intentionally cut short, although the manner in which the exam is performed may need to be modified to accommodate the specific needs of the patient

#### **Treatment and Interventions**

Medical care should not intentionally be reduced or abbreviated during the triage, treatment and transport of patients with functional needs, although the manner in which the care is provided may need to be modified to accommodate the specific needs of the patient

#### **Patient Safety Considerations**

For patients with communication barriers (language or sensory), it may be desirable to obtain secondary confirmation of pertinent data (e.g. allergies) from the patient's family, interpreters, or written or electronic medical records. The family members can be an excellent source of information and the presence of a family member can have a calming influence on some of these patients

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Communication Barriers
  - a. Language Barriers:
    - i. Expressive and/or receptive aphasia
    - ii. Nonverbal

- iii. Fluency in a different language than that of the EMS professional
- iv. Examples of tools to overcome language barriers include:
  - 1. Transport of an individual who is fluent in the patient's language along with the patient to the hospital
  - 2. Medical translation cards
  - 3. Telephone-accessible services with live language interpreters
  - 4. Methods through which the patient augments his/her communication skills (e.g. eye blinking, nodding) should be noted, utilized as able, and communicated to the receiving facility
- b. Sensory Barriers:
  - i. Visual impairment
  - ii. Auditory impairment
  - iii. Examples of tools to overcome sensory barriers include:
    - 1. Braille communication card
    - 2. Sign language
    - 3. Lip reading
    - 4. Hearing aids
    - 5. Written communication
- 2. Physical Barriers:
  - i. Ambulatory impairment (e.g. limb amputation, bariatric)
  - ii. Neuromuscular impairment
- 3. Cognitive Barriers:
  - i. Mental illness
  - ii. Developmental challenge or delay

### **Pertinent assessment findings**

#### **1. Assistance Adjuncts**

Examples of devices that facilitate the activities of life for the patient with functional needs include, but are not limited to:

- a. Extremity prostheses
  - b. Hearing aids
  - c. Magnifiers
  - d. Tracheostomy speaking valves
  - e. White or sensory canes
  - f. Wheelchairs or motorized scooters
2. Service Animals
- As defined by the American Disabilities Act, "any guide dog, signal dog, or other animal individually trained to do work or perform tasks for the benefit of an individual with a disability, including, but not limited to guiding individuals with impaired vision, alerting individuals with impaired hearing to intruders or sounds, providing minimal protection or rescue work, pulling a wheelchair, or fetching dropped items"

Services animals are not classified as a pet and should, by law, always be permitted to accompany the patient with the following exceptions:

A public entity may ask an individual with a disability to remove a service animal from the premises if:

- a. The animal is out of control and the animal's handler does not take effective action to control it; or
- b. The animal is not housebroken

Service animals are not required to wear a vest or a leash. It is illegal to make a request for special identification or documentation from the service animal's partner. EMS providers may only ask the patient if the service animal is required because of a disability and the form of assistance the animal has been trained to perform

EMS providers are not responsible for the care of service animal. If the patient is incapacitated and cannot personally care for the service animal, a decision can be made whether or not to transport the animal in this situation

Animals that solely provide emotional support, comfort, or companionship do not qualify as service animals

### **Quality Improvement**

#### **Key documentation elements**

1. Language barriers:
  - a. The patient's primary language of fluency
  - b. The identification of the person assisting with the communication
  - c. The methods through which the patient augments his/her communication skills should be communicated to the receiving facility
2. Sensory barriers:
  - a. The methods through which the patient augments his/her communication skills communicated to the receiving facility
  - b. Written communication between the patient and the EMS professional is part of the medical record, even if it is on a scrap sheet of paper, and it should be retained with the same collation, storage, and confidentiality policies and procedures that are applicable to the written or electronic patient care report
3. Assistance adjuncts (devices that facilitate the activities of life for the patient)

#### **Performance measures**

1. Accuracy of key data elements (chief complaint, past medical history, medication, allergies)
2. Utilization of the appropriate adjuncts to overcome communication barriers
3. Documentation of the patient's functional need and avenue exercised to support the patient
4. Documentation of complete and accurate transfer of information regarding the functional need to the receiving facility

### **References**

1. Americans with Disabilities Act 1990, 42 U.S. Code, Chapter 126
2. Americans with Disabilities Act Amendments Act of 2008, 42 U.S. Code

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3. Americans with Disabilities Act 2010, 28 Code of Federal Regulations Part 35, July 23, 2010
4. International classification of functioning, disability and health; 54<sup>th</sup> World Health Assembly, WHA 54.21, Agenda Item 13.9, May 21, 2001
5. U.S. Department of Health and Human Services, Office of the Assistant Secretary of Preparedness and Response, FEMA's Functional Needs Support Services Guidance, <http://www.phe.gov/Preparedness/planning/abc/Documents/fema-fnss.pdf>

**Revision Date**

September 15, 2014

## Patient Refusals

(9914189 – Refusal of Care)

### **Patient Care Goals/Patient Presentation (Overview)**

If an individual (or the parent or legal guardian of the individual) refuses secondary care and/or ambulance transport to a hospital after prehospital providers have been called to the scene, providers should determine the patient's capacity to make decisions. Competency is generally a legal status of a person's ability to make decisions. However, state laws vary in the definition of competency and its impact upon authority. Therefore, one should consult with the respective state EMS office for clarification on legal definitions and patient rights

### **Patient Management**

#### **Assessment**

##### **Decision-Making Capacity**

An individual who is alert, oriented, and has the capacity to understand the circumstances surrounding his/her illness or impairment, as well as the possible risks associated with refusing treatment and/or transport, typically is considered to have decision-making capacity. The individual's judgment must also not be significantly impaired by illness, injury or drugs/alcohol intoxication. Individuals who have attempted suicide, verbalized suicidal intent, or have other factors that lead EMS providers to suspect suicidal intent, should not be regarded as having decision-making capacity and may not decline transport to a medical facility

##### **Treatment and Interventions**

1. Obtain a complete set of vital signs and complete an initial assessment with particular attention to the individual's neurologic and mental status
2. Determine the individual's capacity to make a valid judgment concerning the extent of his/her illness or injury. If the EMS provider has doubts about whether the individual has the mental capacity to refuse or if the patient lacks capacity, the EMS provider should contact direct medical oversight
3. If patient has capacity, clearly explain to the individual and all responsible parties the possible risks and overall concerns with regards to refusing care
4. Perform appropriate medical care with the consent of the individual
5. Complete the patient care report clearly documenting the initial assessment findings and the discussions with all involved individuals regarding the possible consequences of refusing additional prehospital care and/or transportation

### **Notes/Educational Pearls**

#### **Key Considerations**

1. An adult or emancipated minor who has demonstrated possessing sufficient mental capacity for making decisions has the right to determine the course of his/her medical care, including the refusal of care. These individuals must be advised of the risks and consequences resulting from refusal of medical care

2. An individual determined to lack decision-making capacity by EMS providers or should not be allowed to refuse care against medical advice or to be released at the scene. Mental illness, drugs, alcohol intoxication, or physical/mental impairment may significantly impair an individual's decision-making capacity. Individuals who have attempted suicide, verbalized suicidal intent, or have other factors that lead EMS providers to suspect suicidal intent, should not be regarded as having demonstrated sufficient decision-making capacity
3. EMS providers should not put themselves in danger by attempting to treat and/or transport an individual who refuses care
4. Always act in the best interest of the patient. EMS providers, with the support of direct medical oversight, must strike a balance between abandoning the patient and forcing care
5. **Special Considerations- Minors**  
It is preferable for minors to have a parent or legal guardian who can provide consent for treatment on behalf of the child. All states allow health care providers to provide emergency treatment when a parent is not available to provide consent. This is known as the emergency exception rule or the doctrine of implied consent. For minors, this doctrine means that the prehospital professional can presume consent and proceed with appropriate treatment and transport if the following four conditions are met:
  - a. The child is suffering from an emergent condition that places his or her life or health in danger
  - b. The child's legal guardian is unavailable or unable to provide consent for treatment or transport
  - c. Treatment or transport cannot be safely delayed until consent can be obtained
  - d. The pre-hospital professional administers only treatment for emergency conditions that pose an immediate threat to the child

As a general rule, when the pre-hospital professional's authority to act is in doubt, EMS providers should always do what they believe to be in the best interest of the minor

If a minor is injured or ill and no parent contact is possible, the provider may contact direct medical oversight for additional instructions

### **References**

No specific recommendations

### **Revision Date**

September 15, 2014

# Cardiovascular

## Adult and Pediatric Syncope and Presyncope

(9914149 – Syncope)

### **Patient Care Goals**

1. Stabilize and resuscitate when necessary
2. Initiate monitoring and diagnostic procedures
3. Transfer for further evaluation

### **Patient Presentation**

Syncope is heralded by both the loss of consciousness and the loss of postural tone. Syncope typically is abrupt in onset and resolves equally quickly. EMS providers may find the patient awake and alert on initial evaluation. Presyncope is defined as the prodromal symptoms of syncope. It usually lasts for seconds to minutes and may be described by the patient as “nearly blacking out” or “nearly fainting”

#### **Inclusion criteria**

1. Abrupt loss of consciousness with loss of postural tone
2. Prodromal symptoms of syncope

#### **Exclusion criteria**

Conditions other than the above, including patients:

1. Patients with alternate and obvious cause of loss of consciousness (such as trauma – see **Head Injury** Guideline)
2. Patients with ongoing mental status changes or coma should be treated per the **Altered Mental Status** guideline

### **Patient Management**

#### **Assessment**

1. Pertinent History
  - a. Review the patient’s past medical history, including a history of:
    - i. Cardiovascular disease (cardiac disease/stroke/ etc.)
    - ii. Seizure
    - iii. Recent trauma
    - iv. Anticoagulation
    - v. Dysrhythmia
    - vi. Congestive heart failure (CHF)
    - vii. Syncope
  - b. History of Present Illness, including:
    - i. Conditions leading to the event
    - ii. Patient complaints before or after the event including prodromal symptoms
    - iii. History from others on scene, including seizures or shaking, presence of pulse/breathing (if noted), duration of the event, events that lead to the resolution of the event

- c. Review of Systems:
  - i. Occult blood loss (GI/GU)
  - ii. Fluid losses (nausea/vomiting/diarrhea) and fluid intake
  - iii. Current Medications
- 2. Pertinent Physical Exam Including:
  - a. Attention to vital signs as well as evaluation for trauma
  - b. Detailed neurologic exam (including stroke screening and mental status)
  - c. Heart, lung, abdominal and extremity exam
  - d. Additional Evaluation:
    - i. Finger stick blood glucose
    - ii. Cardiac monitoring
    - iii. Ongoing vital signs
    - iv. 12-lead EKG

#### **Treatment and Interventions:**

Should be directed at abnormalities discovered in the physical exam or on additional examination and may include management of cardiac dysrhythmias, cardiac ischemia/infarct, hypoglycemia, hemorrhage, shock, and the like.

1. Manage airway as indicated
2. Obtain detailed history
3. Oxygen as appropriate
4. Evaluate for hemorrhage and treat for shock if indicated
5. Obtain blood glucose and treat per **Hypoglycemia/Hyperglycemia** guideline as indicated
6. Establish IV access
7. Fluid bolus if appropriate
8. Cardiac Monitor
9. 12-lead EKG
10. Monitor for and treat arrhythmias (if present refer to appropriate guideline)

#### **Patient Safety Considerations:**

Patients suffering syncope due to arrhythmia may suffer recurrent arrhythmia and should therefore be placed on a cardiac monitor. Geriatric patients suffering falls from standing may sustain significant injury and should be diligently screened for trauma. Refer to the **General Trauma Management** guideline

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. By being most proximate to the scene and to the patient's presentation, EMS providers are commonly in a unique position to identify the cause of syncope. Consideration of potential causes, ongoing monitoring of vitals and cardiac rhythm as well as detailed exam and history are essential pieces of information to pass onto hospital providers
2. All patients suffering from syncope deserve hospital level evaluation, even if they appear normal with few complaints on scene
  - a. High risk causes of syncope include the following:
    - i. Cardiac causes – such as arrhythmias and massive pulmonary embolism

- ii. Neurologic - some of the symptoms of seizure may mimic those of syncope with loss of consciousness and collapse. Consider seizure and obtain full history from bystander witnesses
- b. Consider high risk 12-lead EKG features including:
  - i. Evidence of QT prolongation
  - ii. Delta waves
  - iii. Brugada syndrome (incomplete RBBB pattern in V1/V2 with ST segment elevation)

#### **Pertinent Assessment Findings**

1. Evidence of trauma
2. Evidence of cardiac dysfunction (e.g. evidence of CHF, arrhythmia)
3. Evidence of hemorrhage
4. Evidence of neurologic compromise
5. Evidence of alternate etiology, including seizure
6. Initial and ongoing cardiac rhythm
7. 12-lead EKG findings

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Presenting cardiac rhythm
2. Cardiac rhythm present when patient is symptomatic
3. Any cardiac rhythm changes

##### **Performance Measures**

1. Acquisition of 12-lead EKG
2. Application of cardiac monitor
3. Blood glucose measured

#### **References**

1. ACEP. *Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department with Syncope*
2. Dovgalyuk J et al. The electrocardiogram in the patient with syncope. *Am J Emerg Med*. 2007;25:688-701
3. Benditt D. Approach to the patient with syncope. *Cardiology Clinics*. 2013; 31(1); <http://www.mdconsult.com/das/clinics/view/0/N/25925933?ja=1117539&PAGE=1.html&issn=0733-8651&source=>. Accessed August, 2014
4. Kessler C, et al. The emergency department approach to syncope: evidence-based guidelines and prediction rules. *Emergency Medicine Clinics of North America*. 2010; 28(3); <http://www.sciencedirect.com/science/article/pii/S073386271000043X> . Accessed September, 2014
5. Ouyang H, Quinn J. Diagnosis and management of syncope in the emergency department. *Emergency Medicine Clinics of North America*. 2010; 28(3); <http://www.sciencedirect.com/science/article/pii/S0733862710000362> . Accessed September, 2014
6. Khoo C. Recognizing life threatening causes of syncope. *Cardiol Clinics*. 2013; 31(1):51-66
7. Fischer J. Pediatric syncope: cases from the emergency department. *Emerg Medicine Clinics*

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**Revision Date**

September 15, 2014

## Chest Pain/Acute Coronary Syndrome (ACS)/ST-segment Elevation Myocardial Infarction (STEMI)

(9914117 – Cardiac Chest Pain; 9914143 – ST Elevation Myocardial Infarction)

### **Patient Care Goals**

1. Identify STEMI quickly
2. Determine the time of symptom onset
3. Activate hospital-based STEMI system of care
4. Monitor vital signs and cardiac rhythm and be prepared to provide CPR and defibrillation if needed
5. Administer appropriate medications
6. Transport to appropriate facility

### **Patient Presentation**

#### **Inclusion/Exclusion Criteria**

Chest pain or discomfort in other areas of the body (e.g. arm, jaw, epigastrium) of suspected cardiac origin, shortness of breath, sweating, nausea, vomiting, and dizziness. Atypical or unusual symptoms are more common in women, the elderly and diabetic patients. May also present with CHF, syncope and/or shock

Some patients will present with non-STEMI chest pain and otherwise have a low likelihood of ACS (e.g. blunt trauma to the chest of a child). For these patients, defer the administration of aspirin and nitrates and refer to **Pain Management** guideline

### **Patient Management**

#### **Assessment, Treatment, and Interventions**

1. Signs and symptoms include chest pain, congestive heart failure, syncope, shock, symptoms similar to a patient's previous myocardial infarction (MI)
2. Assess the patient's cardiac rhythm
  - a. Treat pulseless rhythms, tachycardia, or symptomatic bradycardia (see **Cardiovascular** and **Resuscitation** guideline sections)
  - b. Initiate cardiopulmonary resuscitation (CPR), defibrillation, or cardioversion if indicated
3. If the patient is dyspneic, hypoxemic, or has obvious signs of heart failure, EMS providers should administer oxygen and titrate therapy to oxygen saturation of  $\geq 94\%$  (per **Universal Care** guideline)
4. Administer aspirin; chewable, nonenteric-coated aspirin preferred (160 to 325 mg)
5. Establish IV Access
6. The 12-lead EKG is the primary diagnostic tool that identifies a STEMI. It is imperative that EMS providers routinely acquire a 12-lead EKG as soon as possible for all patients exhibiting signs and symptoms of ACS
  - a. The EKG may be transmitted for remote interpretation by a physician or screened for STEMI by properly trained EMS providers, with or without the assistance of computer-interpretation
  - b. Advance notification should be provided to the receiving hospital for patients identified as having STEMI



- c. Performance of serial EKGs is suggested
- d. All EKGs should be made available to treating personnel at the receiving hospital, whether brought in or transmitted from the field
- 7. EMS providers should administer nitroglycerin doses (tablets or spray) q 3-5 minutes as long as SBP > 100 (if range not desired, use q 3 minutes). Nitrates in all forms are contraindicated in patients with initial systolic blood pressure < 90 mm Hg and in patients with suspected right ventricular infarction because these patients require adequate RV preload, which can be affected by nitrate administration.
- 8. Nitrates are contraindicated when patients have taken an erectile dysfunction medication within 24 hours (48 hours for tadalafil)
- 9. Analgesia is indicated in STEMI when chest discomfort is unresponsive to nitrates. Morphine should be used with caution in unstable angina (UA)/NSTEMI due to an association with increased mortality
- 10. Transport and destination decisions should be based on local resources and system of care

#### **Patient Safety Considerations**

- 1. Observe for signs of clinical deterioration: dysrhythmias, CP, SOB, decreased LOC/syncope, or other signs of shock/hypotension
- 2. Perform serial 12-lead EKGs (especially any time clinical changes noted)

#### **Notes/Educational Pearls**

##### **Key Considerations**

Acute coronary syndrome may present with atypical pain, vague or only generalized complaints

##### **Pertinent Assessment Findings**

A complete medication list should be obtained from each patient. It is especially important for the treating physician to be informed if the patient is taking beta-blockers, calcium channel blockers, clonidine, digoxin, and medications for the treatment of erectile dysfunction

#### **Quality Improvement**

##### **Key Documentation Elements**

- 1. The time of symptom onset
- 2. The time of arrival on scene to the time of 12-lead EKG acquisition
- 3. The time of 12-lead EKG acquisition to the time of identification of a STEMI
- 4. The time ASA administered, or reason why not given
- 5. The time of STEMI notification

##### **Performance Measures**

- 1. The time of EMS arrival on scene to the time of 12-lead EKG acquisition
- 2. The time of a STEMI patient's ultimate arrival to a PCI center
- 3. The time of EMS notification to the time of activation of a cardiac catheterization laboratory
- 4. The time of arrival at the PCI center to the time of cardiac catheterization (door-to-balloon time)
- 5. The time of prehospital 12-lead EKG acquisition to the time of cardiac catheterization (EKG-to-balloon time)

**References**

1. O'Gara PT et al. 2013 ACCF/AHA Guideline for the management of ST-elevation myocardial infarction - A report of the American College of Cardiology Foundation/American Heart Association Task Force on practice guidelines. *J Am Coll Cardiol*, 2013 61(4): e78-e140. doi:10.1016/j.jacc.2012.11.019

**Revision Date**

September 15, 2014

## Bradycardia

(9914115 – Bradycardia)

### **Patient Care Goals**

1. Maintain adequate perfusion
2. Treat underlying cause:
  - a. Hypoxia
  - b. Shock
  - c. Second or third degree AV block
  - d. Toxin exposure (beta-blocker, calcium channel blocker, organophosphates, digoxin)
  - e. Electrolyte disorder
  - f. Increased intracranial pressure (ICP)
  - g. Other

### **Patient Presentation**

#### **Inclusion Criteria**

1. Heart rate < 60 with either symptoms (AMS, CP, CHF, seizure, syncope, shock, pallor, diaphoresis) or evidence of hemodynamic instability
2. The major EKG rhythms classified as bradycardia include:
  - a. Sinus bradycardia
  - b. Second-degree AV block
  - c. Type I —Wenckenbach/Mobitz I
  - d. Type II —Mobitz II
  - e. Third-degree AV block complete block
  - f. Ventricular escape rhythms
3. See additional inclusion criteria, below, for pediatric patients

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment, Treatment, and Interventions**

1. Adult Management
  - a. Manage airway as necessary
  - b. Provide supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturation  $\geq$  94%
  - c. Initiate monitoring and perform 12-lead EKG
  - d. Establish IV access
  - e. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
  - f. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
    - i. Atropine 0.5 mg IV q 3-5 minute (max 3 mg)
    - ii. Chronotropic medications (no order of preference intended)

1. Epinephrine 2-10 micrograms/minute IV **or**
  2. Dopamine 2-20 micrograms/kg/minute IV **or**
  3. Norepinephrine - there is recent evidence that supports the use of norepinephrine as the preferred intervention. If no response from other chronotropic medications, and the symptomatic bradycardia is associated with AV heart block, administer 0.03 mg Norepinephrine IV push with caution
- iii. Transcutaneous Pacing  
If pacing is performed, consider sedation or pain control

## 2. Pediatric Management

Treatment is only indicated for patients who are symptomatic (pale/cyanotic, diaphoretic, altered mental status, hypoxic)

- a. Initiate chest compressions
- b. Manage airway and assist ventilations as necessary with minimally interrupted chest compressions using a compression to ventilation ratio 15:2 (30:2 if single provider is present)
- c. Provide supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturations  $\geq 94\%$
- d. Initiate monitoring and perform 12-lead EKG
- e. Establish IV access
- f. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
- g. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
  - i. Epinephrine (1:10,000) 0.01 mg/kg IV every 3-5 minutes
  - ii. Also consider atropine 0.01-0.02 mg/kg IV with minimum dose of 0.1 mg if increased vagal tone or cholinergic drug toxicity
  - iii. Transcutaneous pacing. If pacing is performed, consider sedation or pain control

Epinephrine may be used for bradycardia and poor perfusion unresponsive to ventilation and oxygenation. It is reasonable to administer atropine for bradycardia caused by increased vagal tone or cholinergic drug toxicity

### **Patient Safety Considerations**

If pacing is performed, consider sedation or pain control

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Observe for signs of decreased end-organ perfusion: chest pain (CP), shortness of breath (SOB), decreased level of consciousness, syncope or other signs of shock/hypotension
2. Patients who have undergone cardiac transplant will not respond to atropine

3. Consider potential culprit medications including beta-blockers, calcium channel blockers, sodium channel blockers/anti-depressants, cocaine, clonidine, digoxin, and clonidine. If medication overdose is considered, refer to appropriate guideline in the **Toxins and Environmental** section.
4. The differential diagnosis includes the following: MI, hypoxia, pacemaker failure, hypothermia, sinus bradycardia, athletes, head injury with increased ICP, stroke, spinal cord lesion, sick sinus syndrome, AV blocks, overdose
5. Consider hyperkalemia in the patient with wide complex bradycardia
6. Bradycardia should be managed via the least invasive manner possible, escalating care as needed
  - a. Third degree heart block or the denervated heart (as in cardiac transplant) may not respond to atropine and in these cases, proceed quickly to chronotropic agents (such as epinephrine or dopamine), or transcutaneous pacing.
  - b. In cases of impending hemodynamic collapse, proceed directly to transcutaneous pacing
7. Be aware of acute coronary syndrome as a cause of bradycardia in adult patients
8. For symptomatic bradycardia or unstable bradycardia, IV infusion chronotropic agents (dopamine and epinephrine) are now recommended as an equally effective alternative to external pacing when atropine is ineffective
9. When dosing medications for pediatric patients, dose should be weight based on non-obese patients and based on ideal body weight for obese patients
10. Pediatric patients who receive atropine for bradycardia improved their survival rates compared to those who received epinephrine

#### **Pertinent Assessment Findings**

No specific recommendations

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Time and dose of medications given
2. Time pacing started (as well as rate and joules)

##### **Performance Measures**

1. Response to medication/treatment

#### **References**

1. Brady W, Swart G, Mao R, et al. The efficacy of atropine in the treatment of hemodynamically unstable bradycardia and atrioventricular block: prehospital and emergency department considerations. *Resuscitation*, 1999 41(1): 47-55
2. De Backer D et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*, 2010 Mar 4 362:779
3. Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, et al. Part 1: executive summary: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, Nov 2 2010; 122(18 Suppl 3): S640-56
4. Sherbino J, Verbeek PR, MacDonald RD, Sawadsky BV, McDonald AC, Morrison LJ. Prehospital transcutaneous cardiac pacing for symptomatic bradycardia or bradysystolic cardiac arrest: a systematic review. *Resuscitation*, 2006 70(2): 193-200

5. 2010 American Heart Association. *Pediatric Basic and Advanced Life Support: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations*

**Revision Date**

September 15, 2014

## Tachycardia with a Pulse

(9914147 – Supraventricular Tachycardia (Including Atrial Fibrillation))

### **Patient Care Goals**

1. Maintain adequate oxygenation, ventilation and perfusion
2. Restore regular sinus rhythm - correct rhythm disturbance
3. Search for underlying cause:
  - a. Medications (caffeine, diet pills, thyroid, decongestants)
  - b. Drugs (cocaine, amphetamines)
  - c. History of dysrhythmia
  - d. CHF

### **Patient Presentation**

Patients will manifest elevated heart rate for age and may or may not also present with associated symptoms such as palpitations, dyspnea, chest pain, syncope/near-syncope, hemodynamic compromise, altered mental status or other signs of end organ malperfusion

### **Inclusion Criteria**

Heart Rate > 100 in adults or relative tachycardia in pediatric patients

### **Exclusion Criteria**

Sinus tachycardia

### **Patient Management**

#### **Assessment, Treatments, and Interventions**

1. Adult Management
  - a. Manage airway as necessary
  - b. Provide supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturation  $\geq$  94%
  - c. Initiate monitoring and perform 12-lead EKG
  - d. Establish IV access
  - e. Finger stick blood glucose and treat hypoglycemia per the **Diabetic** guideline
  - f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
    - i. **Regular Narrow Complex Tachycardia – Stable (SVT)**
      1. Perform vagal maneuvers
      2. Adenosine 6 mg IV followed by 10 ml fluid bolus. If tachycardia continues, give adenosine 12 mg IV. A third dose of adenosine, 12 mg IV, can be given
      3. Diltiazem 0.25 mg/kg slowly IV over 2 minutes. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed
      4. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses
    - ii. **Regular Narrow Complex Tachycardia – Unstable**
      1. Deliver a synchronized shock based on manufacturer's recommendations

2. For responsive patients, consider sedation
  - iii. **Irregular Narrow Complex Tachycardia – Stable** (atrial fibrillation, atrial flutter, multifocal atrial tachycardia)
    1. Diltiazem 0.25 mg/kg slowly IV over 2 minutes. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed. For patients older than 65, recommend initial dose of diltiazem 10 mg IV and a second dose of 20mg
    2. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses
  - iv. **Irregular Narrow Complex Tachycardia – Unstable**
    1. Deliver a synchronized shock based on manufacturer's recommendation
    2. For responsive patients, consider sedation
  - v. **Regular Wide Complex Tachycardia – Stable** (ventricular tachycardia - VT, supraventricular tachycardia - SVT, atrial fibrillation/flutter with aberrancy, accelerated idioventricular rhythms, pre-excited tachycardias with accessory pathways, torsades de pointes)
    1. Adenosine 6 mg IV followed by 10 ml fluid bolus; if monomorphic tachycardia continues, give adenosine 12 mg IV
    2. Amiodarone 150 mg IV over 10 minute; may repeat
    3. Procainamide drip at 10 mg/minute for a maximum dose of 17 mg/kg
    4. Lidocaine 1-1.5 mg/kg IV; may be repeated at 5 minute intervals for a maximum dose of 3 mg/kg IV
  - vi. **Irregular Wide Complex Tachycardia – Stable** (atrial fibrillation with aberrancy, pre-excited atrial fibrillation (i.e. atrial fibrillation using an accessory pathway), MAT or polymorphic VT/torsades de pointes.
    1. Amiodarone 150 mg IV over 10 minute; may repeat if needed
    2. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses
    3. If torsades, give magnesium 1-2 grams IV over 15 minutes
2. Pediatric Management
- a. Manage airway as necessary
  - b. Provide supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturation  $\geq$  94%
  - c. Initiate monitoring and perform 12-lead EKG
  - d. Establish IV access
  - e. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
  - f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
    - i. **Regular Narrow Complex Tachycardia – Stable** (SVT)
      1. Perform vagal maneuvers
      2. Adenosine 0.1 mg/kg; if unsuccessful, may repeat with 0.2 mg/kg
    - ii. **Regular Narrow Complex Tachycardia – Unstable**
      1. Deliver a synchronized shock; 0.5-1 J/kg for the first dose
      2. Repeat doses should be 2 J/kg



iii. **Regular, Wide Complex Tachycardia - Stable**

1. Consider adenosine 0.1 mg/kg for SVT with aberrancy
2. Otherwise give amiodarone 5 mg/kg IV over 10 minutes

iv. **Regular, Wide Complex Tachycardia – Unstable**

Synchronized cardioversion 0.5-1.0 J/kg

**Notes/Educational Pearls**

**Key Considerations**

1. Causes:
  - a. Hypovolemia
  - b. Hypoxia
  - c. Hydrogen (acidosis)
  - d. Myocardial Infarction
  - e. Hypokalemia/hyperkalemia
  - f. Hypoglycemia
  - g. Hypothermia
  - h. Toxins/Overdose
  - i. Tamponade
  - j. Tension pneumothorax
  - k. Thrombus – central or peripheral
  - l. Trauma
  - m. Hyperthyroidism
2. Atrial fibrillation rarely requires cardioversion in the field. As it is difficult to ascertain onset, risk of stroke needs to be addressed
3. A wide-complex irregular rhythm should be considered pre-excited atrial fibrillation; extreme care must be taken in these patients. Characteristic EKG findings include a short PR interval and in some cases, a delta wave. Avoid AV nodal blocking agents such as adenosine, calcium channel blockers, digoxin, and possibly beta-blockers in patients with pre-excitation atrial fibrillation because these drugs may cause a paradoxical increase in the ventricular response. Blocking the AV node in some of these patients may lead to impulses that are transmitted exclusively down the accessory pathway, which can result in ventricular fibrillation. Amiodarone can be used instead
4. Amiodarone can be used as a rate-controlling agent for patients who are intolerant of or unresponsive to other agents, such as patients with CHF who may not otherwise tolerate diltiazem or metoprolol. Caution should be exercised in those who are not receiving anticoagulation, as amiodarone can promote cardioversion
5. Administer metoprolol to patients with SBP greater than 120. Worsening CHF, COPD, asthma, as well as hypotension and bradycardia can occur with use of metoprolol
6. Few studies have demonstrated the effectiveness of procainamide so it remains a second-line medication. Procainamide has been shown to cause hypotension, especially in situations when left ventricle function has been impaired. It may induce atrioventricular conduction disturbances, including heart block, and must be used with extreme caution in patients who have previously received amiodarone
7. Lidocaine is less effective in terminating VT than procainamide, sotalol, and amiodarone when given to patients with or without a history of MI with stable VT in the hospital setting. Lidocaine has been reported to variably terminate VT when administered intramuscularly to

patients with AMI and VT in the out-of-hospital setting. Lidocaine should be considered second-line antidysrhythmic therapy for monomorphic VT

8. Biphasic waveforms have been proven to convert atrial fibrillation at lower energies and higher rates of success than monophasic waveforms. Strategies include dose escalation (70, 120, 150, 170J for biphasic or 100, 200, 300, 360J for monophasic) versus beginning with single high energy/highest success rate for single shock delivered
9. Studies in infants and children have demonstrated the effectiveness of adenosine for the treatment of hemodynamically stable or unstable SVT
10. Adenosine should be considered the preferred medication for stable SVT. Verapamil may be considered as alternative therapy in older children but should not be routinely used in infants. Procainamide or amiodarone given by a slow IV infusion with careful hemodynamic monitoring may be considered for refractory SVT
11. When dosing medications for pediatric patients, dose should be weight based in non-obese patients and based on ideal body weight for obese patients

#### **Pertinent Assessment Findings**

No specific recommendations

#### **Patient Safety Considerations**

1. Only use one antidysrhythmic at a time
2. If using cardioversion, consider sedation or pain control
3. With irregular wide complex tachycardia (atrial fibrillation with aberrancy such as Wolff-Parkinson-White and Lown-Ganong Levine), avoid use of calcium channel blockers and beta blockers

#### **Quality Improvement**

##### **Key Documentation Elements**

1. All rhythm changes
2. Patient response to medications
3. Patient response to attempt to cardiovert (as well as times/joules)
4. Obtain monitor strips after each intervention

##### **Performance Measures**

Time to clinical improvement

#### **References**

1. Fuster V, Rydén LE, Cannom DS, Crijns HJ, Curtis AB, Ellenbogen KA, et al. [ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation--executive summary]. *Rev Port Cardiol*, Apr 2007; 26(4): 383-446
2. McNamara RL, Tamariz LJ, Segal JB, Bass EB. Management of atrial fibrillation: review of the evidence for the role of pharmacologic therapy, electrical cardioversion, and echocardiography. *Ann Intern Med*, Dec 16 2003; 139(12): 1018-33
3. Wann LS, Curtis AB, Ellenbogen KA, et al. 2011 ACCF/AHA/HRS focused update on the management of patients with atrial fibrillation (update on dabigatran): A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *Circulation*, Feb 14 2011

4. Zimetbaum P, Reynolds MR, Ho KK, Gaziano T, McDonald MJ, McClennen S, et al. Impact of a practice guideline for patients with atrial fibrillation on medical resource utilization and costs. *Am J Cardiol*, Sep 15 2003; 92(6): 677-81
5. 2010 American Heart Association. Pediatric Basic and Advanced Life Support: 2010 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations

**Revision Date**

September 15, 2014

## Suspected Stroke / Transient Ischemic Attack

(9914145 – Stroke/TIA)

### **Patient Care Goals**

1. Detect neurological deficits
2. Determine eligibility for transport to a stroke center

### **Patient Presentation**

1. Neurologic deficit such as facial droop, localized weakness, gait disturbance, slurred speech, altered mentation
2. Hemiparesis or hemiplegia
3. Dysconjugate gaze, forced or crossed gaze (if patient is unable to voluntarily respond to exam, makes no discernible effort to respond, or LOC is such as there is no response)
4. Severe headache, neck pain/stiffness, difficulty seeing

### **Inclusion Criteria**

Patient has signs and symptoms consistent with stroke or transient ischemic attack (TIA)

### **Exclusion Criteria**

1. If glucose < 60 refer to **Hypoglycemia/Hyperglycemia** guideline
2. If trauma and GCS  $\leq$  13, refer to **Head Injury** and **General Trauma Management** guidelines

### **Patient Management**

#### **Assessment**

1. Use a validated prehospital stroke scale that may include, but is not limited to:
  - a. Facial smile/grimace – ask patient to smile
  - b. Arm drift – close eyes and hold out arms for count of 10 seconds
  - c. Speech - “You can’t teach an old dog new tricks”
2. Pertinent historical data includes:
  - a. History: “last seen normal”
  - b. TPA exclusions
    - i. Previous cerebral hemorrhage
    - ii. Current anti-coagulant therapy
    - iii. Head trauma or prior stroke in previous 3 months
    - iv. Symptoms suggest subarachnoid hemorrhage
    - v. Arterial puncture at noncompressible site in previous 7 days
    - vi. History of previous intracranial hemorrhage
    - vii. Elevated blood pressure (systolic > 185 mm Hg or diastolic > 110 mm Hg)
    - viii. Evidence of active bleeding on examination
    - ix. Blood glucose concentration < 50 mg/dl
    - x. Minor or rapidly improving stroke symptoms (clearing spontaneously)

- xi. Seizure at onset with postictal residual neurologic impairments
- xii. Major surgery or serious trauma within previous 14 days
- xiii. Recent gastrointestinal or urinary tract hemorrhage (within previous 21 days)
- xiv. Recent acute myocardial infarction (within previous 3 months)
- c. Neurologic status assessment (see Appendix VI)

### **Treatment and Interventions**

1. Determine – Time “last seen normal”
2. Provide oxygen only if O<sub>2</sub> saturation < 94%. Titrate to ≥ 94%
3. If seizure activity present, refer to **Seizures** guideline
4. Obtain blood glucose level. Treat only if glucose < 60
5. Acquire 12-lead EKG if possible

### **Patient Safety Considerations**

1. Prevent aspiration – elevate head of stretcher 15-30 degrees if systolic BP >100 mm Hg; maintain head and neck in neutral alignment, without flexing the neck
2. Protect paralyzed limbs from injury
3. Avoid multiple IV attempts

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Patients presenting with signs/symptoms of stroke should be transported to the nearest stroke center or, if not available, a stroke-capable facility
2. Do not treat hypertension
3. Cardiac monitor
4. Complete stroke checklist and leave copy with hospital – forward one to EMS agency
5. Pediatrics: Treatment principles remain the same. Although rare, pediatric patients can have strokes. Stroke scales are not validated for pediatric patients. The EMS crew should call ahead to make sure that the hospital can manage the patient

### **Quality Improvement**

#### **Key Documentation Elements**

1. “Last seen normal” must be specific. If the patient was last seen normal prior to bedtime the night before, this is the time to be documented. (Not time the patient woke up with symptoms present)
2. Blood glucose results
3. Specific validated stroke scale used and findings

#### **Performance Measures**

Documentation of neuro assessment status, changes prehospital including validated stroke scale used and findings

## **References**

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## **Revision Date**

September 15, 2014

# General Medical

## Abuse and Maltreatment

(9914187 – Neglect or Abuse Suspected)

### **Patient Care Goals**

1. Recognize any act or series of acts of commission or omission by a caregiver or person in a position of power over the patient that results in harm, potential for harm, or threat of harm to a patient
2. These situations may involve safety issues for responding providers, so take appropriate steps to protect the safety of the responders as well as bystanders
3. Get the patient out of immediate danger
4. Assess any patient injuries that may be the result of acute or chronic events
5. Attempt to preserve evidence whenever possible, however the overriding concern should be providing appropriate emergency care to the patient

### **Patient Presentation**

1. Clues to abuse or maltreatment can vary with age group of the patient and type of abuse
2. Not all abuse or maltreatment is physical
3. EMS role is to:
  - a. Document concerns
  - b. Assess potentially serious injuries
  - c. Disclose concerns to appropriate authorities
  - d. Initiate help to get the patient into a safe situation
  - e. Not to investigate or intervene beyond the steps above
  - f. Leave further intervention to law enforcement personnel

### **Inclusion/Exclusion Criteria**

Absolute inclusion/exclusion criteria are not possible in this area. Rather, clues consistent with different types of abuse/maltreatment should be sought:

1. Potential clues to abuse/maltreatment from caregivers or general environment:
  - a. Caregiver apathy about patient's current situation
  - b. Caregiver overreaction to questions about situation
  - c. Inconsistent histories from caregivers or bystanders regarding what happened
  - d. Information provided by caregivers or patient that is not consistent with injury patterns
  - e. Injuries not appropriate for patient's age or physical abilities (e.g. infants with injuries usually associated with ambulatory children, elders who have limited mobility with injury mechanisms inconsistent with their capabilities)
  - f. Caregiver not allowing patient to speak for himself/herself, or who appears controlling
  - g. Inadequate facilities where the patient lives and/or evidence of security measures that appear to confine people to the facility
2. Potential clues to abuse or maltreatment that can be obtained from the patient:
  - a. Multiple bruises in various stages of healing

- b. Age inappropriate behavior (e.g. adults who are submissive or fearful, children who act in a sexually inappropriate way)
  - c. Pattern burns, bruises, or scars suggestive of specific weaponry used
  - d. Evidence of medical neglect for injuries or infections
  - e. Trauma to genitourinary systems or frequent infections to this system
  - f. Evidence of malnourishment and/or serious dental problems
  - g. Inability to communicate due to language and/or cultural barrier
- 3. Have a high index of suspicion for abuse in children presenting with an Apparent Life Threatening Event (ALTE)

## **Patient Management**

### **Assessment**

- 1. Start with a primary survey and identify any potentially life threatening issues
- 2. Document thorough secondary survey for potential abuse/maltreatment red flags:
  - a. Inability to communicate due to language and/or cultural barrier
  - b. Multiple bruises in various stages of healing
  - c. Age inappropriate behavior (e.g. adults who are submissive or fearful, children who act in a sexually inappropriate way)
  - d. Pattern burns, bruises, or scars suggestive of specific weaponry used
  - e. Evidence of medical neglect for injuries or infections
  - f. Trauma to genitourinary systems or frequent infections to this system
  - g. Evidence of malnourishment and/or serious dental problems
- 3. Assess physical issues and avoid extensive investigation of the specifics of abuse or maltreatment, but document any statements made spontaneously by patient

### **Treatment and Interventions**

- 1. Address life threatening issues
- 2. Find way to get patient to a safe place even if no medical indication for transport
- 3. Report concerns about potential abuse/maltreatment to law enforcement immediately, in accordance with state law, about:
  - a. Caregivers impeding your ability to assess/transport patient
  - b. Caregivers refusing care for the patient
- 4. For patients transported, report concerns to hospital and/or law enforcement personnel per mandatory reporting laws

### **Patient Safety Considerations**

- 1. If no medical emergency exists, next priority is safe patient disposition/removal from the potentially abusive situation
- 2. Do not confront suspected perpetrators of abuse/maltreatment. This can create an unsafe situation for EMS and for the patient



## **Notes/Educational Pearls**

### **Key Considerations**

1. Definitions:
  - a. Abuse/maltreatment: Any act or series of acts of commission or omission by a caregiver or person in a position of power over the patient that results in harm, potential for harm, or threat of harm to a patient
  - b. Child maltreatment/abuse: Child maltreatment includes any act or series of acts of commission or omission by a parent or other caregiver that results in harm, potential for harm, or threat of harm to a child. An act of commission (child abuse) is the physical, sexual or emotional maltreatment or neglect of a child or children. An act of omission (child neglect) includes failure to provide (e.g. physical, emotional, medical/dental, and educational neglect) and failure to supervise (e.g. inadequate supervision, and exposure to violent environments)
  - c. Human trafficking: when people are abducted or coerced into service and often transported across international borders
2. Clues to abuse or maltreatment can vary depending on the age group of the patient and on the nature of the abuse. Remember that not all abuse or maltreatment involves physical harm. It is important to realize that the job of EMS is to document their concerns, assess the patient for potentially serious injuries, make sure that their concerns are disclosed to the appropriate legal authorities, and work towards getting the patient into a safe situation. EMS personnel should not take it upon themselves to investigate or intervene above and beyond those concepts and should leave further intervention to the appropriate law enforcement personnel
3. It is very important to have a high index of suspicion for abuse in children presenting with an Apparent Life Threatening Event (ALTE). Of the very serious causes of ALTE, child abuse has been found in as many as 11% of cases. One retrospective review noted that a call to 911 for ALTE was associated with an almost 5 times greater odds of abusive head trauma being diagnosed as the cause of the ALTE, clearly emphasizing the high index of suspicion EMS providers must have when responding to these calls
4. Abuse and maltreatment can happen to patients of all ages
5. Patients may be unwilling or unable to disclose abuse or maltreatment so the responsibility falls on EMS personnel to assess the situation, document appropriately, and take appropriate action to secure a safe place for the patient
6. Document findings by describing what you see and not ascribing possible causes (e.g. "0.5 inch round burn to back" as opposed to "burn consistent with cigarette burn")

### **Pertinent Assessment Findings**

As noted above

## **Quality Improvement**

### **Key Documentation Elements**

Meticulous documentation of any statements by the patient and any physical findings on the patient or the surroundings are critical in abuse or maltreatment cases

### **Performance Measures**

No specific recommendations

## **References**

1. Department of Homeland Security has an initiative called the Blue Campaign that focuses on helping EMS personnel recognize potential human trafficking – the website, which includes resources for EMS personnel, is at:  
[http://www.usfa.fema.gov/fireservice/ems/human\\_trafficking/](http://www.usfa.fema.gov/fireservice/ems/human_trafficking/)
2. All states have specific mandatory reporting laws that dictate which specific crimes such as suspected abuse or maltreatment must be reported and to whom they must be reported. It is important to be familiar with the specific laws in your state including specifically who must make disclosures, what the thresholds are for disclosures, and to whom the disclosures must be made
3. Centers for Disease Prevention  
<http://www.cdc.gov/violenceprevention/childmaltreatment/definitions.html>; accessed July 13, 2014

## **Revision Date**

September 15, 2014

## Agitated or Violent Patient/Behavioral Emergency

(9914053 – Behavioral/Patient Restraint)

### **Patient Care Goals**

1. Provision of emergency medical care to the agitated, violent, or uncooperative patient
2. Maximizing and maintaining safety for the patient, EMS personnel, and others

### **Patient Presentation**

#### **Inclusion criteria**

Patients of all ages who are exhibiting agitated, violent, or uncooperative behavior or who are a danger to self or others

#### **Exclusion criteria**

Patients exhibiting agitated or violent behavior due to medical conditions including, but not limited to:

1. Head trauma
2. Metabolic disorders (e.g. hypoglycemia, hypoxia)

### **Patient Management**

#### **Assessment**

1. Note medications/substances on scene that may contribute to the agitation, or may be treatment of relevant medical condition
2. Maintain and support airway
3. Respiratory rate and effort. Ideally, monitor pulse oximetry and/or capnography
4. Circulatory status:
  - a. Blood pressure (if possible)
  - b. Pulse rate
  - c. Capillary refill
5. Mental status
  - a. Obtain blood glucose (if possible)
6. Temperature (if possible)
7. Evidence of traumatic injuries

#### **Treatment and Interventions**

1. Patient Rapport
  - a. Attempt verbal reassurance and calm patient prior to use of chemical and/or physical restraints
  - b. Engage family members/loved ones to encourage patient cooperation if their presence does not exacerbate the patient's agitation
  - c. Continued verbal reassurance and calming of patient following chemical/physical restraints

## 2. Chemical Restraints

### a. Notes:

- i. Selection of chemical restraint should be based upon the patient's clinical condition, current medications, and allergies in addition to EMS resources and medical oversight
- ii. The numbering of medications below is not intended to indicate a hierarchy/preference of administration
- iii. Chemical restraints should be a later consideration for pediatric patients

### b. Antipsychotics

#### i. Droperidol

##### 1. Adults:

- a. 2.5 mg IV; 10 minute onset of action, or
- b. 5 mg IM; 20 minute onset of action

##### 2. Pediatrics: Not routinely recommended

#### ii. Haloperidol

##### 1. Adults:

- a. 5 mg IV; 5-10 minute onset of action, or
- b. 10 mg IM; 10-20 minute onset of action

##### 2. Pediatrics:

- a. Age 6-12 years: 1-3 mg IM (maximum dose 0.15 mg/kg)

#### iii. Olanzapine

##### 1. Adults: 10 mg IM; 15-30 minute onset of action

##### 2. Pediatrics:

- a. Age 6-11 years: 5 mg IM (limited data available for pediatric use)
- b. Age 12-18 years: 10 mg IM

#### iv. Ziprasidone

##### 1. Adults: 10 mg IM; 10 minute onset of action

##### 2. Pediatrics:

- a. Age 6-11 years: 5 mg IM (limited data available for pediatric use)
- b. Age 12-18 years: 10 mg IM

### c. Benzodiazepines

#### i. Diazepam

##### 1. Adults:

- a. 5 mg IV; 2-5 minute onset of action, or
- b. 10 mg IM; 15-30 minute onset of action

##### 2. Pediatrics:

- a. 0.05-0.1 mg/kg IV, or
- b. 0.1-0.2 mg/kg IM

#### ii. Lorazepam

##### 1. Adults:

- a. 2 mg IV; 2-5 minute onset of action, or

- b. 4 mg IM; 15-30 minute onset of action
    - 2. Pediatrics:
      - a. 0.05 mg/kg IV, or
      - b. 0.05 mg/kg IM
  - iii. Midazolam
    - 1. Adults:
      - a. 5 mg IV; 3-5 minute onset of action, or
      - b. 5 mg IM; 10-15 minute onset of action, or
      - c. 5 mg IN; 3-5 minute onset of action
    - 2. Pediatrics:
      - a. 0.05-0.1 mg/kg IV, or
      - b. 0.1-0.15 mg/kg IM, or
      - c. 0.3 mg/kg IN
  - d. Dissociative Agents (Provide Sedation and Anesthesia)
    - i. Ketamine
      - 1. Adults:
        - a. 2 mg/kg IV; 1 minute onset of action, or
        - b. 4 mg/kg IM; 3-5 minute onset of action
      - 2. Pediatrics:
        - a. 1 mg/kg IV, or
        - b. 3 mg/kg IM
    - e. Antihistamines
      - i. Diphenhydramine
        - 1. Pediatrics:
          - a. 1 mg/kg IM/IV/PO (maximum dose of 25 mg)
  - 3. Physical Restraints
    - a. Body
      - i. Stretcher straps should be applied as the standard procedure for all patients during transport
      - ii. Sheets can be used as additional stretcher straps if necessary
      - iii. Stretcher straps and sheets should never restrict the patient's chest wall motion
      - iv. Placement of stretcher straps or sheets (to prevent flexion/extension of torso, hips, legs) around:
        - 1. the lower lumbar region, below the buttocks, or
        - 2. the thighs, knees, and legs
    - b. Extremities
      - i. Soft or leather restraint devices should not require a key to release them
      - ii. Restrain all four extremities to maximize safety for patient, staff, and others
      - iii. Restrain all extremities to the stationary frame of the stretcher
      - iv. Multiple knots should not be used to secure the restraint device

### **Patient Safety Considerations**

1. Don personal protective equipment (PPE)
2. Do not attempt to enter or control a scene where physical violence or weapons are present
3. Dispatch law enforcement immediately to secure and maintain scene safety
4. Urgent de-escalation of patient agitation is imperative in the interest of patient safety as well as for EMS personnel and others on scene
5. Uncontrolled or poorly controlled patient agitation and physical violence can place the patient at risk for sudden cardiopulmonary arrest due to the following etiologies:
  - a. Excited delirium/exhaustive mania: A postmortem diagnosis of exclusion for sudden death thought to result from metabolic acidosis (most likely from lactate) stemming from physical agitation or physical control measures (including TASER®s) and potentially exacerbated by stimulant drugs (e.g. cocaine) or alcohol withdrawal
  - b. Positional asphyxia: Sudden death from restriction of chest wall movement and/or obstruction of the airway secondary to restricted head or neck positioning resulting in hypercarbia and/or hypoxia
6. Apply a cardiac monitor as soon as possible, particularly when chemical restraints have been administered
7. All patients who have received chemical restraints must be monitored closely for the development of oversedation. Utilize capnography if available
8. Patients who have received antipsychotic medication as a chemical restraint must be monitored closely for the potential development of :
  - a. Dystonic reactions (this can easily be treated with diphenhydramine/benzodiazepines)
  - b. Mydriasis (dilated pupils)
  - c. Ataxia
  - d. Cessation of perspiration
  - e. Dry mucous membranes
  - f. Cardiac arrhythmias (particularly QT prolongation)
9. Placement of stretcher in sitting position prevents aspiration and reduces the patient's physical strength by placing the abdominal muscles in the flexed position
10. Patients who are more physically uncooperative should be physically restrained in the lateral decubitus position (one arm above the head and the other arm below the waist), rather than the prone, to avoid airway compromise
11. Patients should never be transported while hobbled, "hog-tied", or restrained in a prone position with hands and feet behind the back
12. Patients should never be transported while "sandwiched" between backboards or mattresses

### **Notes/Educational Pearls**

#### **Key considerations**

1. Direct medical oversight should be contacted at any time for advice, especially when patient's level of agitation is such that transport may place all parties at risk
2. Transport by air is not advised

3. Some chemical restraint medications are available in auto-injectors for rapid administration
4. Stretchers with adequate foam padding, particularly around the head, facilitates patient's ability to self-position the head and neck to maintain airway patency
5. For patients with key-locking restraint devices, applied by another agency, consider the following options:
  - a. Remove restraint device and replace it with a restraint device that does not require a key
  - b. Administer chemical restraints then remove and replace restraint device with another non-key-locking device after patient has become more cooperative
  - c. Transport patient, accompanied in patient compartment by person who has key for the device
  - d. Transport patient in vehicle of person with device key if medical condition of patient is deemed stable, direct medical oversight so authorizes, and law allows

### **Pertinent assessment findings**

Continuous monitoring of:

1. Airway patency
2. Respiratory status with pulse oximetry and/or capnography
3. Circulatory status with frequent blood pressure measurements
4. Mental status and trends in level of patient cooperation
5. Cardiac status, especially if the patient has received chemical restraints
6. Extremity perfusion with capillary refill in patients in physical restraints

### **Quality Improvement**

#### **Key Documentation Elements**

1. Etiology of agitated or violent behavior if known
2. Patient's medications, other medications or substances found on scene
3. Patient's medical history or other historic factors reported by patient, family or bystanders
4. Physical evidence or history of trauma
5. Adequate oxygenation by pulse oximetry
6. Blood glucose measurement
7. Measures taken to establish patient rapport
8. Dose, route, and number of doses of chemical restraints administered
9. Clinical response to chemical restraints
10. Number and physical sites of placement of physical restraints
11. Duration of placement of physical restraints
12. Repeated assessment of airway patency
13. Repeated assessment of respiratory rate, effort, pulse oximetry/capnography
14. Repeated assessment of circulatory status with blood pressure, capillary refill, cardiac monitoring
15. Repeated assessment of mental status and trends in the level of patient cooperation
16. Repeated assessment of capillary refill in patient with extremity restraints

17. Communications with EMS direct medical oversight
18. Initiation and duration of engagement with law enforcement

### **Performance Measures**

1. Incidence of injuries to patient, EMS personnel , or others on scene
2. Incidence of injuries to patient, EMS personnel, or others during transport
3. Medical or physical complications (including sudden death) in patients
4. Advance informational communication of EMS protocols for the management of agitated and violent patients to others within the emergency care system and law enforcement
5. Initiation and engagement with EMS direct medical oversight
6. Initiation and duration of engagement with law enforcement

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### **Revision Date**

September 15, 2014



## Anaphylaxis and Allergic Reaction

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914111 – Allergic Reaction/Anaphylaxis)

### **Patient Care Goals**

1. Provide timely therapy for potentially life-threatening reactions to known or suspected allergens to prevent cardiorespiratory collapse and shock
2. Provide symptomatic relief for symptoms due to known or suspected allergens

### **Patient Presentation**

#### **Inclusion Criteria**

Patients of all ages with suspected allergic reaction

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Evaluate for patent airway and presence of oropharyngeal edema
2. Auscultate for wheezing and assess level of respiratory effort
3. Assess for adequacy of perfusion
4. Assess for presence of signs of anaphylaxis
5. Determine:
  - a. Non-anaphylactic Allergic Reaction  
Symptoms involving only **one** organ system (i.e. localized angioedema that does not compromise the airway, or not associated with vomiting)
  - b. Anaphylaxis - More severe and is characterized by an acute onset involving:
    - i. The skin (urticaria) and/or mucosa with either respiratory compromise or decreased BP or signs of end-organ dysfunction,  
**OR**
    - ii. Hypotension for that patient (systolic BP < 90 for adults; see Normal Vital Signs table, **Appendix VII**, for pediatric cut-offs) after exposure to a known allergen  
**OR**
    - iii. Two or more of the following occurring rapidly after exposure to a likely allergen:
      1. Skin and/or mucosal involvement (urticaria, itchy, swollen tongue/lips)
      2. Respiratory compromise (dyspnea, wheeze, stridor, hypoxemia)
      3. Persistent gastrointestinal symptoms (vomiting, abdominal pain)
      4. Hypotension or associated symptoms (syncope, hypotonia, incontinence)

### **Treatment and Interventions**

1. If signs of allergic reaction without signs of anaphylaxis, go to step 4
2. If signs of anaphylaxis, administer epinephrine (0.3 mg IM if  $\geq 25$  kg; 0.15 mg IM if  $< 25$  kg) via an epinephrine auto-injector, if available, in the anterolateral thigh
3. If signs of anaphylaxis are exhibited and an epinephrine auto-injector has not been administered and is not available, administer epinephrine 1:1,000 at the doses noted above
4. For urticaria or pruritus, administer an H1-blocking antihistamine (diphenhydramine 1 mg/kg, up to max dose of 50 mg IM, IV, or PO). The IV route is preferred for the patient in severe shock
5. For urticaria, any H2-blocking antihistamine (e.g. famotidine, cimetidine) can be given IV or PO in conjunction with an H1-blocking antihistamine
6. If respiratory distress with wheezing is present, consider administering inhaled albuterol (2.5-5 mg) and/or inhaled epinephrine (5 ml, 1:1,000). For stridor, consider administering inhaled epinephrine as noted above
7. If signs of anaphylaxis and hypoperfusion persist following the first dose of epinephrine, additional IM epinephrine can be repeated every 5-15 minutes at the doses noted above
8. For signs of hypoperfusion, also administer 20 ml/kg isotonic fluid (normal saline or lactated Ringer's) rapidly (over 15 minutes) via IV or IO, and repeat as needed for ongoing hypoperfusion
9. Consider an epinephrine IV drip (0.5 mcg/kg/minute) when cardiovascular collapse (hypotension with altered mental status, pallor, diaphoresis and/or delayed capillary refill) is present despite repeated IM doses of epinephrine in conjunction with at least 60 ml/kg isotonic fluid boluses
10. Transport as soon as possible, and perform ongoing assessment as indicated. Cardiac monitoring is not required, but should be considered for those with known heart problems or who received multiple doses of epinephrine

### **Patient Safety Considerations**

1. Time to epinephrine delivery
2. Concentration of epinephrine in relation to route
3. Use of epinephrine auto-injectors to reduce dosing errors
4. Weight-based dosing of medications

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Allergic reactions and anaphylaxis are serious and potentially life-threatening medical emergencies. It is the body's adverse reaction to a foreign protein (i.e. food, medicine, pollen, insect sting or any ingested, inhaled, or injected substance). A localized allergic reaction (i.e. urticaria or angioedema that does not compromise the airway) may be treated with antihistamine therapy. When anaphylaxis is suspected, EMS personnel should always consider epinephrine as first-line treatment. Cardiovascular collapse may occur abruptly, without the prior development of skin or respiratory symptoms. Constant monitoring of the patient's airway and breathing is essential

2. A thorough assessment and a high index of suspicion are required for all potential allergic reaction patients. Consider:
  - a. History of Present Illness:
    - i. Onset and location
    - ii. Insect sting or bite
    - iii. Food allergy/exposure
    - iv. New clothing, soap, detergent
    - v. Past history of reactions
    - vi. Medication history
  - b. Signs and Symptoms
    - i. Itching or urticaria
    - ii. Coughing, wheezing, or respiratory distress
    - iii. Chest tightness or throat constriction
    - iv. Hypotension or shock
    - v. Persistent gastrointestinal symptoms (nausea, vomiting, and diarrhea)
    - vi. Altered mental status
  - c. Other Considerations
    - i. Angioedema (drug-induced)
    - ii. Aspiration/airway obstruction
    - iii. Vasovagal event
    - iv. Asthma or COPD
    - v. Heart failure
3. Gastrointestinal symptoms occur most commonly in food-induced anaphylaxis, but can occur with other causes. Oral pruritus is often the first symptom observed in patients experiencing food-induced anaphylaxis. Abdominal cramping is also common, but nausea, vomiting, and diarrhea are frequently observed as well
4. Contrary to common belief that all cases of anaphylaxis present with cutaneous manifestations, such as urticaria or mucocutaneous swelling, a significant portion of anaphylactic episodes may not involve these signs and symptoms on initial presentation. Moreover, most fatal reactions to food-induced anaphylaxis in children were not associated with cutaneous manifestations
5. Patients with asthma are at high risk for a severe allergic reaction
6. There is no proven benefit to using steroids in the management of allergic reactions and/or anaphylaxis
7. There is controversy among experts with very low quality evidence to guide management for the use of empiric IM epinephrine after exposure to a known allergen in asymptomatic patients with a history of prior anaphylaxis

#### **Pertinent Assessment Findings**

1. Presence or absence of angioedema
2. Presence or absence of respiratory compromise
3. Presence or absence of circulatory compromise
4. Localized or generalized urticaria
5. Response to therapy

## **Quality Improvement**

### **Key Documentation Elements**

1. Medications given
2. Dose and concentration of epinephrine given
3. Route of epinephrine administration
4. Time of epinephrine administration
5. Signs and symptoms of the patient

### **Performance Measures**

1. Percentage of patients with anaphylaxis that receive epinephrine for anaphylaxis:
  - a. Via the IM route (vs. other routes)
  - b. Via the IM route in the anterolateral thigh (vs. other locations)
  - c. Via an IM auto-injector (vs. IM without an auto-injector)
2. Percentage of patients with anaphylaxis who receive epinephrine within 10 minutes of arrival
3. Percentage of patients with anaphylaxis who receive the appropriate weight-based dose of epinephrine
4. Presence of auto-injectors in the 0.15 mg and 0.3 mg dosing formats, for use by both BLS and ALS providers
5. Percentage of patients that require airway management in the prehospital setting (and/or the emergency department)

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#### Revision Date

September 15, 2014

## Altered Mental Status

(9914113 – Altered Mental Status)

### **Patient Care Goals**

1. Identify treatable causes
2. Protect patient from harm

### **Patient Presentation**

#### **Inclusion criteria**

Impaired decision-making capacity

#### **Exclusion criteria**

Traumatic brain injury

### **Patient Management**

#### **Assessment**

Look for treatable causes of altered mental status:

1. Airway: make sure airway can remain patent; reposition patient as needed
2. Breathing: look for respiratory depression; check SPO<sub>2</sub>, ETCO<sub>2</sub>, and CO detector readings
3. Circulation: look for signs of shock
4. Glasgow Coma Score and/or AVPU
5. Pupils
6. Neck rigidity or pain with range of motion
7. Stroke tool
8. Blood glucose level
9. EKG: arrhythmia limiting perfusion
10. Breath odor: possible unusual odors include alcohol, acidosis, ammonia
11. Chest/Abdominal: intra-thoracic hardware, assist devices, abdominal pain or distention
12. Extremities/skin: track marks, hydration, edema, dialysis shunt, temperature to touch (or if able, use a thermometer)
13. Environment: survey for pills, paraphernalia, ambient temperature

#### **Treatment and Interventions**

1. Oxygen (see Universal Care guideline for treatments)
2. Glucose (see **Hypoglycemia/Hyperglycemia** guideline for treatments)
3. Naloxone (see **Opioid Poisoning/Overdose** guideline for treatments)
4. Restraint: physical and chemical (see **Agitated or Violent Patient/Behavioral Emergency** guideline for treatments)
5. Anti-dysrhythmic medication (see **Cardiovascular Section** guidelines for specific dysrhythmia guidelines for treatments)
6. Active cooling or warming (see **Hypothermia/Cold Exposure or Hyperthermia/Heat Emergency** guidelines for treatments)
7. IV fluids (see fluid administration doses in **Shock** and **Hypoglycemia/Hyperglycemia** guidelines)

8. Vasopressors (see **Shock** guideline for treatments)

### **Patient Safety Considerations**

With depressed mental status, initial focus is on airway protection, oxygenation, ventilation, and perfusion. The violent patient may need chemical and/or physical restraint to insure proper assessment and treatment. Hypoglycemic and hypoxic patients can be irritable and violent (see **Agitated or Violent Patient/Behavioral Emergency** guideline)

### **Notes/Educational Pearls**

#### **Key Considerations**

1. History from bystanders
2. Age of the patient
3. Environment where patient found
4. Recent complaints (e.g. headache, chest pain, difficulty breathing, vomiting, fever)
5. Pill bottles/medications: anti-coagulants, anti-depressants, narcotic pain relievers, benzodiazepines
6. Medical alert tags and accessory medical devices
7. Toddlers should be evaluated for reduced PO intake and/or vomiting and/or diarrhea as a cause of AMS

#### **Pertinent Assessment Findings**

1. Track marks
2. Breath odor
3. Skin temperature
4. Location

### **Quality Improvement**

#### **Key Documentation Elements**

1. GCS or AVPU description
2. Temperature was taken when able
3. Patient and medic safety were considered
4. Pupil and neck exam were done

#### **Performance measures**

1. Hypoglycemia considered and treated appropriately
2. Hypotension raised the possibility of sepsis
3. Hypotension appropriately treated
4. Naloxone is used as therapeutic intervention, not a diagnostic tool
5. CO detector is used when available

### **References**

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**Revision Date**

September 15, 2014



## Hypoglycemia/Hyperglycemia

(9914125 – Hypoglycemia/Diabetic Emergency; 9914121 – Hyperglycemia)

### **Patient Care Goals**

Limit morbidity from hypoglycemia and hyperglycemia by:

1. Describing appropriate use of glucose monitoring
2. Treating symptomatic hypoglycemia
3. Appropriate hydration for hyperglycemia

### **Patient Presentation**

#### **Inclusion Criteria**

1. Adult or pediatric patient with blood glucose < 60 mg/dl with symptoms of hypoglycemia
2. Adult or pediatric patient with altered level of consciousness (also see **Altered Mental Status** guideline)
3. Adult or pediatric patient with stroke symptoms (e.g. hemiparesis, dysarthria; also see **Suspected Stroke/Transient Ischemic Attack** guideline)
4. Adult or pediatric patient with seizure [Also see **Seizures** guideline]
5. Adult or pediatric patient with symptoms of hyperglycemia (e.g. polyuria, polydipsia, weakness, dizziness)
6. Adult or pediatric patient with history of diabetes and other medical symptoms
7. Pediatric patient with suspected alcohol ingestion

#### **Exclusion Criteria**

Patient in cardiac arrest

### **Patient Management**

#### **Assessment**

1. Monitoring:  
Obtain point of care blood glucose level
2. Secondary survey pertinent to altered blood glucose level:
  - a. Constitutional: assess for tachycardia and hypotension
  - b. Eyes: assess for sunken eyes from dehydration
  - c. Nose /mouth/ears: assess for dry mucus membranes or tongue bite from seizure
  - d. Neurologic:
    - i. Assess GCS and mental status
    - ii. Assess for focal neurologic deficit: motor and sensory

#### **Treatment and Interventions**

1. If altered level of consciousness or stroke, also follow **Altered Mental Status** or **Suspected Stroke/Transient Ischemic Attack** guidelines accordingly
2. If hypoglycemia (glucose < 60 mg/dl) with related symptoms; administer one of the following to increase blood sugar:
  - a. Glucose, oral (in form of glucose tablets, glucose gel, tube of cake icing, etc.)
    - i. Avoid oral glucose in patients that are unable to swallow or maintain airway
    - ii. Adult Dosing: 25 gm

- iii. Pediatric Dosing: 0.5-1 gm/kg
- b. Dextrose IV
  - i. Adult Dosing: 25 gm of 10-50% dextrose IV
    - 1. 50 ml of 50% dextrose
    - 2. 100 ml of 25% dextrose
    - 3. 250 ml of 10% dextrose
  - ii. Pediatric Dosing: 0.5-1 gm/kg of 10-25% dextrose IV
    - 1. 2 – 4 ml/kg of 25% dextrose
    - 2. 4 – 8 ml/kg of 12.5% dextrose
    - 3. 5 – 10 ml/kg of 10% dextrose
- c. Glucagon IM/IN
  - i. Adult Dosing: 1 mg IM/IN
  - ii. Pediatric Dosing: 1 mg IM/IN if  $\geq 20$  kg (or  $\geq 5$  yo)  
0.5 mg IM/IN if  $< 20$  kg (or  $< 5$  yo)
- 3. If hyperglycemia (glucose  $> 250$  mg/dl) with symptoms of dehydration, vomiting, or altered level of consciousness:
  - a. Volume expansion with normal saline bolus
    - i. Adult: Normal saline 1 L bolus IV; reassess and rebolus 1 L if indicated
    - ii. Pediatric: Normal saline 10 ml/kg bolus IV, reassess and repeat up to 40 ml/kg total
- 4. Reassess patient
  - a. Reassess vital signs, mental status, and indications of dehydration
  - b. Repeat point of care blood glucose level indicated if previous hypoglycemia and mental status has not returned to normal
    - i. It is not necessary to repeat blood sugar if mental status has returned to normal
    - ii. It is not necessary to repeat blood glucose level if initial hyperglycemia
  - c. If continued altered mental status and hypoglycemia, give additional dextrose or glucagon using initial dosing
- 5. Disposition
  - a. If hyperglycemia, transport to closest appropriate receiving facility
  - b. If hypoglycemia with continued symptoms, transport to closest appropriate receiving facility
  - c. If hypoglycemia with resolved symptoms, consider release without transport if all of the following are true:
    - i. Repeat glucose is  $> 80$  mg/dl
    - ii. Patient takes insulin
    - iii. Patient does NOT use oral medications to control blood glucose
    - iv. Patient returns to normal mental status, with no focal neurologic signs/symptoms after receiving glucose/dextrose
    - v. Patient can promptly obtain and will eat a carbohydrate meal
    - vi. Patient refuses transport or patient and EMS providers agree transport not indicated
    - vii. A reliable adult will be staying with patient
    - viii. No major co-morbid symptoms exist, like chest pain, shortness of breath, seizures, intoxication, also received naloxone
    - ix. Patient or legal guardian refuses transport

**Patient Safety Considerations**

1. Dextrose 50% can cause local tissue damage if it extravasates from vein. EMS systems may consider carrying no more than 25% concentration of dextrose for treating hypoglycemia in adults
2. For children < 8 years of age, dextrose 25% should be used
3. For neonates and infants < 1 month of age, dextrose 10-12.5% should be used

**Notes/Educational Pearls**

A formula for calculating a 0.5 gm/kg dose of IV dextrose is:

$$[50] / [\text{___ \% concentration of glucose}] = \text{___ ml/kg}$$

For example:

Desired Dose	Fluid type	ml of fluid
0.5g/kg	25% dextrose	2mL/kg
	12.5% dextrose	4mL/kg
	10% dextrose	5mL/kg
1g/kg	25% dextrose	4mL/kg
	12.5% dextrose	8mL/kg
	10% dextrose	10mL/kg

**Key Considerations**

1. Consider contribution of oral diabetic medications to hypoglycemia
2. If possible, have family/patient turn off insulin pumps
3. Consider potential for intentional overdose of hypoglycemic agents

**Pertinent Assessment Findings**

1. Concomitant trauma
2. Diaphoresis or hypothermia may be associated with hypoglycemia

**Quality Improvement****Key Documentation Elements**

1. Document reassessment of vital signs and mental status after administration of glucose/dextrose/glucagon
2. Document point of care glucose level (if in scope of practice) when indicated

### **Performance Measures**

1. When in scope of practice, point of care blood glucose checked for all patients with symptoms of altered level of consciousness, seizure, stroke, or hyperglycemia
2. Within scope of practice, oral glucose or parenteral dextrose/glucagon given when indicated
3. When hyperglycemia documented, appropriate volume replacement given while avoiding overzealous repletion before insulin therapy at receiving center
4. If patient released at scene, criteria documented for safe release

### **References**

1. Kitabchi AE, Umpierrez GE, Miles JM, et al. Hyperglycemic crises in adult patients with diabetes. *Diabetes Care*, 2009 32(7):1335–43
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### **Revision date**

September 15, 2014

## Pain Management

(Incorporates elements of an evidence-based guideline for prehospital analgesia in trauma created using the National Prehospital Evidence-Based Guideline Model Process)

(9914071 – Pain Control)

### **Patient Care Goals**

The practice of prehospital emergency medicine requires expertise in a wide variety of pharmacological and non-pharmacological techniques to treat acute pain resulting from myriad injuries and illnesses. One of the most essential missions for all healthcare providers should be the relief and/or prevention of pain and suffering. Approaches to pain relief must be designed to be safe and effective in the organized chaos of the prehospital environment. The degree of pain and the hemodynamic status of the patient will determine the rapidity of care

### **Patient Presentation**

#### **Inclusion Criteria**

Patients who are experiencing pain

#### **Exclusion Criteria**

1. Patients who are allergic to narcotic medications
2. Patients who have altered mentation (GCS < 15 or mentation not appropriate for age)

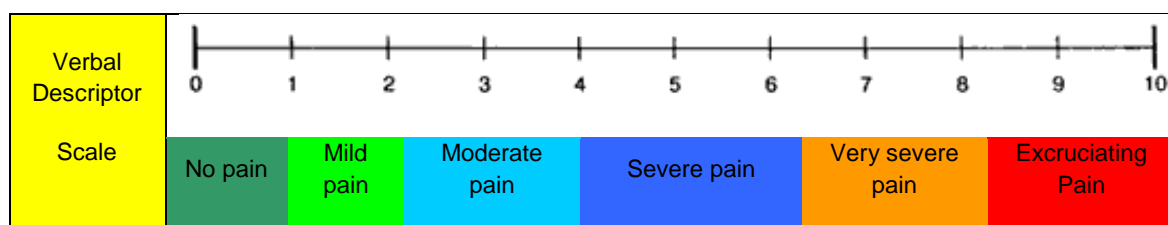
### **Patient Management**

#### **Assessment, Treatment and Interventions**

1. Apply a pulse oximeter and administer oxygen as needed to maintain a O<sub>2</sub> saturation  $\geq 94\%$
2. Determine patient's pain score assessment using standard pain scale.
  - a. < 4 years: Observational scale (e.g. Faces, Legs, Arms, Cry, Consolability (FLACC) or Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)
  - b. 4-12 years: Self-report scale (e.g. Wong Baker Faces, Faces Pain Scale (FPS), Faces Pain Scale Revised (FPS-R)
  - c. > 12 years: Self-report scale (Numeric Rating Scale (NRS)
3. Place patient on cardiac monitor per patient assessment
4. If available, consider use of non-pharmaceutical pain management techniques
  - a. Placement of the patient in a position of comfort
  - b. Application of ice packs and/or splints for pain secondary to trauma
  - c. Verbal reassurance to control anxiety
5. If not improved, consider use of analgesics as available and as permitted by direct medical oversight
  - a. Acetaminophen 15 mg/kg PO (maximum dose 1 gm)
  - b. Ibuprofen 10 mg/kg PO for patients greater than 6 months of age (maximum dose 800 mg)
  - c. Fentanyl 1 mcg/kg IN or IM

- d. Ketorolac – Adult: 60 mg IM in adults who are not pregnant  
Pediatric: (2-16 years) 1mg/kg IM (maximum dose 30 mg)  
Geriatric/Renal impairment: 1mg/kg IM (maximum dose 30 mg)
- e. Morphine sulfate 0.1 mg/kg (maximum dose 15 mg)
- f. Nitrous Oxide
- 6. Establish IV of normal saline per patient assessment
- 7. If the patient is experiencing significant pain, administer IV analgesics
  - a. Ketorolac - Adult: 30 mg IV in adults who are not pregnant  
Pediatric: (2-16 years) 0.5mg/kg (maximum dose 15 mg)  
Geriatric/Renal impairment: 0.5mg/kg (maximum dose 15 mg)
  - b. Morphine sulfate 0.1 mg/kg IV or IO
  - c. Fentanyl 1 mcg/kg IV or IO
- 8. Consider administration of oral, sublingual, or IV antiemetics to prevent nausea in high risk patients. See **Nausea/Vomiting** guideline
- 9. If indicated based on pain assessment, repeat pain medication administration after 10 minutes of the previous dose
- 10. Transport in position of comfort and reassess as indicated

## Universal Pain Assessment Tool



Descriptive Scale	Alert Smiling	No Humor Serious, Flat	Furrowed brow Pursed lips Breath holding	Wrinkled nose Raised upper lip Rapid breathing	Slow blink Open mouth	Eyes closed Moaning Crying
Activity Tolerance Scale	No pain	Can be ignored	Interferes with tasks	Interferes with concentration	Interferes with basic needs	Bed rest required
Spanish	Nada de dolor	Un poquito de dolor	Un dolor leve	Dolor fuerte	Dolor demasiado fuerte	Un dolor insoportable

Source: Hybrid of scales by authors. Wong-Baker FACES Pain Rating Scale license granted for this use. Reproduction of the Wong-Baker material requires licensing at [www.wongbakerFACES.org](http://www.wongbakerFACES.org).

Here are two examples of pediatric-appropriate pain assessment tools

- The Face, Legs, Activity, Cry, Consolability (FLACC) Scale for 0-3 Year Olds
- The Faces Pain Scale - Revised for 4-12 year olds

## FLACC SCALE

Categories	Scoring		
	0	1	2
FACE	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested.	Frequent to constant quivering chin, clenched jaw.
LEGS	Normal position or relaxed.	Uneasy, restless, tense.	Kicking, or legs drawn up.
ACTIVITY	Lying quietly, normal position moves easily.	Squirming, shifting back and forth, tense.	Arched, rigid or jerking.
CRY	No cry, (awake or asleep)	Moans or whimpers; occasional complaint	Crying steadily, screams or sobs, frequent complaints.
CONSOLABILITY	Content, relaxed.	Reassured by occasional touching hugging or being talked to, distractable.	Difficulty to console or comfort

Source: Extracted from *The FLACC: A behavioral scale for scoring postoperative pain in young children*, by S Merkel and others, 1997, *Pediatr Nurse* 23(3), p. 293–297



## Faces Pain Scale – Revised (FPS-R)

From Pediatric Pain Sourcebook, [www.painsourcebook.ca](http://www.painsourcebook.ca)  
Version: 7 Aug 2007 CL von Baeyer

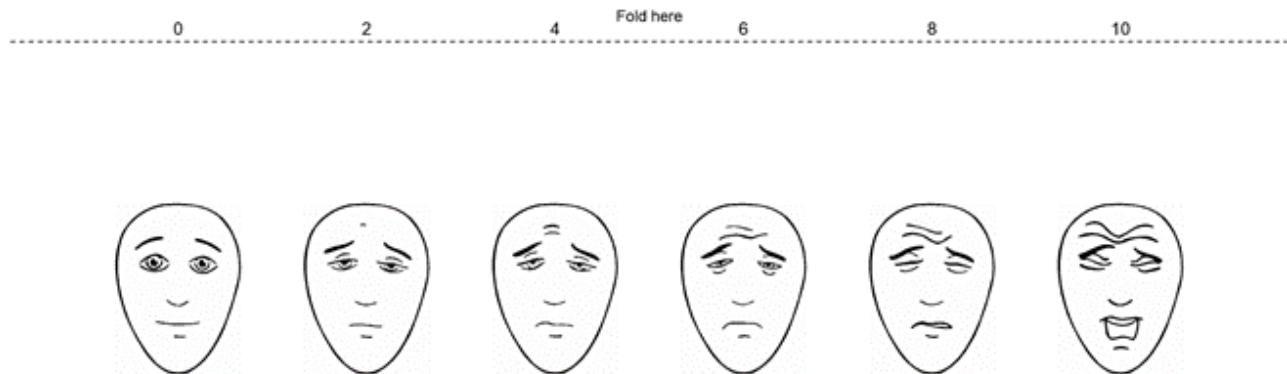
In the following instructions, say "hurt" or "pain," whichever seems right for a particular child.

"These faces show how much something can hurt. This face [point to left-most face] shows no pain. The faces show more and more pain [point to each from left to right] up to this one [point to right-most face] – it shows very much pain. Point to the face that shows how much you hurt [right now]."

Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so '0' = 'no pain' and '10' = 'very much pain.' Do not use words like 'happy' and 'sad'. This scale is intended to measure how children feel inside, not how their face looks.

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**Sources.** Hicks CL, von Baeyer CL, Spafford P, van Korihaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain* 2001;93:173-183. Bieri D, Reeve R, Champion GD, Addicott L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. *Pain* 1990;41:139-150.



Source: This Faces Pain Scale-Revised has been reproduced with permission of the International Association for the Study of Pain® (IASP). The figure may **NOT** be reproduced for any other purpose without permission.

### Patient Safety Considerations

1. All patients should have drug allergies identified prior to administration of pain medication
2. Administer narcotics with caution to patients with GCS < 15, hypotension, identified medication allergy, hypoxia (oxygen saturation < 90%) after maximal supplemental oxygen therapy, or signs of hypoventilation
3. Fentanyl is contraindicated for patients who have taken monoamine oxidase inhibitors (MAOI) during the previous 14 days
4. Non-steroidal anti-inflammatory medications should not be administered to pregnant patients
5. Avoid Ketorolac in patients with NSAID allergy, aspirin-sensitive asthma, renal insufficiency, pregnancy, or known peptic ulcer disease

### Notes/Educational Pearls

#### Key Considerations

1. Pain severity (0 - 10) should be recorded before and after analgesic medication administration and upon arrival at destination

2. Narcotic analgesia was historically contraindicated in the prehospital setting for abdominal pain of unknown etiology. It was thought that analgesia would hinder the emergency physician's or surgeon's evaluation. Recent studies have demonstrated that opiate administration may alter the physical examination findings, but these changes result in no significant increase in management errors
3. Opiates may cause a rise in intracranial pressure

#### **Pertinent Assessment Findings**

1. Mental status (GCS and pain level)
2. Respiratory system (tidal volume, chest rigidity)
3. Gastrointestinal (assess for tenderness, rebound, guarding, and nausea)

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Documentation of patient vital signs with pulse oximetry
2. Acquisition of patient's allergies prior to administration of medication
3. Documentation of initial patient pain scale assessment
4. Documentation of medication administration with correct dose
5. Documentation of patient reassessment with repeat vital signs and patient pain scale assessment

##### **Performance Measures**

1. The clinical efficacy of prehospital analgesia in terms of adequacy of dosing parameters
2. The utilization of alternate medications for patients with drug allergies or during emergency care drug shortages

#### **References**

1. De Nadal M, Munar F, Poca MA, Sahuquillo J, Garnacho A, Rosselló J. Cerebral hemodynamic effects of morphine and fentanyl in patients with severe head injury: absence of correlation to cerebral autoregulation. *Anesthesia*, Jan 2000 volume 92, pages 1-11
2. Merkel S, et al. The FLACC: A behavioral scale for scoring postoperative pain in young children. 1997, *Pediatr Nurse* 23(3), p. 293-297

#### **Revision Date**

September 15, 2014

## Seizures

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914141 – Seizure)

### **Patient Care Goals**

1. Cessation of seizures in the prehospital setting
2. Minimizing adverse events in the treatment of seizures in the prehospital setting
3. Minimizing seizure recurrence during transport

### **Patient Presentation**

#### **Inclusion Criteria**

Seizure activity upon arrival of prehospital personnel or new/recurrent seizure activity lasting > 5 minutes

#### **Exclusion Criteria**

None - (seizures due to trauma, pregnancy, hyperthermia, or toxic exposure should be managed according to those condition-specific guidelines)

### **Patient Management**

#### **Assessment**

1. History
  - a. Duration of current seizure
  - b. Prior history of seizures, diabetes, or hypoglycemia
  - c. Typical appearance of seizures
  - d. Baseline seizure frequency and duration
  - e. Concurrent symptoms of apnea, cyanosis, vomiting, bowel/bladder incontinence, or fever
  - f. Bystander administration of medications to stop the seizure
  - g. Current medications, including anticonvulsants
  - h. Recent dose changes or non-compliance with anticonvulsants
  - i. History of trauma, pregnancy, heat exposure, or toxin exposure
2. Exam
  - a. Air entry/airway patent?
  - b. Breath sounds, respiratory rate and effectiveness of ventilation
  - c. Signs of perfusion (pulses, capillary refill, color)
  - d. Neurologic status (GCS, nystagmus, pupil size)

#### **Treatment and Interventions**

1. If signs of airway obstruction are present and a chin-lift, jaw thrust, and/or suctioning does not alleviate it, place oropharyngeal airway (if gag reflex is absent) or nasopharyngeal airway. Place pulse oximeter and/or waveform capnography to monitor oxygenation/ventilation

2. Apply oxygen via face mask or non-rebreather mask. Administer bag-valve mask ventilation if oxygenation/ventilation are compromised
3. Assess signs of perfusion
4. Assess neurologic status
5. Routes for Treatment  
Buccal, intranasal, or intramuscular routes for benzodiazepines are preferred as first line for administration of anticonvulsants. Rectal administration of anticonvulsants is not recommended. Intravenous (IV) placement is not necessary for treatment of seizures, but could be obtained if needed for other reasons
6. Anticonvulsant Treatment
  - a. 0.2 mg/kg (maximum dose 10 mg) buccal, intramuscular or intranasal midazolam is preferred over rectal diazepam
  - b. If IV routes are utilized, 0.1 mg/kg (maximum dose 4 mg) of diazepam, lorazepam, or midazolam may be used
  - c. Recent evidence supports the use of IM midazolam as an intervention that is at least as safe and effective as intravenous lorazepam for prehospital seizure cessation
7. Glucometry
  - a. If still actively seizing, check capillary blood glucose level
  - b. If < 60 mg/dL, refer to **Hypoglycemia/Hyperglycemia** guideline for treatment recommendations
8. Consider magnesium sulfate, 4 grams IV over 5 minutes in the presence of seizure in the third trimester of pregnancy or post-partum

#### **Patient safety considerations**

1. Trained personnel should be able to give medication without contacting direct medical oversight. However, more than two doses of benzodiazepines are associated with high risk of airway compromise. Use caution, weigh risks/benefits of deferring treatment until hospital, and/or consider consultation with direct medical oversight if patient has received two doses of benzodiazepines by bystanders and/or prehospital providers
2. Hypoglycemic patients who are treated in the field for seizure should be transported to hospital, regardless of whether or not they return to baseline mental status after treatment

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Many airway/breathing issues in seizing patients can be managed without intubation or placement of an advanced airway. Reserve these measures for patients that fail less invasive maneuvers as noted above
2. For children with convulsive status epilepticus requiring medication management in the prehospital setting, trained EMS personnel should be allowed to administer medication without direct medical oversight
3. For new onset seizures or seizures that are refractory to treatment, consider other potential causes including trauma, stroke, electrolyte abnormality, toxic ingestion, pregnancy, hyperthermia
4. A variety of safe and efficacious doses for benzodiazepines have been noted in the literature for seizures. The doses for anticonvulsant treatment noted above are those that are common to the forms and routes of benzodiazepines noted in this guideline. One dose, rather than a range, has been suggested in order to standardize a common dose in situations

when an EMS agency may need to switch from one type of benzodiazepine to another due to cost or resource limitations

### **Pertinent Assessment Findings**

The presence of fever with seizure in children < 6 months old and > 6 years old is **not** consistent with a simple febrile seizure, and should be concerning for meningitis or encephalitis

## **Quality Improvement**

### **Key Documentation Elements**

1. Actively seizing during transport and time of seizure onset/cessation
2. Concurrent symptoms of apnea, cyanosis, vomiting, bowel/bladder incontinence, or fever
3. Medication amounts/routes given by bystanders or prehospital providers
4. Neurologic status (GCS, nystagmus, pupil size)

### **Performance Measures**

- Frequency of performing glucometry
- Time to administration of anticonvulsant medication
- Rate of respiratory failure
- Rate of seizure recurrence

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#### **Revision Date**

September 15, 2014

Adapted from the following article: Shah MI, Macias CG, Dayan PS, et al. An Evidence-Based Guideline for Pediatric Prehospital Seizure Management Using GRADE Methodology. *Prehospital Emergency Care*, 2014 18(Suppl1): 15-24



## Shock

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914127 – Hypotension/Shock (Non-trauma))

### **Patient Care Goals**

1. Initiate early fluid resuscitation and vasopressors to maintain/restore adequate perfusion to vital organs
2. Differentiate between possible underlying causes of shock in order to promptly initiate additional therapy

### **Patient Presentation**

#### **Inclusion Criteria**

1. Signs of poor perfusion (due to a medical cause) such as one or more of the following:
  - a. Altered mental status
  - b. Delayed/flash capillary refill
  - c. Hypoxia (pulse oximetry < 94%)
  - d. Decreased urine output
  - e. Respiratory rate > 20 in adults or elevated in children (see normal vital signs table)
  - f. Hypotension for age (lowest acceptable systolic blood pressure in mm Hg):
    - i. < 1 year: 60
    - ii. 1-10 years: (age in years)(2)+70
    - iii. > 10 years: 90
  - g. Tachycardia for age, out of proportion to temperature (see **Normal Vital Signs** table, **Appendix VII**)
  - h. Weak, decreased or bounding pulses
  - i. Cool/mottled or flushed/ruddy skin
2. AND potential etiologies of shock:
  - a. Hypovolemia (poor fluid intake, excessive fluid loss (e.g. bleeding, SIADH, hyperglycemia, excessive diuretics, vomiting, diarrhea))
  - b. Sepsis (temperature instability: < 36 C or 96.8 F; > 38.5 C or 101.3 F; and/or tachycardia, warm skin, tachypnea)
  - c. Anaphylaxis (urticaria, nausea/vomiting, facial edema, wheezing)
  - d. Signs of heart failure (hepatomegaly, rales on pulmonary exam, extremity edema, JVD)

#### **Exclusion Criteria**

Shock due to suspected trauma (see **Trauma** section guidelines)

### **Patient Management**

#### **Assessment**

1. History
  - a. History of GI bleeding
  - b. Cardiac problems



- c. Stroke
  - d. Fever
  - e. Nausea/vomiting, diarrhea
  - f. Frequent or no urination
  - g. Syncopal episode
  - h. Allergic reaction
  - i. Immunocompromise (malignancy, transplant, asplenia)
  - j. Adrenal insufficiency
  - k. Presence of a central line
  - l. Other risk of infection (spina bifida or other genitourinary anatomic abnormality)
2. Exam
    - a. Airway/breathing (airway edema, rales, wheezing, pulse oximetry, respiratory rate)
    - b. Circulation (heart rate, blood pressure, capillary refill)
    - c. Abdomen (hepatomegaly)
    - d. Mucous membrane hydration
    - e. Skin (turgor, rash)
    - f. Neurologic (GCS, sensorimotor deficits)
  3. Determination of type of shock
    - a. Cardiogenic
    - b. Distributive (neurogenic, septic, anaphylactic)
    - c. Hypovolemic
    - d. Obstructive (e.g. pulmonary embolism, cardiac tamponade, tension pneumothorax)

### **Treatment and Interventions**

1. Check full vital signs
2. Administer oxygen (titrate oxygen to  $\text{SPO}_2 \geq 94\%$ )
3. Cardiac monitor
4. Pulse oximetry
5. Check blood sugar, and correct if  $< 60 \text{ mg/dl}$
6. EKG
7. Check lactate, if available ( $> 2.5 \text{ mmol/L}$  is abnormal)
8. Antipyretics for fever
  - a. Acetaminophen (15 mg/kg; max dose of 1000 mg)
  - b. Ibuprofen (10 mg/kg; max dose of 800 mg)
9. Establish IV access; if unable to obtain within 2 attempts or  $< 90$  seconds, place an IO needle
10. IV fluids (20 ml/kg isotonic fluid; max of 1 liter) over  $< 15$  minutes, using a push-pull method of drawing up the fluid in a syringe and pushing it through the IV. May repeat up to 3 times
11. If there is a history of adrenal insufficiency, give:
  - a. Hydrocortisone succinate, 2 mg/kg (max 100 mg) IV/IM (preferred) **or**
  - b. Methylprednisolone 2 mg/kg IV (max 125 mg)
12. Vasopressors (shock unresponsive to IV fluids)
  - a. Cardiogenic shock, hypovolemic shock, obstructive shock:
    - Give dopamine, 2-20 mcg/kg/minute
    - Give epinephrine, 0.05-0.3 mcg/kg/minute

- Norepinephrine - there is recent evidence that supports the use of norepinephrine as the preferred intervention (initial dose: 0.5 – 1 mcg/minute titrated to effect. For patients in refractory shock: 8-30 mcg/minute)
- b. Distributive shock (with the exception of anaphylactic shock):
  - Give norepinephrine, 0.05-0.5 mcg/kg/minute
  - Norepinephrine is the first-line drug of choice for neurogenic shock
  - For anaphylactic shock see **Anaphylaxis and Allergic Reaction** guideline
- 13. Provide advanced notification to the hospital
- 14. Consider empiric antibiotics for suspected septic shock if transport time is anticipated to be > 1 hour, if blood cultures can be obtained in advance, and/or EMS has coordinated with regional receiving hospitals about choice of antibiotic therapy.

### **Patient Safety Considerations**

Recognition of cardiogenic shock: if patient condition deteriorates after fluid administration, rales or hepatomegaly develop, then consider cardiogenic shock and holding further fluid administration

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Early, aggressive IV fluid administration is essential in the treatment of suspected shock
2. Patients predisposed to shock:
  - a. Immunocompromised (patients undergoing chemotherapy or with a primary or acquired immunodeficiency)
  - b. Adrenal insufficiency (Addison's disease, congenital adrenal hyperplasia, chronic or recent steroid use)
  - c. History of a solid organ or bone marrow transplant
  - d. Infants
  - e. Elderly
3. Tachycardia is the first sign of compensated shock, and may persist for hours. Hypotension indicates uncompensated shock, which may progress to cardiopulmonary failure within minutes
4. Hydrocortisone succinate, if available, is preferred over methylprednisolone and dexamethasone for the patient with adrenal insufficiency, because of its dual glucocorticoid and mineralocorticoid effects. Patients with no reported history of adrenal axis dysfunction may have adrenal suppression due to their acute illness, and hydrocortisone should be considered for any patient showing signs of treatment-resistant shock. Patients with adrenal insufficiency may have an emergency dose of hydrocortisone available that can be administered IV or IM

#### **Pertinent Assessment Findings**

Decreased perfusion manifested by altered decreased mental status, decreased urine output (< 1 ml/kg/hr) or abnormalities in capillary refill or pulses:

1. Cardiogenic, hypovolemic, obstructive shock: capillary refill >2 seconds, diminished peripheral pulses, mottled cool extremities
2. Distributive shock: flash capillary refill, bounding peripheral pulses

## **Quality Improvement**

### **Key Documentation Elements**

1. Medications administered
2. Full vital signs with reassessment every 15 minutes or as appropriate
3. Lactate level
4. Neurologic status assessment (see **Appendix VI**)
5. Amount of fluids given

### **Performance Measures**

1. Percentage of patients who have full vital signs (HR, RR, BP, T, O2) documented
2. Presence of a decision support tool (laminated card, a protocol, or electronic alert) to identify patients in shock
3. Percentage of patients with suspected shock for whom advanced notification to the hospital was provided
4. Mean time from abnormal vitals to initiation of a fluid bolus
5. Percentage of patients who receive pressors for ongoing hypotension after receiving 60 ml/kg isotonic fluid in the setting of shock

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**Revision Date**

September 15, 2014

# Resuscitation

## Cardiac Arrest (VF/VT/Asystole/PEA)

(9914011 – Cardiac Arrest-Asystole; 99014013 – Cardiac Arrest-Hypothermia-Therapeutic; 9914015 – Cardiac Arrest-Pulseless Electrical Activity; 9914017 – Cardiac Arrest-Ventricular Fibrillation/Pulseless Ventricular Tachycardia)

### **Patient Care Goals**

1. Return of spontaneous circulation (ROSC)
2. Preservation of neurologic function

### **Inclusion Criteria**

Patients with cardiac arrest

### **Exclusion Criteria**

Include the following:

1. Patients suffering cardiac arrest due to severe hypothermia (see **Hypothermia/Cold Exposure** guideline)
2. Patients with identifiable Do Not Resuscitate (or equivalent such as POLST) order (see **Terminating or Not Starting Resuscitation Due to DO Not Resuscitate/Advance Directive/Healthcare Power of Attorney (POA)** guideline)
3. Patients with transient loss of consciousness and presence of pulses upon EMS evaluation (see **Syncope/Pre-syncope** guideline)
4. Patients in arrest due to traumatic etiology (see **General Trauma Management** guideline)

### **Patient Management**

#### **Assessment**

The patient in cardiac arrest requires a prompt balance of treatment and assessment. In cases of cardiac arrest, assessments should be focused and limited to obtaining enough information to reveal the patient is pulseless. Once pulselessness is discovered, treatment should be initiated immediately and any further history must be obtained by bystanders while treatment is ongoing

#### **Treatment and Interventions**

The most important therapies for patients suffering from cardiac arrest are prompt cardiac defibrillation and effective chest compressions

1. Initiate chest compressions in cases with no bystander chest compressions, or take over compressions from bystanders while a second rescuer is setting up the AED or defibrillator.
  - a. If adequate, uninterrupted bystander CPR has been performed or if the patient arrests in front of the EMS providers, immediately proceed with rhythm analysis and defibrillation, if appropriate
  - b. If no compressions and the arrest was not witnessed by EMS providers, perform chest compressions at a rate of 100-120/minute, followed by rhythm analysis and defibrillation, if appropriate. In the unwitnessed arrest, chest compressions are

commonly the most rapidly applied therapy and should be instituted immediately in an effort to minimize the “no flow” state of cardiac arrest

2. All efforts should be instituted to create a “low flow” state (through effective chest compressions) or “normal flow” state through return of spontaneous circulation (via defibrillation or other treatment)
3. Defibrillation should be at the maximum output of the defibrillator, based on manufacturer’s recommendations, up to 360 joules (or 4 J/kg for pediatric patients), for initial and subsequent defibrillation attempts
4. Chest compressions should resume immediately after defibrillation attempts with no pauses for pulse checks
5. All attempts should be made to prevent avoidable interruptions in chest compressions, such as pre-charging the defibrillator and hovering over the chest, rather than stepping away during defibrillations
6. IV access should be obtained within the first 2-minute period of chest compressions and Epinephrine 1 mg (0.01 mg/kg for pediatrics) IV should be provided every 3-5 minutes starting with the first or second round of chest compressions. The first or second dose of epinephrine may be substituted by vasopressin 40 units IV (except in pediatrics)
7. Continue the cycle of chest compressions for 2 minutes, followed by rhythm analysis and defibrillation of shockable rhythms. During this period of time, the proper strategy of airway management is currently not defined and many options for airway management exist. Regardless of the airway management strategy, consider the following principles:
  - a. The airway management strategy should not interrupt compressions
  - b. Consider ventilation rates between 8-10 breaths/minute  
If no advanced airway, consider either a 15:1 or 30:2 ventilation to compression ratio. For pediatrics a ratio of 15:2 should be used when 2 rescuers are present. Once advanced airway is applied, ventilations should not exceed 8-10 breaths/minute
  - c. Consider limited tidal volumes. For neonates and young children, an adult sized BVM may be used as long as a proper mask size and tidal volume are utilized
8. Consider use of antidysrhythmic for recurrent VF/Pulseless VT
  - a. Amiodarone 300 mg (or 5 mg/kg for pediatrics) IV, (Amiodarone may be repeated once at a dose of 150 mg in adults and twice for pediatrics, up to a maximum of 15 mg/kg or 300 mg), or
  - b. Lidocaine – Initial dose is 1.0 - 1.5 mg/kg (or 1 mg/kg for pediatrics, although amiodarone is preferred for pediatrics) IV (Lidocaine may be repeated every 5-10 minutes at a dose of 0.5 - 0.75 mg/kg IV up to a total dose of 3 mg/kg. For pediatrics, the maximum total dose is 1 mg/kg), or
  - c. For torsades de pointes, magnesium sulfate 2 g (or 25-50 mg/kg for pediatrics) IV
9. Consider reversible causes of cardiac arrest which include the following:
  - a. Hypothermia – additions to care include attempts at active rewarming. Refer to **Hypothermia/Cold Exposure** guideline.
  - b. The dialysis patient/known hyperkalemic patient – Additions to care include the following:
    - i. Calcium chloride 10% 10ml IV (for pediatrics, the dose is 20 mg/kg which is 0.2 ml/kg)
    - ii. Sodium Bicarbonate 1 mEq/kg IV
  - c. Tricyclic antidepressant overdose - Additions to care include the following:

- Sodium bicarbonate 1 mEq/kg IV
- d. Hypovolemia - Additions to care include the following:
    - Normal saline 2 L IV (or 20 ml/kg, repeated up to 3 times for pediatrics)
  - e. If the patient is intubated at the time of arrest, assess for tension pneumothorax and misplaced ETT. If tension pneumothorax suspected, perform needle decompression. Assess ETT, if misplaced, replace ETT
10. If at any time during this period of resuscitation the patient regains return of spontaneous circulation, proceed to the **Adult Post-ROSC Care** guideline
11. If resuscitation remains ineffective, consider termination of resuscitation (see **Termination of Resuscitative Efforts** guideline)

### **Patient Safety Considerations**

It is not safe for the patient or providers to perform chest compressions during transport. Chest compressions during patient movement are less effective in regards to hands on time, depth, recoil and rate and providers performing chest compressions in a moving vehicle are at risk for injury. Therefore, patients should be resuscitated as close to the scene as operationally possible

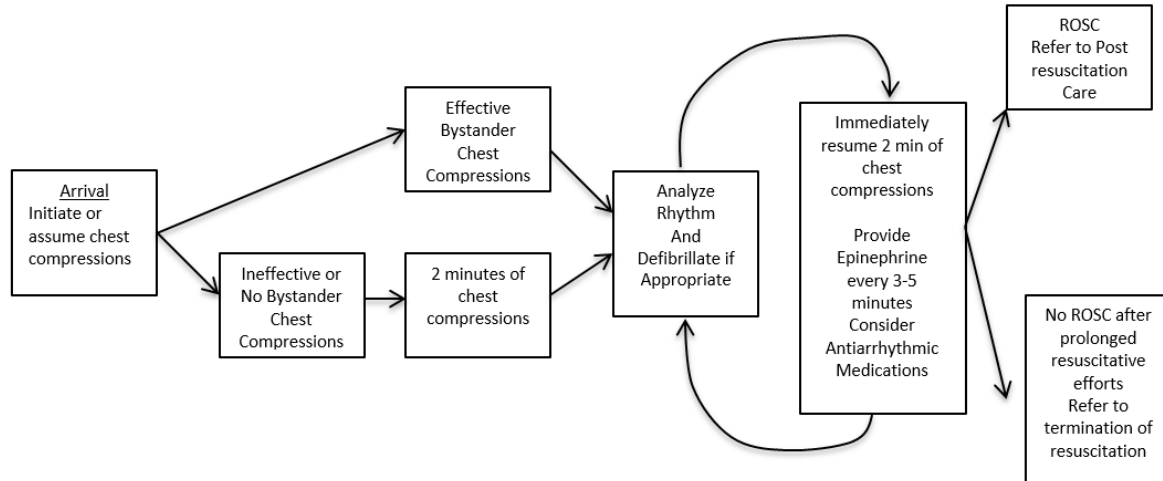
### **Notes/Educational Pearls**

#### **Key Considerations**

1. Effective chest compressions and defibrillation are the most important therapies to the patient in cardiac arrest. Effective chest compressions are defined as:
  - a. A rate of greater than 100 and less than 120 compressions/minute
  - b. Depth of at least 2 inches (5 cm) for adults and children or 1.5 inches (4 cm) for infants
  - c. Allow for complete chest recoil
  - d. Minimize interruptions in compressions
  - e. Avoid rescuer fatigue by rotating rescuers every 1-2 minutes
  - f. Avoid excessive ventilation. If no advanced airway, consider either a 15:1 or 30:2 ventilation to compression ratio for adults, and 15:2 for children when 2 rescuers are present. Once advanced airway is applied, ventilations should not exceed 8-10 breaths/minute
  - g. Quantitative end-tidal CO<sub>2</sub> should be used to monitor effectiveness of chest compressions. If ET CO<sub>2</sub> < 10 mmHg, attempt to improve chest compression quality. Consider additional monitoring with biometric feedback which may improve compliance with suggested resuscitation guidelines



## General Cardiac Arrest Process



- h. Chest compressions are usually the most rapidly applied therapy for the patient in cardiac arrest and should be applied as soon as the patient is noted to be pulseless. If the patient is being monitored with pads in place at the time of arrest, immediate defibrillation should take precedence over all other therapies, however, if there is any delay in defibrillation (for instance, in order to place pads), chest compressions should be initiated while the defibrillator is being applied. There is no guidance on how long these initial compressions should be applied, however, it is reasonable to either complete between 30 seconds and 2 minutes of chest compressions in cases of no bystander chest compressions OR to perform defibrillation as soon as possible after chest compressions initiated in cases of witnessed arrest
- i. Chest compressions should be reinitiated immediately after defibrillation as pulses, if present, are often difficult to detect and rhythm and pulse checks interrupt compressions
- j. Continue chest compressions between completion of AED analysis and AED charging
- k. Effectiveness of chest compressions decreases with any movements. Patients should therefore be resuscitated as close to the point at which they are first encountered and should only be moved if the conditions on scene are unsafe or do not operationally allow for resuscitation. Chest compressions are also less effective in a moving vehicle. It is also dangerous to EMS providers, patients, pedestrians and other motorists to perform chest compressions in a moving ambulance. For these reasons and because in most cases the care provided by EMS providers is equivalent to that provided in emergency departments, resuscitation should occur on scene
- l. Defibrillation dosing should follow manufacturer's recommendation in the case of biphasic defibrillators. If the manufacturer's recommendation is unknown, use highest setting possible. In the case of monophasic devices, setting should be 360J (or 4 J/kg for children)

2. Consider IV access during first round of chest compressions

3. Administer epinephrine during the first or second round of compressions
4. Airway management strategy should be considered early during the case. At present, the most effective mechanism of airway management is uncertain with some systems managing the airway aggressively and others managing the airway with basic measures and both types of systems finding excellent outcomes. Regardless of the airway management style, consider the following principles:
  - a. Airway management should not interrupt chest compressions
  - b. Carefully follow ventilation rate and prevent hyperventilation
  - c. Consider limited tidal volumes
  - d. There is uncertainty regarding the proper goals for oxygenation during resuscitation. Current recommendations suggest using the highest flow rate possible through NRB or BVM. This should not be continued into the post-resuscitation phase in which there becomes more clear guidance on maintaining an oxygenation saturation of  $\geq 94\%$
  - e. Special attention should be applied to the pediatric population and airway management/respiratory support. Given that the most likely cause of cardiac arrest is respiratory, airway management may be considered early in the patient's care. However, the order of Circulation-Airway-Breathing is still recommended as the order of priority by the American Heart Association for pediatric resuscitation in order to ensure timely initiation of chest compressions to maintain perfusion, regardless of the underlying cause of the arrest. In addition, conventional CPR is preferred in children, since it is associated with better outcomes when compared to compression-only CPR
5. Special Circumstances in Cardiac Arrest
  - a. Trauma – Refer to **General Trauma Management** guideline
  - b. Pregnancy
    - i. The best hope for fetal survival is maternal survival
    - ii. Position the patient in the supine position with a second rescuer performing manual uterine displacement to the left in an effort to displace the gravid uterus and increase venous return by avoiding aorto-caval compression
    - iii. If manual displacement is unsuccessful, the patient may be placed in the left lateral tilt position at 30°. This position is less desirable than the manual uterine displacement as chest compressions are more difficult to perform in this position
    - iv. Chest compressions should be performed slightly higher on the sternum than in the non-pregnant patient to account for elevation of the diaphragm and abdominal contents in the obviously gravid patient
    - v. Defibrillation should be performed as in non-pregnant patients
  - c. Arrests of respiratory etiology (including drowning)
 

Consider early and aggressive management of the patient's airway as well as the above protocols for cardiac arrest
6. Consider application of the "pit crew" model of resuscitation
  - a. Ideally, providers in each EMS agency will use a "pit crew" approach when using this protocol to ensure the most effective and efficient cardiac arrest care. Training should

include teamwork simulations integrating first responders, BLS, and ALS crewmembers who regularly work together. High-performance systems should practice teamwork using “pit crew” techniques with predefined roles and crew resource management principles.

For example (the Pennsylvania State EMS Model for Pit Crew):

- i. Rescuer 1 and 2 set up on opposite sides of patient’s chest and perform continuous chest compressions, alternating after every 100 compressions to avoid fatigue
- ii. Consider use of a metronome or CPR feedback device to ensure that compression rate is 100-120/minute
- iii. Chest compressions are only interrupted during rhythm check (AED analysis or manual) and defibrillation shocks. Continue compressions when AED/defibrillator is charging
- iv. Additional rescuer obtains IO (or IV) access and gives Epinephrine. Consider tibial IO as first attempt at vascular access
- v. During the first four cycles of compressions/defibrillation (approximately 10 minutes) avoid any attempt at intubation
- vi. One responding provider assumes code leader position overseeing the entire response
- vii. Use a CPR checklist to ensure that all best practices are followed during CPR
- b. For efficient “pit crew” style care, the EMS agency medical director should establish the options that will be used by providers functioning within the EMS agency. Options include establishing:
  - i. The airway/ventilation management, if any, that will be used
  - ii. The initial route of vascular access
- c. The EMS agency must, overseen by the agency medical director, perform a QI review of care and outcome for every patient that receives CPR
  - i. The QI should be coordinated with local receiving hospitals to include hospital admission, discharge, and condition information. This EMS agency QI can be accomplished by participation an organized cardiac arrest registry
  - ii. The QI should be coordinated with local PSAP/dispatch centers to review opportunities to assure optimal recognition of possible cardiac arrest cases and provision of dispatch-assisted CPR (including hands-only CPR when appropriate)

## **Quality Improvement**

### **Key Documentation Elements**

Should be tailored to any locally utilized data registry but may include as a minimum the following elements:

1. Resuscitation attempted and all interventions performed
2. Arrest witnessed
3. Location of arrest
4. First monitored rhythm

5. CPR before EMS arrival
6. Outcome
  - a. Any ROSC
7. Presumed etiology
  - a. Presumed cardiac
  - b. Trauma
  - c. Submersion
  - d. Respiratory
  - e. Other non-cardiac
  - f. Unknown

#### **Performance Measures**

1. Time to scene
2. Time to patient
3. Time to first CPR
4. Time to first shock
5. Review of CPR Quality

#### **References**

1. Berg et al. Part 5: Adult Basic Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
2. Link et al. Part 6: Electrical therapies: automated external defibrillators, defibrillators, cardioversion and pacing. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
3. Cave et al. Part 7: CPR techniques and devices: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
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5. Vanden Hoek et al. Part 12: cardiac arrest in special situations: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
6. Kleinman et al. Part 14: pediatric Advanced Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
7. Berg et al. Part 13: pediatric Basic Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010
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#### **Revision Date**

September 15, 2014

## Adult Post-ROSC (Return of Spontaneous Circulation) Care

(9914019 – Post Resuscitation Care)

### **Patient Care Goals**

Out-of-hospital cardiac arrest in the U.S. has a mortality rate greater than 90% and results in excess of 300,000 deaths per year. Many of those who do survive suffer significant neurologic morbidity. Current research has demonstrated that care of patients with return of spontaneous circulation (ROSC) at specialized centers is associated with both decreased mortality and improved neurologic outcomes. It is believed that hypothermia suppresses the cascade of damaging biochemical events that causes secondary cellular injury and death after an anoxic insult

The goal is therefore to optimize neurologic and other function following a return of spontaneous circulation following resuscitated cardiac arrest

### **Patient Presentation**

#### **Inclusion Criteria**

Patient returned to spontaneous circulation following cardiac arrest resuscitation

#### **Exclusion Criteria**

None

### **Patient Management**

#### **Assessment, Treatment, and Interventions**

1. Perform general patient management
2. Support life-threatening problems associated with airway, breathing, and circulation. Monitor closely for reoccurrence of cardiac arrest
3. Titrate oxygen to keep O<sub>2</sub> saturation  $\geq$  94%. Do NOT hyper-oxygenate
4. For hypotension (SBP less than 90 mmHg) associated with cardiogenic shock, give a Dopamine infusion at 5–20 mcg/kg/minute IV. Titrate to SBP greater than 90 mmHg in adults. Consider norepinephrine: there is recent evidence that supports the use of norepinephrine as the preferred intervention (initial dose: 0.5 – 1 mcg/minute titrated to effect. For patients in refractory shock: 8-30 mcg/minute)
5. Check blood glucose. If hypoglycemic, see appropriate guideline. If hyperglycemic, notify hospital on arrival
6. If patient seizes, refer to seizure guideline
7. Perform 12-lead EKG
8. Post cardiac arrest patients with evidence or interpretation consistent with ST elevation myocardial infarction (STEMI/Acute MI) may be transported to any hospitals which offer percutaneous coronary intervention in their cardiac catheterization laboratory
9. Consider transport patients to facility which offers specialized post-resuscitative care
10. Do not allow patient to become hyperthermic
11. Mild therapeutic hypothermia may be beneficial in unresponsive patients with ROSC. Only if a coordinated system of care exists to maintain therapy, **may** consider:
  - a. Start an IV of ice-cold normal saline

- b. Infuse a 20 to 30 ml/kg bolus (Goal: 2 liters of ice cold saline in adult patients)
- c. While administering fluid boluses, frequently reassess perfusion for improvement and/or fluid overload respiratory distress. If perfusion improves, slow the IV to KVO and monitor closely. If patient develops fluid overload respiratory distress (dyspnea, rales, crackles, decreasing SpO<sub>2</sub>), slow the IV to KVO
- d. If patient unresponsive and patient begins shivering, sedate further with benzodiazepines

**INDICATION FOR ICE SALINE:** Unresponsive adult patients (with return of spontaneous return of circulation after a non-traumatic cardiac arrest.

**CONTRAINDICATIONS FOR ICE SALINE:**

- 1. Major trauma.
- 2. Preexisting hypothermia.
- 3. Hypotension (SBP less than 90 mmHg) unresponsive to vasopressors.
- 4. Known bleeding disorders or liver failure.
- 5. Responsive patient.

**Patient Safety Considerations**

None

**Notes/Educational Pearls**

**Key Considerations**

- 1. Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post resuscitation phase and must be avoided
- 2. Most patients immediately post resuscitation will require ventilatory assistance
- 3. The condition of post-resuscitation patients fluctuates rapidly and continuously, and they require close monitoring. A significant percentage of Post ROSC patients will re-arrest
- 4. A moderate number of post ROSC patients may have evidence of ST elevation MI on EKG
- 5. Common causes of post-resuscitation hypotension include hyperventilation, hypovolemia, and pneumothorax

**Pertinent Assessment Findings**

Assess post ROSC rhythm, lung sounds, and for signs of hypoperfusion

**Quality Improvement**

**Key Documentation Elements**

- 1. Bystander CPR performed
- 2. First initial rhythm (presenting rhythm)
- 3. Immediate post-arrest rhythms, vital signs, oxygen saturation, neurologic status assessment
- 4. Post ROSC 12 lead ECG

### **Performance Measures**

1. Survival to hospital discharge neurologically intact (CPC1 or CPC2)
2. Percent of ROSC patients transported to appropriate facility as defined by the EMS system

### **References**

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2. Epidemiology, Pathophysiology, Treatment, and Prognostication. A consensus statement from the International Liaison Committee on Resuscitation (American Heart Association, Australian and New Zealand Council on Resuscitation, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Asia, and the Resuscitation Council of Southern Africa); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; and the Stroke Council. *Circulation* 2008; 118: 2452–2483
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10. Aufderheide TP, Lurie KG. Death by hyperventilation: a common and life-threatening problem during cardiopulmonary resuscitation. *Crit Care Med*, 2004; 32 (suppl): S345–S351
11. Quintero-Moran B, Moreno R, Villarreal S, Perez-Vizcayno MJ, Hernandez R, Conde C, Vazquez P, Alfonso F, Bañuelos C, Escaned J, Fernandez-Ortiz A, Azcona L, Macaya C. Percutaneous coronary intervention for cardiac arrest secondary to ST-elevation acute myocardial infarction: influence of immediate paramedical/medical assistance on clinical outcome. *J Invasive Cardiol*, 2006; 18: 269–272
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**Revision Date**  
September 15, 2014



## Determination of Death / Withholding Resuscitative Efforts

(No NEMSIS category)

### **Patient Care Goals**

All clinically dead patients will receive all available resuscitative efforts including cardiopulmonary resuscitation (CPR) unless contraindicated by one of the exceptions defined below

### **Patient Presentation**

A clinically dead patient is defined as any unresponsive patient found without respirations and without a palpable carotid pulse

#### **Inclusion/Exclusion Criteria:**

Resuscitation must be started on all patients who are found apneic and pulseless unless the following conditions exist (does not apply to victims of lightning strikes, drowning or hypothermia):

1. Traumatic injury or body condition clearly indicating biological death (irreversible brain death), limited to:
  - a. Decapitation: the complete severing of the head from the remainder of the patient's body
  - b. Decomposition or putrefaction: the skin is bloated or ruptured, with or without soft tissue sloughed off. The presence of at least one of these signs indicated death occurred at least 24 hours previously
  - c. Transection of the torso: the body is completely cut across below the shoulders and above the hips through all major organs and vessels. The spinal column may or may not be severed
  - d. Incineration: 90% of body surface area with full thickness burns as exhibited by ash rather than clothing and complete absence of body hair with charred skin
  - e. Dependent lividity with rigor mortis (when clothing is removed there is a clear demarcation of pooled blood within the body, and the body is generally rigid)
  - f. Injuries incompatible with life (such as massive crush injury, complete exsanguination, severe displacement of brain matter)

**OR**

2. A valid DNR order (form, card, bracelet) or other actionable medical order (e.g. POLST/MOLST form) present, when it:
  - a. Conforms to the state specifications for color and construction
  - b. Is intact: it has not been cut, broken or shows signs of being repaired
  - c. Displays the patient's name and the physician's name

## **Patient Management**

### **Assessment**

Assess for dependent lividity with rigor mortis and/or other inclusion criteria

### **Treatment and Interventions**

1. If all the components above are confirmed, no CPR is required
2. If CPR has been initiated but all the components above have been subsequently confirmed, CPR may be discontinued and direct medical oversight contacted as needed
3. If any of the findings are different than those described above, clinical death is not confirmed and resuscitative measures must be immediately initiated or continued and the patient transported to a receiving hospital unless paramedic intercept is pending. The **Termination of Resuscitation** guideline should then be implemented
4. Do Not Resuscitate order (DNR/MOLST/POLST) with signs of life:
  - a. If there is a DNR bracelet or DNR transfer form and there are signs of life (pulse and respirations), provide standard appropriate treatment under existing protocols matching the patient's condition
  - b. To request permission to withhold treatment under these conditions for any reason obtain direct medical oversight
  - c. If there is documentation of a Do Not Intubate (DNI/MOLST/POLST) advanced directive, the patient should receive full treatment per protocols with the exception of any intervention specifically prohibited in the patient's advanced directive
  - d. If for any reason an intervention that is prohibited by an advanced directive is being considered, direct medical oversight should be obtained

### **Patient Safety Considerations**

In cases where the patient's status is unclear and the appropriateness of withholding resuscitation efforts is questioned, EMS personnel should initiate CPR immediately and then contact direct medical oversight

## **Notes/Educational Pearls**

### **Key Considerations**

When there is a personal physician present at the scene who has an ongoing relationship with the patient, that physician may decide if resuscitation is to be initiated. When there is a registered nurse from a home health care or hospice agency present at the scene who has an ongoing relationship with the patient, and who is operating under orders from the patient's private physician, that authorized nurse may decide if resuscitation is to be initiated. If the physician or nurse decides resuscitation is to be initiated, usual direct medical oversight procedures will be followed

Special Consideration: For scene safety and/or family wishes, provider may decide to implement CPR even if all the criteria for death are met

### **Pertinent Assessment Findings**

No specific recommendations

## **Quality improvement**

### **Key Documentation Elements**

1. Clinical/situational details that may be available from bystanders/caregivers
2. Documentation of details surrounding decision to determine death
  - a. Time of contact with direct medical oversight
  - b. Time of death determination
3. Names/contact information for significant bystanders (e.g. MD/RN, caregivers)

### **Performance Measures**

Compliance with guideline

## **References**

1. ACEP Policy Statement 'Do Not Attempt Resuscitation' (DNAR) in the Out-of-Hospital Setting. October 2003
2. National Guidelines for Statewide Implementation of EMS "Do Not Resuscitate" (DNR) Programs National Association of Emergency Medical Services Directors and the National Association of Emergency Medical Services Physicians. *Prehospital and Disaster Medicine*, April-June, 1994

## **Revision Date**

September 15, 2014

## Do Not Resuscitate Status/Advanced Directives/Health Care Power of Attorney (POA) Status

(9914169 – Cardiac Arrest – Do Not Resuscitate)

### **Patient Care Goals**

To acknowledge and maintain the variety of ways that patients can express their wishes about cardiopulmonary resuscitation or end of life decision making

### **Patient Presentation**

#### **Inclusion/Exclusion Criteria**

1. Patients must have one of the following documents or a valid alternative (such as identification bracelet indicating wishes) immediately available – note that some specifics can vary widely from state to state:
  - a. Physician Orders for Life Sustaining Treatment (POLST) or Medical Orders for Life Sustaining Treatment (MOLST) – explicitly describes acceptable interventions for the patient in the form of medical orders, must be signed by a physician or other empowered medical provider to be valid
  - b. Do Not Resuscitate (DNR) order – identifies that CPR and intubation are not to be initiated if the patient is in arrest or peri-arrest. The interventions covered by this order and the details around when to implement them can vary widely
  - c. Advanced directives – document that describes acceptable treatments under a variable number of clinical situations including some or all of the following: what to do for cardiac arrest, whether artificial nutrition is acceptable, organ donation wishes, dialysis, etc. Frequently does not apply to emergent or potentially transient medical conditions
  - d. As specified from state to state, in the absence of formal written directions (MOLST, POLST, DNR, advanced directives), and in the presence of a person with power of attorney for healthcare, or healthcare proxy, that person may prescribe limits of treatment
2. One of the documents above is valid when it meets all of the following criteria:
  - a. Conforms to the state specifications for color and construction
  - b. Is intact: it has not been cut, broken or shows signs of being repaired
  - c. Displays the patient's name and the physician's name
3. If there is question about the validity of the form/instrument, the best course of action is to proceed with the resuscitation until additional information can be obtained to clarify the best course of action
4. If a patient has a valid version of one of the above documents it will be referred to as a "valid exclusion to resuscitation" for the purposes of this protocol

### **Patient Management**

#### **Assessment**

1. If the patient has a valid exclusion to resuscitation then no CPR or airway management

should be attempted, however this does not exclude comfort measures including medications for pain as appropriate

2. If CPR has been initiated and a valid exclusion to resuscitation has been subsequently verified, CPR may be discontinued and direct medical oversight contacted as needed

### **Treatment and Interventions**

1. If there is a valid exclusion to resuscitation and there are signs of life (pulse and respirations), EMS providers should provide standard appropriate treatment under existing protocols according to the patient's condition. If the patient has a MOLST or POLST, it may provide specific guidance on how to proceed in this situation. Directives should be followed as closely as possible and direct medical oversight contacted as needed
2. The patient should receive full treatment per protocols with the exception of any intervention specifically prohibited in the patient's valid exclusion to resuscitation
3. If for any reason an intervention that is prohibited by an advanced directive is being considered, direct medical oversight should be obtained

### **Patient Safety Considerations**

In cases where the patient's status is unclear and the appropriateness of withholding resuscitation efforts is questioned, EMS personnel should initiate CPR immediately and contact direct medical oversight

## **Notes/Educational Pearls**

### **Key Considerations**

1. If there is a personal physician present at the scene who has an ongoing relationship with the patient, that physician may decide if resuscitation is to be initiated
2. If there is a registered nurse from a home health care or hospice agency present at the scene who has an ongoing relationship with the patient, and who is operating under orders from the patient's private physician, that nurse (authorized nurse) may decide if resuscitation is to be initiated
3. If the physician or nurse decides resuscitation is to be initiated, usual direct medical oversight procedures will be followed
4. Special Consideration: For scene safety and/or family wishes, provider may decide to implement CPR even if all the criteria for death are met

### **Pertinent Assessment Findings**

No specific recommendations

## **Quality Improvement**

### **Key Documentation Elements**

1. Detailed description of the valid exclusion to resuscitation documentation used to guide resuscitation including a copy of the document if possible
2. Names/contact information for significant bystanders (family members, MD/RN, caregivers, healthcare power of attorney or proxy)

### **Performance Measures**

Compliance with guideline

**References**

1. ACEP Policy Statement 'Do Not Attempt Resuscitation' (DNAR) in the Out-of-Hospital Setting. October 2003
2. National Guidelines for Statewide Implementation of EMS "Do Not Resuscitate" (DNR) Programs National Association of Emergency Medical Services Directors and the National Association of Emergency Medical Services Physicians. *Prehospital and Disaster Medicine*, April-June, 1994

**Revision Date**

September 15, 2014

## Termination of Resuscitative Efforts

(No NEMSIS category)

### **Patient Care Goals**

When there is no response to prehospital cardiac arrest treatment, it is acceptable and often preferable to cease futile resuscitation efforts in the field.

1. In patients with cardiac arrest, prehospital resuscitation is initiated with the goal of returning spontaneous circulation before permanent neurologic damage occurs. In most situations, ALS providers are capable of performing an initial resuscitation that is equivalent to an in-hospital resuscitation attempt, and there is usually no additional benefit to emergency department resuscitation in most cases
2. CPR that is performed during patient packaging and transport is much less effective than CPR done at the scene. Additionally, EMS providers risk physical injury while attempting to perform CPR in a moving ambulance while unrestrained. In addition, continuing resuscitation in futile cases places other motorists and pedestrians at risk, increases the time that EMS crews are not available for another call, impedes emergency department care of other patients, and incurs unnecessary hospital charges. Lastly, return of spontaneous circulation is dependent on a focused, timely resuscitation. The patient in arrest should be treated as expeditiously as possible, including quality, uninterrupted CPR and timely defibrillation as indicated
3. When cardiac arrest resuscitation becomes futile, the patient's family should become the focus of the EMS providers. Families need to be informed of what is being done, and transporting all cardiac arrest patients to the hospital is not supported by evidence and inconveniences the family by requiring a trip to the hospital where they must begin grieving in an unfamiliar setting. Most families understand the futility of the situation and are accepting of ceasing resuscitation efforts in the field

### **Patient Presentation**

Patient in cardiac arrest

#### **Inclusion Criteria**

1. Any cardiac arrest patient that has received resuscitation in the field but has not responded to treatment
2. When resuscitation has begun and it is found that the patient has a DNR order or other actionable medical order (e.g. POLST/MOLST form)

#### **Exclusion Criteria**

Consider continuing resuscitation for patients with the following conditions (although under certain circumstances, direct medical oversight may order termination of resuscitation in these conditions also):

Cardiac arrest associated with medical conditions that may have a better outcome despite prolonged resuscitation, including:

1. Hypothermia
2. Near-drowning

3. Lightning strike
4. Electrocution
5. Drug overdose
6. Cardiac arrest in infants and children
7. Cardiac arrest in a public place

### **Patient Management**

Resuscitation may/should be terminated under the following circumstance:

1. Non-traumatic arrest
  - a. Patient is at least 18 years of age
  - b. Patient is in cardiac arrest at the time of arrival of advanced life support
    - i. No pulse
    - ii. No respirations
    - iii. No evidence of meaningful cardiac activity (e.g. no heart sounds, asystole or wide complex PEA < 60)
  - c. Advanced life support resuscitation is administered for at least 20 minutes
  - d. There is no return of spontaneous pulse and no evidence of neurological function (non-reactive pupils, no response to pain, no spontaneous movement)
  - e. No evidence or suspicion of any of the following:
    - i. Drug/toxin overdose
    - ii. Hypothermia
    - iii. Active internal bleeding
    - iv. Preceding trauma
  - f. All EMS personnel involved in the patient's care agree that discontinuation of the resuscitation is appropriate
  - g. Consider direct medical oversight before termination of resuscitative efforts
2. Traumatic arrest
  - a. Patient is at least 18 years of age.
  - b. Resuscitation efforts may be terminated in any blunt trauma patient who, based on thorough primary assessment, is found apneic, pulseless, and asystolic on an EKG or cardiac monitor upon arrival of emergency medical services at the scene
  - c. Victims of penetrating trauma found apneic and pulseless by EMS, should be rapidly assessed for the presence of other signs of life, such as pupillary reflexes, spontaneous movement, response to pain and electrical activity on EKG
    - i. Resuscitation may be terminated with direct medical oversight if these signs of life are absent
    - ii. If resuscitation is not terminated, transport is indicated
  - d. Cardiopulmonary arrest patients in whom mechanism of injury does not correlate with clinical condition, suggesting a non-traumatic cause of arrest, should have standard ALS resuscitation initiated
  - e. All EMS personnel involved in the patient's care agree that discontinuation of the resuscitation is appropriate
  - f. Consider direct medical oversight before termination of resuscitative efforts

### **Assessment**

1. Pulse
2. Respirations



3. Neurologic status assessment (see **Appendix VI**; purposeful movement, pupillary response)
4. Cardiac activity (including electrocardiography, cardiac auscultation and/or ultrasonography)
5. Quantitative capnography

#### **Treatment and Interventions**

1. Focus on continuous, quality CPR that is initiated as soon as possible
2. Focus attention on the family and/or bystanders. Explain the rationale for termination
3. Consider support for family members such as other family, friends, clergy, faith leaders, or chaplains

#### **Patient Safety Considerations:**

All patients who are found in ventricular fibrillation or whose rhythm changes to ventricular fibrillation should in general have full resuscitation continued on scene

#### **Notes / Educational Pearls:**

##### **Key Considerations and Pertinent Assessment Findings**

1. In remote or wilderness situations, EMS providers should make every effort to contact direct medical oversight, but resuscitation may be terminated in the field without direct medical oversight when the following have occurred:
  - a. There has been no return of pulse despite > 30 minutes of CPR (this does not apply in the case of hypothermia)
  - b. Transport to an emergency department will take > 30 minutes (this does not apply in the case of hypothermia)
  - c. EMS providers are exhausted and it is physically impossible to continue the resuscitation
2. Logistical factors should be considered, such as collapse in a public place, family wishes, and safety of the crew and public
3. Survival and functional neurologic outcomes are unlikely if ROSC is not obtained by EMS. It is dangerous to crew, pedestrians, and other motorists to attempt to resuscitate a patient during ambulance transport
4. Quantitative end-tidal carbon dioxide measurements of less than 10 mmHg or falling > 25% despite resuscitation indicates a poor prognosis and provide additional support for termination

#### **Quality Improvement**

##### **Key Documentation Elements**

1. All items (a-f in Non-traumatic or Traumatic arrest) listed under patient management must be clearly documented in the EMS patient care report in addition to the assessment findings supporting this medical decision making
2. If resuscitation is continued for special circumstance or despite satisfying the criteria in this guideline, the rationale for such decision making must be documented

##### **Performance Measures**

1. Time to CPR
2. Time to AED application if applicable
3. Review of CPR quality
4. Assurance of appropriateness of transport and CPR during transport

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## **Revision Date**

September 15, 2014

# Pediatric Specific Guidelines

## Apparent Life Threatening Event (ALTE)

(9914197 – Apparent Life Threatening Event (ALTE))

### **Patient Care Goals**

1. Recognize patient characteristics and symptoms consistent with an ALTE
2. Promptly identify and intervene for patients who require escalation of care
3. Choose proper destination for patient transport

### **Patient Presentation**

#### **Inclusion Criteria**

Suspected ALTE: A patient with an episode that is frightening to the observer with some combination of the following:

1. Apnea (central or obstructive)
2. Color change (usually cyanosis or pallor)
3. Marked change in muscle tone (flaccid or rigid)

#### **Exclusion Criteria**

1. Age > 12 months
2. Presumed underlying cause that includes one of the following (refer to appropriate guidelines):
  - a. Seizure
  - b. Respiratory distress
  - c. Cardiopulmonary arrest
  - d. Trauma with known mechanism of injury

### **Patient Management**

#### **Assessment**

1. History
  - a. History and circumstances associated with event of symptoms
  - b. History of color change (including cyanosis and/or pallor), irregular breathing or change in muscle tone
  - c. Concurrent symptoms (fever, cough, rhinorrhea, vomiting, diarrhea, rash, labored breathing)
  - d. Prior history of ALTE, prior ALTE event in last 24 hours
  - e. Family history of SIDS
  - f. Treatment and Interventions performed (resuscitation attempts at home)
  - g. History of premature birth before 37 weeks gestation
  - h. Past medical history (cardiac, neurologic, respiratory, or chromosomal anomalies)
  - i. History of gastroesophageal reflux
2. Exam
  - a. Full set of vital signs (per **Universal Care** guideline)
  - b. Signs of respiratory distress (grunting, nasal flaring, retracting)
  - c. Color (pallor, cyanosis, normal)

- d. Mental status (alert, tired, lethargic, unresponsive, irritability)
- e. Physical exam for external signs of trauma

### **Treatment and Interventions**

1. Monitoring
  - a. Place on cardiac monitor
  - b. Pulse oximetry should be routinely used as an adjunct to other monitoring
  - c. Blood glucose. Repeat glucose assessments on prolonged transports
2. Airway
  - a. Give supplemental oxygen for signs of respiratory distress or hypoxemia. Escalate from a nasal cannula to a simple face mask to a non-rebreather mask as needed, in order to maintain normal oxygenation
  - b. Suction the nose and/or mouth (via bulb, suction catheter) if excessive secretions are present
3. Utility of IV Placement and Fluids  
IVs should only be placed in children for clinical concerns of shock, or when administering IV medications
4. Advanced Airway Management
  - a. If apnea persists, initiate bag-valve-mask ventilation
  - b. Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails in setting of respiratory failure or apnea. The airway should be managed in the least invasive way possible

### **Patient Safety Considerations**

1. Regardless of patient appearance, all patients with a history of signs or symptoms of ALTE should be transported for further evaluation
2. Destination Considerations
  - a. Consider transport to a facility with pediatric critical care capability for patients with history of cyanosis, significant past medical history (e.g. cardiac, respiratory) or past medical history of ALTE, resuscitation attempt by caregiver, or more than one ALTE in 24 hours
  - b. Given possible need for intervention, all patients should be transported to facilities with baseline readiness to care for children

### **Notes/Educational Pearls**

#### **Key Considerations**

1. ALTE is a group of symptoms, not a disease process
2. As many as 10% of patients will require ED or hospital intervention
3. Determine severity, duration, and nature of event
4. All patients should be transported
5. Contact direct medical oversight if parent/guardian is refusing medical care and/or transport

#### **Pertinent Assessment Findings**

1. Assess for irritability (cries with minimal provocation)
2. Look for external signs of trauma

## **Quality Improvement**

### **Key Documentation Elements**

1. Document key aspect of history
  - a. Color change
  - b. Apnea
  - c. Change in muscle tone
  - d. Caregiver resuscitation efforts
  - e. History of prematurity
  - f. Prior ALTE events
  - g. Past medical history
2. Document key aspects of the exam to assess for a change after each intervention:
  - a. Respiratory rate and effort
  - b. Oxygen saturation
  - c. Air entry
  - d. Mental status, presence of irritability
  - e. Color

### **Performance Measures**

1. Prehospital on-scene time
2. Appropriateness of IV placement
3. Appropriate transport destination

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#### **Revision Date**

September 15, 2014

## Pediatric Respiratory Distress (Bronchiolitis)

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(No NEMSIS category)

### **Patient Care Goals**

1. Alleviate respiratory distress
2. Promptly identify respiratory distress, failure, and/or arrest, and intervene for patients who require escalation of therapy
3. Deliver appropriate therapy by differentiating other causes of pediatric respiratory distress

### **Patient Presentation**

#### **Inclusion Criteria**

Child < age 2 with wheezing or diffuse rhonchi

#### **Exclusion Criteria**

1. Anaphylaxis
2. Croup
3. Epiglottitis
4. Foreign body aspiration
5. Submersion/drowning

### **Patient Management**

#### **Assessment**

1. History
  - a. Onset of symptoms
  - b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
  - c. Sick contacts
  - d. History of wheezing
  - e. Treatments given
  - f. Number of emergency department visits in the past year
  - g. Number of admissions in the past year
  - h. Number of ICU admissions ever
  - i. History of prematurity
  - j. Family history of asthma, eczema, or allergies
2. Exam
  - a. Full set of vital signs (T, BP, RR, P, O<sub>2</sub> saturation)
  - b. Air entry (normal vs. diminished)
  - c. Breath sounds (wheezes, crackles, rales, rhonchi, diminished, clear)
  - d. Signs of distress (grunting, nasal flaring, retracting, stridor)
  - e. Weak cry or inability to speak full sentences (sign of shortness of breath)
  - f. Color (pallor, cyanosis, normal)
  - g. Mental status (alert, tired, lethargic, unresponsive)

- h. Hydration status (+/- sunken eyes, delayed capillary refill, mucus membranes moist vs. tacky, fontanel flat vs. sunken)

### **Treatment and Interventions**

1. Pulse oximetry and end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) should be routinely used as an adjunct to other forms of respiratory monitoring
2. Perform EKG only if there are no signs of clinical improvement after treating respiratory distress
3. Airway
  - a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-breather mask as needed, in order to maintain normal oxygenation
  - b. Suction the nose and/or mouth (via bulb, Yankauer®, or suction catheter) if excessive secretions are present
4. Inhaled Medications

Nebulized epinephrine should be administered to children in severe respiratory distress with bronchiolitis (e.g. coarse breath sounds) in the prehospital setting if other treatments (e.g., suctioning, oxygen) fail to result in clinical improvement
5. Utility of IV Placement and Fluids

IVs should only be placed in children with respiratory distress for clinical concerns of dehydration, or when administering IV medications
6. Steroids

Are generally not efficacious, and not given in the prehospital setting
7. Improvement of Oxygenation and/or Respiratory Distress with Non-invasive Airway Adjuncts
  - a. Continuous positive airway pressure (CPAP) or high flow nasal cannula (HFNC) should be administered, when available, for severe respiratory distress
  - b. Bag-Valve-Mask Ventilation should be utilized in children with respiratory failure
8. Supraglottic Devices and Intubation
  - a. Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails
  - b. The airway should be managed in the least invasive way possible

### **Patient Safety Considerations**

Routine use of lights and sirens is not recommended during transport

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Suctioning can be a very effective intervention to alleviate distress, since infants are obligate nose breathers
2. Heliox should not be routinely administered to children with respiratory distress
3. Insufficient data exist to recommend the use of inhaled steam or nebulized saline
4. Though albuterol has previously been a consideration, the most recent evidence does not demonstrate a benefit in using it for bronchiolitis
5. Ipratropium and other anticholinergic agents should not be given to children with bronchiolitis in the prehospital setting
6. Though nebulized hypertonic saline has been shown to decrease hospital length of stay when used for bronchiolitis, it does not provide immediate relief of distress and should not be administered to children in respiratory distress in the prehospital setting



### **Pertinent Assessment Findings**

Frequent reassessment is necessary to determine if interventions have alleviated signs of respiratory distress or not

### **Quality Improvement**

#### **Key Documentation Elements**

Document key aspects of the exam to assess for a change after each intervention:

1. Respiratory rate
2. Oxygen saturation
3. Use of accessory muscles
4. Breath sounds
5. Air entry
6. Mental status
7. Color

#### **Performance Measures**

1. CPAP utilization
2. Time to administration of specified interventions in the protocol
3. Rate of administration of accepted therapy (whether or not certain medications/interventions were given)
4. Change in vital signs (i.e. heart rate, blood pressure, temperature, respiratory rate, pulse oximeter, capnography values)
5. Time to administration of specified interventions in the protocol. Number of advanced airway attempts
6. Mortality

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#### **Revision Date**

September 15, 2014

## Pediatric Respiratory Distress (Croup)

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(No NEMSIS category)

### **Patient Care Goals**

1. Alleviate respiratory distress
2. Promptly identify respiratory distress, respiratory failure, and respiratory arrest, and intervene for patients who require escalation of therapy
3. Deliver appropriate therapy by differentiating other causes of pediatric respiratory distress

### **Patient Presentation**

#### **Inclusion Criteria**

Suspected Croup (history of stridor or history of barking cough)

#### **Exclusion Criteria**

Presumed underlying cause that includes one of the following:

1. Anaphylaxis
2. Asthma
3. Bronchiolitis (wheezing < 2 years of age)
4. Foreign body aspiration
5. Submersion/drowning

### **Patient Management**

#### **Assessment**

1. History
  - a. Onset of symptoms (history of choking)
  - b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
  - c. Sick contacts
  - d. Treatments given
  - e. Personal history of asthma, wheezing, or croup in past
2. Exam
  - a. Full set of vital signs (T, BP, RR, P, O<sub>2</sub> sat)
  - b. Presence of stridor at rest or when agitated
  - c. Description of cough
  - d. Other signs of distress (grunting, nasal flaring, retracting,)
  - e. Color (pallor, cyanosis, normal)
  - f. Mental status (alert, tired, lethargic, unresponsive)

#### **Treatment and Interventions**

1. Monitoring
  - a. Pulse oximetry and end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) should be routinely used as an adjunct to other forms of respiratory monitoring

- b. Perform EKG only if there are no signs of clinical improvement after treating respiratory distress
- 2. Airway
  - a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-breather mask as needed, in order to maintain normal oxygenation
  - b. Suction the nose and/or mouth (via bulb, Yankauer®, or suction catheter) if excessive secretions are present
- 3. Inhaled Medications
  - a. Epinephrine 5 ml of 1:10,000 (0.5 mg) nebulized, should be administered by advanced life support (ALS) providers to all children in respiratory distress with signs of stridor at rest. This medication should be repeated at this dose with unlimited frequency for ongoing distress
  - b. Humidified oxygen or mist therapy is **not** indicated
- 4. Medications
 

Dexamethasone 0.6 mg/kg oral, IV, or IM to max dose of 16 mg should be administered to patients with suspected croup
- 5. Utility of IV Placement and Fluids
 

IVs should only be placed in children with respiratory distress for clinical concerns of dehydration, or when administering IV medications
- 6. Improvement of Oxygenation and/or Respiratory Distress with Non-invasive Airway Adjuncts
  - a. Heliox for the treatment of croup can be considered for severe distress not responsive to more than 2 doses of epinephrine
  - b. Continuous positive airway pressure (CPAP) should be administered for severe respiratory distress
  - c. Bag-valve-mask ventilation should be utilized in children with respiratory failure
- 7. Supraglottic Devices and Intubation
 

Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails. The airway should be managed in the least invasive way possible

#### **Patient Safety Considerations**

- 1. Routine use of lights and sirens is not recommended during transport
- 2. Patients who receive inhaled epinephrine should be transported to definitive care

#### **Notes/Educational Pearls**

##### **Key Considerations**

- 1. Upper airway obstruction can have inspiratory, expiratory, or biphasic stridor
- 2. Foreign bodies can mimic croup, it is important to ask about a possible choking event
- 3. Impending respiratory failure is indicated by:
  - a. Change in mental status such as fatigue and listlessness
  - b. Pallor
  - c. Dusky appearance
  - d. Decreased retractions
  - e. Decreased breath sounds with decreasing stridor
- 4. Without stridor at rest or other evidence of respiratory distress, inhaled medications may not be necessary

### **Pertinent Assessment Findings**

1. Respiratory distress (retractions, wheezing, stridor)
2. Decreased oxygen saturation
3. Skin color
4. Neurologic status assessment
5. Reduction in work of breathing after treatment
6. Improved oxygenation after breathing

### **Quality Improvement**

#### **Key Documentation Elements**

Document key aspects of the exam to assess for a change after each intervention:

1. Respiratory rate
2. Oxygen saturation
3. Use of accessory muscles or tracheal tugging
4. Breath sounds
5. Air entry
6. Mental status
7. Color

#### **Performance Measures**

1. Time to administration of specified interventions in the protocol
2. Frequency of administration of specified interventions in the protocol

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**Revision Date**

September 15, 2014



## Neonatal Resuscitation

(9914133 – Newborn/Neonatal Resuscitation)

### **Patient Care Goals**

1. Provide routine care to the newly born infant
2. Perform a neonatal assessment
3. Rapidly identify newly born infants requiring resuscitative efforts
4. Provide appropriate interventions to minimize distress in the newly born infant
5. Recognize the need for additional resources based on patient condition and/or environmental factors

### **Patient Presentation**

#### **Inclusion Criteria**

Newly born infants

#### **Exclusion Criteria**

Documented gestational age < 20 weeks (usually calculated by date of last menstrual period). If any doubt about accuracy of gestational age, initiate resuscitation

### **Patient Management**

#### **Assessment**

1. History
  - a. Date and time of birth
  - b. Onset of symptoms
  - c. Prenatal history (prenatal care, substance abuse, multiple gestation, maternal illness)
  - d. Birth history (maternal fever, presence of meconium, prolapsed or nuchal cord, maternal bleeding)
  - e. Estimated gestational age (may be based on last menstrual period)
2. Exam
  - a. Respiratory rate and effort (strong, weak, or absent; regular or irregular)
  - b. Signs of respiratory distress (grunting, nasal flaring, retractions, gasping, apnea)
  - c. Heart rate (fast, slow, or absent)
    - i. Precordium, umbilical stump or brachial pulse may be used
    - ii. Auscultation of chest is preferred since palpation of umbilical stump is less accurate
  - d. Muscle tone (poor or strong)
  - e. Color/Appearance (central cyanosis, acrocyanosis, pallor, normal)
  - f. APGAR score (appearance, pulse, grimace, activity, respiratory effort)

May be calculated for documentation, but not necessary to guide resuscitative efforts
  - g. Estimated gestational age (term, late preterm, premature)
  - h. Pulse oximetry should be considered if prolonged resuscitative efforts or if supplemental oxygen is administered

Goal: oxygen saturation at 10 minutes is 85-95%

### **Treatment and Interventions**

1. Clamp cord in two places and cut cord between the clamps if still attached to mother
2. Warm, dry, and stimulate
  - a. Wrap infant in dry towel or thermal blanket to keep infant as warm as possible during resuscitation; keep head covered if possible
  - b. If strong cry, regular respiratory effort, good tone, and term gestation, infant should be placed skin-to-skin with mother and covered with dry linen
3. If weak cry, signs of respiratory distress, poor tone, or preterm gestation then position airway (sniffing position) and clear airway as needed  
If thick meconium or secretions present and signs of respiratory distress, suction mouth then nose
4. If heart rate > 100 beats per minute
  - a. Monitor for central cyanosis  
Provide blow-by oxygen as needed
  - b. Monitor for signs of respiratory distress. If apneic or in significant respiratory distress:
    - i. Initiate bag-valve-mask ventilation with room air at 40-60 breaths per minute
    - ii. Consider endotracheal intubation as per local guidelines
5. If heart rate < 100 beats per minute
  - a. Initiate bag-valve-mask ventilation with room air at 40-60 breaths per minute
    - i. Primary indicator of effective ventilation is improvement in heart rate
    - ii. Rates and volumes of ventilation required can be variable, only use the minimum necessary rate and volume to achieve chest rise and a change in heart rate
  - b. If no improvement after 90 seconds, change oxygen delivery to 30% FiO<sub>2</sub> if blender available, otherwise 100% FiO<sub>2</sub> until heart rate normalizes
  - c. Consider endotracheal intubation per local guidelines if bag-valve-mask ventilation is ineffective
6. If heart rate < 60 beats per minute
  - a. Ensure effective ventilations with supplementary oxygen and adequate chest rise
  - b. If no improvement after 30 seconds, initiate chest compressions
    - i. Two-thumb-encircling-hands technique is preferred
  - c. Coordinate chest compressions with positive pressure ventilation (3:1 ratio, 90 compressions and 30 breaths per minute)
  - d. Consider endotracheal intubation per local guidelines

### **Patient Safety Considerations**

Hypothermia is common in newborns and worsens outcomes of nearly all post-natal complications. Ensure heat retention by drying the infant thoroughly, covering the head, and wrapping the baby in dry cloth. When it does not encumber necessary assessment or required interventions, “kangaroo care” (i.e. placing the infant skin-to-skin directly against mother’s chest and wrapping them together) is an effective warming technique

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Approximately 10% of newly born infants require some assistance to begin breathing
2. Deliveries complicated by maternal bleeding (placenta previa, vas previa, or placental abruption) place the infant at risk for hypovolemia secondary to blood loss
3. Low birth weight infants are at high risk for hypothermia due to heat loss

4. If pulse oximetry is used as an adjunct, the preferred placement place of the probe is the right arm, preferably wrist or medial surface of the palm. Normalization of blood oxygen levels (SaO<sub>2</sub> 85-95%) will not be achieved until approximately 10 minutes following birth
5. Both hypoxia and excess oxygen administration can result in harm to the infant. If prolonged oxygen use is required, titrate to maintain an oxygen saturation of 85-95%
6. While not ideal, a larger facemask than indicated for patient size may be used to provide bag-valve-mask ventilation if an appropriately sized mask is not available. Avoid pressure over the eyes as this may result in bradycardia
7. Increase in heart rate is the most reliable indicator of effective resuscitative efforts
8. A multiple gestation delivery may require additional resources and/or providers

#### **Pertinent Assessment Findings**

1. It is difficult to determine gestational age in the field. If there is any doubt as to viability, resuscitation efforts should be initiated
2. Acrocyanosis, a blue discoloration of the distal extremities, is a common finding in the newly born infant transitioning to extrauterine life. This must be differentiated from central cyanosis

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Historical elements
  - a. Prenatal complications
  - b. Delivery complications
  - c. Date and time of birth
  - d. Estimated gestational age
2. Physical exam findings
  - a. Heart rate
  - b. Respiratory rate
  - c. Respiratory effort
  - d. Appearance
  - e. APGAR score at 1 and 5 minutes

##### **Performance Measures**

1. Prehospital on-scene time
2. Call time for additional resources
3. Arrival time of additional unit
4. Time to initiation of interventions
5. Use of oxygen during resuscitation
6. Presence of advanced life support (ALS) versus basic life support (BLS) providers
7. ROSC and/or normalization of heart rate
8. Length of stay in neonatal intensive care unit
9. Length of stay in newborn nursery
10. Length of stay in hospital
11. Knowledge retention of prehospital providers
12. Number of advanced airway attempts
13. Mortality

### **References**

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### **Revision Date**

September 15, 2014

## Childbirth

(9914155 – Childbirth/Labor/Delivery)

### **Patient Care Goals**

1. Recognize imminent birth
2. Assist with uncomplicated delivery of term newborn
3. Recognize complicated delivery situations
4. Apply appropriate techniques when delivery complication exists

### **Patient Presentation**

#### **Inclusion Criteria**

Imminent delivery with crowning

#### **Exclusion Criteria**

1. Vaginal bleeding in any stage of pregnancy (see **Obstetrical/Gynecological Conditions** guideline)
2. Emergencies in first or second trimester of pregnancy (see **Obstetrical/Gynecological Conditions** guideline)
3. Seizure from eclampsia (see **Seizure** guideline)

### **Patient Management**

#### **Assessment:**

Signs of imminent delivery:

Contractions, crowning, urge to push, urge to move bowels, membrane rupture or bloody show

#### **Treatment and Interventions**

1. If patient in labor but no signs of impending delivery, transport to appropriate receiving facility
2. Delivery should be controlled so as to allow a slow controlled delivery of infant. This will prevent injury to mother and infant
3. If complications of delivery are identified, follow the following steps:
  - a. Shoulder Dystocia – if delivery fails to progress after head delivers, quickly attempt the following
    - i. Hyperflex mother's hips to severe supine knee-chest position
    - ii. Apply firm suprapubic pressure to attempt to dislodge shoulder
    - iii. Apply high-flow oxygen to mother
    - iv. Transport as soon as possible
    - v. Contact direct medical oversight and/or closest appropriate receiving facility for direct medical oversight and to prepare team
  - b. Prolapsed Umbilical Cord
    - i. Placed gloved fingers between infant and uterus to avoid compression of cord

- ii. Consider placing mother in prone knee-chest position
  - iii. Apply high-flow oxygen to mother
  - iv. Transport as soon as possible
  - v. Contact and/or closest appropriate receiving facility for direct medical oversight and to prepare team
- c. Maternal Cardiac Arrest
  - i. Apply manual pressure to displace uterus from right to left
  - ii. See **Cardiac Arrest (VF/VT/Asystole/PEA)** guideline for resuscitation care (defibrillation and medications should be given for same indications and doses as if non-pregnant patient)
  - iii. Transport as soon as possible if infant is estimated to be over 24 weeks gestation (perimortem Cesarean section at receiving facility is most successful if done within 5 minutes of maternal cardiac arrest)
  - iv. Contact direct medical oversight and/or closest appropriate receiving facility for direct medical oversight and to prepare team
- d. Breech Birth
  - i. If head fails to deliver, place gloved hand into vagina with fingers between infant's face and uterine wall to create an open airway
  - ii. Apply high-flow oxygen to mother
  - iii. Transport as soon as possible
  - iv. Contact direct medical oversight and/or closest appropriate receiving facility for direct medical oversight and to prepare team
- 4. Support the infant's head as needed
- 5. Check the umbilical cord surrounding the neck. If present, slip it over the head. If unable to free the cord from the neck, double clamp the cord and cut between the clamps
- 6. Do NOT routinely suction the infant's airway (even with a bulb syringe) during delivery
- 7. Grasping the head with hand over the ears, gently pull down to allow delivery of the anterior shoulder
- 8. Gently pull up on the head to allow delivery of the posterior shoulder
- 9. Slowly deliver the remainder of the infant
- 10. Clamp cord 2 inches from the abdomen with 2 clamps and cut the cord between the clamps
- 11. Record APGAR scores at 1 and 5 minutes. After delivery of infant, suctioning (including suctioning with a bulb syringe) should be reserved for infants who have obvious obstruction to the airway or require positive pressure ventilation (follow **Neonatal Resuscitation** guideline for further care of the infant)
- 12. The placenta will deliver spontaneously, often within 5-15 minutes of the infant. Do not force the placenta to deliver. Contain all tissue in plastic bag and transport
- 13. After delivery, massaging the uterus and allowing the infant to nurse will promote uterine contraction and help control bleeding

#### **Patient Safety Considerations**

- 1. Supine Hypotension Syndrome: place patient in lateral recumbent position if mother has hypotension before delivery
- 2. Do NOT routinely suction the infant's airway (even with a bulb syringe) during delivery
- 3. Newborns are very slippery, take care not to drop the infant
- 4. Do not pull on the umbilical cord while the placenta is delivering
- 5. If possible, transport between deliveries if mother is expecting twins

### **Notes/Educational Pearls**

1. OB assessment:
  - a. Length of pregnancy
  - b. Number of pregnancies
  - c. Number of viable births
  - d. Number of non-viable births
  - e. Last menstrual period
  - f. Due date
  - g. Prenatal care
  - h. Number of expected babies
  - i. Drug use
2. Notify direct medical oversight if:
  - a. Prepartum hemorrhage
  - b. Postpartum hemorrhage
  - c. Breech presentation
  - d. Limb presentation
  - e. Nuchal cord
  - f. Prolapsed cord
3. Some bleeding is normal with any childbirth. Large quantities of blood or free bleeding are abnormal

### **Quality Improvement**

#### **Key Documentation Elements**

Document all times (delivery, contraction frequency and length)

#### **Performance Measures**

1. Recognition of complications
2. Documentation of APGAR scores
3. Maternal reassessment

### **References**

Consensus process based. No specific recommendations

### **Revision Date**

September 15, 2014

## Nausea/Vomiting

(9914131 – Nausea/Vomiting)

### **Patient Care Goals**

Decrease discomfort secondary to nausea and vomiting

### **Patient Presentation**

#### **Inclusion criteria**

Currently nauseated and/or vomiting

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Routine patient care (vital signs)
2. History and physical examination focused on potential causes of nausea and vomiting (e.g. gastrointestinal, cardiovascular, gynecologic)

#### **Treatment and Interventions**

1. Anti-emetic medication administration (optional, if available):
  - a. Ondansetron
    - i. Adult: 4mg IV/PO
    - ii. Pediatric between 6 m/o –14 yo: 0.15 mg/kg IV/PO (maximum dose of 4 mg)
  - b. Prochlorperazine
    - i. Adult: 5 mg IV/IM
    - ii. Pediatric over 2 yo only: 0.1 mg/kg slow IV or deep IM (maximum 10 mg)
  - c. Metoclopramide
    - i. Adult: 10 mg IV/IM
    - ii. Pediatric over 2 yo only: 0.1 mg/kg IM or IV (maximum 10 mg)
    - iii. May repeat x 1 in 20 -30 minutes if no relief
2. Consider Normal Saline bolus of 500 ml unless contraindicated (e.g. h/o CHF, renal failure)
  - a. May repeat as indicated
  - b. Consider 10 – 20 ml/kg IV fluid unless contraindicated

#### **Patient Safety Considerations**

Although less common than with other anti-emetics, dystonic and extrapyramidal symptoms are possible in response to ondansetron administration

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Ondansetron is preferred in children for the treatment of nausea and vomiting. Metoclopramide has less adverse effects than prochlorperazine in children
2. Prochlorperazine and metoclopramide have an increased risk of dystonic reactions. Some phenothiazines also have an increased risk of respiratory depression when used with other



medications that cause respiratory depression, and some phenothiazines can cause neuroleptic malignant syndrome

3. IV form of ondansetron may be given PO in same dose
4. For dystonia/akathisia induced by an anti-emetic administer diphenhydramine:
  - a. Adult: 25-50 mg IV/IM/PO
  - b. Pediatric: 1-2 mg/kg IV/IM/PO (maximum 50 mg)
5. Nausea and vomiting are symptoms of illness – in addition to treating the patient's nausea and vomiting a thorough history and physical are key to identifying what may be a disease in need of emergent treatment (e.g. bowel obstruction, myocardial infarction, pregnancy)

#### **Pertinent Assessment Findings**

1. Vital signs
2. Risk factors for heart disease/EKG if applicable
3. Pregnancy status
4. Abdominal exam

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Vital signs
2. History and physical in regards to etiology of nausea/vomiting
3. Vital sign and subjective response to interventions

##### **Performance Measures**

No specific recommendations

#### **References**

1. Warden CR, Moreno R, Daya M. Prospective evaluation of ondansetron for undifferentiated nausea and vomiting in the prehospital setting. *Prehosp Emerg Care*, 2008 Jan-Mar;12(1):87-91
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#### **Revision Date**

September 15, 2014

## Obstetrical/Gynecological Conditions

(9914159 – Gynecological Emergencies; 9914161 – Pregnancy Related Emergencies)

### **Patient Care Goals**

1. Recognize serious conditions associated with hemorrhage during pregnancy even when hemorrhage or pregnancy is not apparent (e.g. ectopic pregnancy, abruption placenta, placenta previa)
2. Provide adequate resuscitation for hypovolemia

### **Patient Presentation**

#### **Inclusion Criteria**

1. Female patient with vaginal bleeding in any trimester
2. Female patient with pelvic pain or possible ectopic pregnancy
3. Maternal age at pregnancy may range from 10 to 60 years of age

#### **Exclusion Criteria**

1. Childbirth and active labor (see **Childbirth** guideline)
2. Seizure related to pregnancy/eclampsia (see **Seizures** guideline)
3. Post-partum hemorrhage (see **Childbirth** guideline)

### **Patient Management**

#### **Assessment**

1. Obtain history
  - a. Abdominal pain – onset, duration, quality, radiation, provoking or relieving factors
  - b. Vaginal bleeding – onset, duration, quantity (pads saturated)
  - c. Syncope/lightheadedness
  - d. Nausea/vomiting
  - e. Fever
2. Monitoring
  - a. Monitor EKG if history of syncope or lightheadedness
  - b. Monitor pulse oximetry if signs of hypotension or respiratory symptoms
3. Secondary survey pertinent to obstetric issues:
  - a. Constitutional: vital signs, orthostatic vital signs, skin color
  - b. Abdomen: distention, tenderness
  - c. Genitourinary: visible bleeding
  - d. Neurologic: mental status

#### **Treatment and Interventions**

1. If signs of shock or orthostasis:
  - a. Position patient supine and keep patient warm
  - b. Volume resuscitation:  
Normal saline 1-2 liters IV
  - c. Reassess vital signs and response to fluid resuscitation
2. Disposition:  
Transport to closest appropriate receiving facility

**Patient Safety Considerations**

1. Patients in third trimester of pregnancy should be transported on left side or with uterus manually displaced to left if hypotensive
2. Do not place hand/fingers into vagina of bleeding patient except in cases of prolapsed cord or breech birth that is not progressing

**Notes/Educational Pearls****Key Considerations**

Syncope can be a presenting symptom of hemorrhage from ectopic pregnancy or causes of vaginal bleeding

**Pertinent Assessment Findings**

1. Vital signs to assess for signs of shock (e.g. tachycardia, hypotension)
2. Abdominal exam (e.g. distension, rigidity, guarding)
3. If pregnant, evaluate fundal height

**Quality Improvement****Key Documentation Elements**

Document full vital signs and physical exam findings

**Performance Measures**

1. Patients with signs of hypoperfusion or shock should not be ambulated to stretcher
2. If available, IV should be initiated on patients with signs of hypoperfusion or shock
3. Recognition and appropriate treatment of shock

**References**

General consensus process based. No specific recommendations

**Revision Date**

September 15, 2014

# Respiratory

## Airway Management

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914003 – Airway Failed; 9914001 – Airway)

### **Patient Care Goals**

1. Provide effective oxygenation and ventilation
2. Recognize and alleviate respiratory distress
3. Provide necessary interventions quickly and safely to patients with the need for respiratory support
4. Identify a potentially difficult airway in a timely fashion

### **Patient Presentation**

#### **Inclusion Criteria**

1. Children and adults with signs of severe respiratory distress/respiratory failure
2. Patients with evidence of hypoxemia or hypoventilation

#### **Exclusion Criteria**

1. Patients with tracheostomies
2. Chronically ventilated patients
3. Newborn patients
4. Patients in whom oxygenation and ventilation is adequate with supplemental oxygen alone, via simple nasal cannula or face mask

### **Patient Management**

#### **Assessment**

1. History: Assess for
  - a. Time of onset of symptoms
  - b. Associated symptoms
  - c. History of asthma or other breathing disorders
  - d. Choking or other evidence of upper airway obstruction
  - e. History of trauma
2. Physical Examination: Assess for
  - a. Shortness of breath
  - b. Abnormal respiratory rate and/or effort
  - c. Use of accessory muscles
  - d. Quality of air exchange, including depth and equality of breath sounds
  - e. Wheezing, rhonchi, rales, or stridor
  - f. Cough
  - g. Abnormal color (cyanosis or pallor)
  - h. Abnormal mental status

- i. Evidence of hypoxemia
- j. Signs of a difficult airway (short jaw or limited jaw thrust, small thyromental space, upper airway obstruction, large tongue, obesity, large tonsils, large neck, craniofacial abnormalities, excessive facial hair)

### **Treatment and Interventions**

1. Non-Invasive Ventilation Techniques
  - a. Use continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), intermittent positive pressure breathing (IPPB), humidified high-flow nasal cannula (HFNC), and/or bilevel nasal CPAP for severe respiratory distress or *impending* respiratory failure
  - b. Use bag-valve mask (BVM) ventilation in the setting of respiratory failure or arrest
2. Oropharyngeal airways (OPA) and nasopharyngeal airways (NPA)  
Consider the addition of an OPA and/or NPA to make BVM more effective, especially in patients with altered mental status
3. Supraglottic airways (SGA) or extraglottic devices (EGD)  
Consider the use of a SGA or EGD if BVM is not effective in maintaining oxygenation and/or ventilation. Examples include, but are not limited to, the laryngeal mask airway (LMA) or King® laryngeal tube (KLT). This is especially important in children, since endotracheal intubation is an infrequently performed skill in this age group, and has not been shown to improve outcomes
4. Endotracheal Intubation
  - a. When less-invasive methods (BVM, SGA/EGD placement) are ineffective, however, use endotracheal intubation to maintain oxygenation and/or ventilation
  - b. Other indications may include potential airway obstructions, severe burns, multiple traumatic injuries, altered mental status or loss of normal protective airway reflexes
  - c. Monitor clinical signs, pulse oximetry, and capnography for the intubated patient
  - d. Video laryngoscopy enhances intubation success rates, and should be used when available. Fiberoptic-assisted endotracheal intubation may be needed if the vocal cords cannot be visualized by other means
5. Gastric decompression may improve oxygenation and ventilation, so it should be considered when there is obvious gastric distention
6. When patients cannot be oxygenated/ventilated effectively by previously mentioned interventions, the provider should consider cricothyroidotomy if the risk of death for not escalating airway management seems to outweigh the risk of a procedural complication
7. Transport to the closest appropriate hospital for airway stabilization should occur when respiratory failure cannot be successfully managed in the prehospital setting

### **Patient safety considerations**

1. Avoid excessive pressures or volumes during BVM
2. Avoid endotracheal intubation, unless less invasive methods fail, since it can be associated with aspiration, oral trauma, worsening of cervical spine injury, malposition of the ET tube (mainstem intubation, esophageal intubation), or adverse effects of sedation, especially in children

3. Once a successful SGA/EGD placement or intubation has been performed, obstruction or displacement of the tube can have further deleterious effects on patient outcome. Tubes should be secured with either a commercial tube holder or tape
4. Providers who do not routinely use medications for rapid sequence intubation (RSI) should not use RSI on children, since the loss of airway protection with the use of RSI may increase complications. RSI should be reserved for specialized providers operating within a comprehensive program with ongoing training and quality assurance measures

## **Notes/Educational Pearls**

### **Key Considerations**

1. When compared to the management of adults with cardiac arrest, paramedics are less likely to attempt endotracheal intubation in children with cardiac arrest. Further, paramedics are more likely to be unsuccessful when intubating children in cardiac arrest and complications such as malposition of the ET tube or aspiration can be nearly three times as common in children as compared to adults
2. Use continuous waveform capnography to detect end-tidal carbon dioxide (ETCO<sub>2</sub>). This is an important adjunct in the monitoring of patients with respiratory distress, respiratory failure, and those treated with positive pressure ventilation. It should be used as the standard to confirm extraglottic device and endotracheal tube placement
3. CPAP, BiPAP, IBPP, HFNC  
Contraindications to these non-invasive ventilator techniques include intolerance of the device, increased secretions inhibiting a proper seal, or recent gastrointestinal and/or airway surgery
4. Bag-Valve Mask:
  - a. Appropriately-sized masks should completely cover the nose and mouth and maintain an effective seal around the cheeks and chin
  - b. Ventilation should be delivered with only sufficient volume to achieve chest rise
  - c. Ventilating breaths should be delivered over one second, with a two second pause between breaths (20 breaths/minute)

### 5. Orotacheal intubation

#### a. Endotracheal tube sizes

Age	Size (mm) – Uncuffed	Size (mm) – Cuffed
Premature	2.5	
Term to 3 months	3.0	
3-7 months	3.5	3.0
7-15 months	4.0	3.5
15-24 months	4.5	3.5
2-15 years	$[\text{age}(\text{yr})/4]+4$	$[\text{age}(\text{yr})/4]+3.5$

- b. Approximate depth of insertion = (3) x (endotracheal tube size)
- c. Confirm successful placement with waveform capnography. Less optimal methods of confirmation include bilateral chest rise, bilateral breath sounds, maintenance of adequate oxygenation, and color change on end-tidal CO<sub>2</sub> colorimetric device. Misting observed in the tube is not a reliable method of confirmation

- d. Ongoing education and hands-on practice is essential to maintain skills. This is especially true for children since pediatric intubation is an infrequently utilized skill for many prehospital providers
- e. Video laryngoscopy may be helpful, if available, to assist with endotracheal intubation
- 6. Consideration should be made to dispatch the highest level provider for an EMS system given the potential need for advanced airway placement for patients with severe respiratory distress or failure

#### **Pertinent Assessment Findings**

- 1. Ongoing assessment is critical when an airway device is in place
- 2. Acute worsening of respiratory status or evidence of hypoxemia is can be secondary to displacement or obstruction of the airway device, pneumothorax or equipment failure

#### **Quality Improvement**

##### **Key Documentation Elements**

- 1. Initial vital signs and physical exam
- 2. Interventions attempted including the method of airway intervention, the size of equipment used, and the number of attempts to achieve a successful result
- 3. Subsequent vital signs and physical exam to assess for change after the interventions

##### **Performance Measures**

- 1. Percentage of providers that have received hands-on airway training (simulation or non-simulation-based) within the past 2 years
- 2. Respiratory rate and oxygen saturation are both measured and documented
- 3. Percentage of patients with advanced airway who have waveform capnography used for both initial confirmation and continuous monitoring during transport
- 4. Percentage of patients who were managed upon arrival to the emergency department (ED) with each of the following: Bag-valve mask, extraglottic device, or endotracheal intubation
- 5. Percentage of intubated patients with endotracheal tube in proper position upon ED arrival
- 6. Survival upon ED arrival

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**Revision Date**

September 15, 2014

## Bronchospasm (due to Asthma and Obstructive Lung Disease)

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914139 – Respiratory Distress/Asthma/COPD/Croup/Reactive Airway)

### **Patient Care Goals**

1. Alleviate respiratory distress due to bronchospasm
2. Promptly identify and intervene for patients who require escalation of therapy
3. Deliver appropriate therapy by differentiating other causes of respiratory distress

### **Patient Presentation**

#### **Inclusion Criteria**

Respiratory distress with wheezing or decreased air entry in patients  $\geq 2$  years of age, presumed to be due to bronchospasm from reactive airway disease, asthma, or obstructive lung disease. These patients may have a history of recurrent wheezing that improves with beta-agonist inhalers/nebulizers such as albuterol or levalbuterol

1. Symptoms/signs may include:
  - a. Wheezing - will have expiratory wheezing unless they are unable to move adequate air to generate wheezes
  - b. May have signs of respiratory infection (e.g. fever, nasal congestion, cough, sore throat)
  - c. May have acute onset after inhaling irritant
2. This includes:
  - a. Asthma exacerbation
  - b. Chronic obstructive pulmonary disease (COPD) exacerbation
  - c. Wheezing from suspected pulmonary infection (e.g. pneumonia, acute bronchitis)

#### **Exclusion Criteria**

Respiratory distress due to a presumed underlying cause that includes one of the following:

1. Anaphylaxis
2. Bronchiolitis (wheezing  $< 2$  years of age)
3. Croup
4. Epiglottitis
5. Foreign body aspiration
6. Submersion/drowning
7. Congestive heart failure
8. Trauma

### **Patient Management**

#### **Assessment**

1. History
  - a. Onset of symptoms
  - b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)

- c. Usual triggers of symptoms (cigarette smoke, change in weather, upper respiratory infections)
  - d. Sick contacts
  - e. Treatments given
  - f. Previously intubated
  - g. Number of emergency department visits in the past year
  - h. Number of admissions in the past year
  - i. Number of ICU admissions
  - j. Family history of asthma, eczema, or allergies
2. Exam
- a. Full set of vital signs (T, BP, RR, P, O<sub>2</sub> sat); waveform capnography is a useful adjunct and will show a “sharkfin” waveform in the setting of obstructive physiology
  - b. Air entry (normal vs. diminished; prolonged expiratory phase)
  - c. Breath sounds (wheezes, crackles, rales, rhonchi, diminished, clear)
  - d. Signs of distress (grunting, nasal flaring, retracting, stridor)
  - e. Inability to speak full sentences (sign of shortness of breath)
  - f. Color (pallor, cyanosis, normal)
  - g. Mental status (alert, tired, lethargic, unresponsive)
  - h. Signs of distress include:
    - i. Apprehension, anxiety, combativeness
    - ii. Hypoxia (< 90% oxygen saturation)
    - iii. Intercostal/subcostal/supraclavicular retractions
    - iv. Nasal flaring
    - v. Cyanosis

### **Treatment and Interventions**

- 1. Monitoring
  - a. Pulse oximetry and end-tidal CO<sub>2</sub> (ETCO<sub>2</sub>) should be routinely used as an adjunct to other forms of respiratory monitoring
  - b. Check an EKG only if there are no signs of clinical improvement after treating respiratory distress
- 2. Airway
  - a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-rebreather mask as needed, in order to maintain normal oxygenation
  - b. Suction the nose and/or mouth (via bulb, Yankauer, suction catheter) if excessive secretions are present
- 3. Inhaled Medications
  - a. Albuterol 5 mg nebulized (or 6 puffs metered dose inhaler) should be administered to all patients in respiratory distress with signs of bronchospasm (e.g. known asthmatics, quiet wheezers) either by basic life support (BLS) or advanced life support (ALS) providers. This medication should be repeated at this dose with unlimited frequency for ongoing distress
  - b. Ipratropium 0.5 mg nebulized should be given up to 3 doses, in conjunction with albuterol
- 4. Utility of IV Placement and Fluids
 

IVs should be placed when there are clinical concerns of dehydration in order to administer fluids, or when administering IV medications

5. Steroids  
Methylprednisolone (2 mg/kg, max dose =125 mg) IV/IM or dexamethasone (0.6 mg/kg, max dose of 16 mg) IV/IM/PO should be administered in the prehospital setting. Other steroids at equivalent doses may be given as alternatives
6. Magnesium  
Magnesium sulfate (40 mg/kg IV, max dose of 2 grams) over 15-30 minutes should be administered for severe bronchoconstriction and concern for impending respiratory failure
7. Epinephrine  
Epinephrine (0.01 mg/kg of 1:1,000 IM, max dose of 0.3 mg) should only be administered for impending respiratory failure as adjunctive therapy when there are no clinical signs of improvement
8. Improvement of Oxygenation and/or Respiratory Distress with Non-invasive Airway Adjuncts
  - a. Non-invasive positive pressure ventilation via continuous positive airway pressure (CPAP) or biphasic positive airway pressure (BiPAP) should be administered for severe respiratory distress
  - b. Bag-valve-mask ventilation should be utilized in children with respiratory failure
9. Supraglottic Devices and Intubation  
Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails. The airway should be managed in the least invasive way possible

#### **Patient Safety Considerations**

1. Routine use of lights and sirens is not recommended during transport
2. Giving positive pressure in the setting of bronchoconstriction, either via a supraglottic airway or intubation, increases the risk of air trapping, which can lead to pneumothorax and cardiovascular collapse. So, these interventions should be reserved for situations of respiratory failure

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Inhaled magnesium sulfate should not be administered
2. Heliox should not be administered
3. COPD patients not in respiratory distress should be given oxygen to maintain adequate oxygen saturation above 90%
4. Nebulizer droplets can carry viral particles, so additional personal protective equipment should be considered, including placement of a surgical mask over the nebulizer to limit droplet spread

##### **Pertinent Assessment Findings**

In the setting of severe bronchoconstriction, wheezing might not be heard. Patients with known asthma who complain of chest pain or shortness of breath should be empirically treated, even if wheezing is absent.

#### **Quality Improvement**

##### **Key Documentation Elements**

Document key aspects of the exam to assess for a change after each intervention:

1. Respiratory rate
2. Oxygen saturation

3. Use of accessory muscles
4. Breath sounds
5. Air entry
6. Mental status
7. Color

#### **Performance Measures**

1. CPAP/BiPAP utilization
2. Time to administration of specified interventions in the protocol
3. Rate of administration of accepted therapy (whether or not certain medications/interventions were given)
4. Change in vital signs (i.e. heart rate, blood pressure, temperature, respiratory rate, pulse oximeter, capnography values)
5. Time to administration of specified interventions in the protocol
6. Number of advanced airway attempts
7. Mortality

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**Revision Date**

September 15, 2014

## Pulmonary Edema

(9914137 – Pulmonary Edema/CHF)

### **Patient Care Goals**

1. Decrease respiratory distress and work of breathing
2. Maintaining adequate oxygenation and perfusion
3. Direct supportive efforts towards decreasing afterload and increasing preload

### **Patient Presentation**

#### **Inclusion Criteria**

1. Respiratory distress with presence of rales
2. Clinical impression consistent with congestive heart failure

#### **Exclusion Criteria**

1. Clinical impression consistent with infection (e.g. fever)
2. Clinical impression consistent with asthma/COPD

### **Patient Management**

#### **Assessment**

1. History
  - a. Use of diuretics and compliance
  - b. Weight gain
  - c. Leg swelling
  - d. Orthopnea
2. Exam
  - a. Breath sounds – crackles/rales
  - b. Lower extremity edema
  - c. JVD
  - d. Cough and/or productive cough with pink/frothy sputum
  - e. Diaphoresis
  - f. Chest discomfort
  - g. Hypotension
  - h. Shock
  - i. Respiratory distress, assess:
    - i. Patient's ability to speak in full sentences
    - ii. Respiratory accessory muscle use

#### **Treatment and Interventions**

1. Manage airway as necessary
2. Provide supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturation  $\geq$  94%
3. Initiate monitoring and perform 12-lead EKG
4. Establish IV access
5. Nitroglycerin 0.4 mg SL, can repeat q 3-5 minutes as long as SBP > 100 (if range not desired use q 3 minutes)

6. CPAP/BiPAP Consider advanced airway for severe distress or if not improving with less invasive support
7. If suspect high altitude pulmonary edema, follow **Altitude Illness** guideline

### **Patient Safety Considerations**

No specific recommendations

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Differential:
  - a. MI
  - b. CHF
  - c. Asthma
  - d. Anaphylaxis
  - e. Aspiration
  - f. COPD
  - g. Pleural effusion
  - h. Pneumonia
  - i. PE
  - j. Pericardial tamponade
  - k. Toxin exposure
2. Non-Invasive Positive Pressure Ventilation:
  - a. Contraindications:
    - i. Hypoventilation
    - ii. Altered level of consciousness
    - iii. Airway compromise
    - iv. Aspiration risk
    - v. Pneumothorax
    - vi. Facial trauma/burns
    - vii. Systolic BP < 90 mmHg
    - viii. Recent oropharyngeal/tracheal/bronchial surgery
  - b. Benefits:
    - i. Increased oxygenation and perfusion by reducing work of breathing
    - ii. Maintaining inflation of atelectatic alveoli
    - iii. Improving pulmonary compliance
    - iv. Decreases respiratory rate and the work of breathing, HR, and SBP
    - v. Improves delivery of bronchodilators
    - vi. Reduces preload and afterload, improving cardiac output
  - c. Complications:
    - i. Most common is anxiety
    - ii. Theoretical risk of hypotension and pneumothorax as NIPPV increases intrathoracic pressure which decreases venous return and cardiac output
    - iii. Sinusitis
    - iv. Skin abrasions
    - v. Conjunctivitis – minimized with proper size mask
    - vi. Potential for barotrauma - pneumothorax or pneumomediastinum (rare)

3. Allow patient to remain in position of comfort. Patients may decompensate if forced to lie down.
4. CHF is a common cause of pulmonary edema. Other causes include:
  - a. Medications
  - b. High altitude exposure
  - c. Kidney failure
  - d. Lung damage caused by gases or severe infection
  - e. Major injury
5. Avoid nitroglycerin in patients who have taken sildenafil in the last 24 hours, or tadalafil or vardenafil in the last 48 hours. Nitroglycerin reduces left ventricular (LV) filling pressure primarily via venous dilation. At higher doses the drug variably lowers systemic afterload and increases stroke volume and cardiac output. Although some have advocated early use of ACE inhibitor in patients with acute decompensated heart failure, we do not recommend this approach. There are limited data on the safety and efficacy of initiating new ACE inhibitor or angiotensin receptor blockers (ARB) therapy in the early phase of therapy of acute decompensated heart failure (i.e. the first 12 to 24 hours)
6. There is controversy regarding the use of Lasix in acute pulmonary edema in the prehospital setting, and use is not recommended at this time. Lasix has been widely used in the treatment of CHF and acute pulmonary edema despite limited studies on its effectiveness. Since pulmonary edema is more commonly a problem of volume distribution than overload, administration of furosemide provides no immediate benefit for most patients. There are potential risks of hypokalemia, arrhythmias and increased systemic vascular resistance through enhancement of the Renin Angiotensin System, all of which may be deleterious to the acute CHF patient. Misdiagnosis of CHF and subsequent inducement of inappropriate diuresis can lead to increased morbidity and mortality in patients
7. Nitrates provide both subjective and objective improvement, and might decrease intubation rates, incidence of MIs, and mortality. High-dose nitrates can reduce both preload and afterload and potentially increase cardiac output. Because many CHF patients present with very elevated arterial and venous pressure, frequent doses of nitrates may be required to control blood pressure and afterload. High dose nitrate therapy, nitroglycerin SL, 0.8–2 mg q 3–5 minutes has been used in patients in severe distress such as hypoxia, altered mentation, diaphoresis, or speaking in one word sentences. A concern with high doses of nitrates is that some patients are very sensitive to even normal doses and may experience marked hypotension; it is therefore critical to monitor blood pressure during high-dose nitrate therapy

### **Quality Improvement**

#### **Key Documentation Elements**

1. Vital signs
2. Oxygen saturation
3. Time of intervention
4. Response to interventions

#### **Performance Measures**

1. Time to NIPPV
2. Number of CPAP/BiPAP patients who require intubation
3. Time to clinical improvement

4. Assessment/auscultation of lung sounds before and after each intervention

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#### **Revision Date**

September 15, 2014



# Trauma

## General Trauma Management

(No NEMSIS category)

### **Patient Care Goals**

1. Rapid assessment and management of life-threatening injuries
2. Safe movement of patient to prevent worsening injury severity
3. Rapid and safe transport to the appropriate level of trauma care

### **Patient Presentation**

#### **Inclusion Criteria**

Patients of all ages who have sustained an injury as a result of mechanical trauma. This includes both blunt and penetrating injury as well as burns

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Assess scene safety: evaluate for hazards to EMS personnel, patient, bystanders
  - a. Determine number of patients
  - b. Determine mechanism of injury
  - c. Request additional resources if needed. Weigh the benefits of waiting for additional resources against rapid transport to definitive care
  - d. Consider declaration of mass casualty incident if needed
2. Use appropriate personal protective equipment
3. Primary survey
  - a. Hemorrhage control  
Assess for and stop severe hemorrhage (see **Extremity Trauma/External Hemorrhage Management** guideline)
  - b. Airway
    - i. Assess airway patency, ask patient to talk to assess stridor and ease of air movement
    - ii. Look for injuries that may lead to airway obstruction including unstable facial fractures, expanding neck hematoma, blood or vomitus in the airway, facial burns/inhalation injury
    - iii. Evaluate mental status for ability to protect airway (GCS < 8 likely to require airway protection)
  - c. Breathing
    - i. Assess respiratory rate and pattern
    - ii. Assess symmetry of chest wall movement
    - iii. Listen bilaterally on lateral chest wall for breath sounds
  - d. Circulation
    - i. Assess blood pressure and heart rate

- ii. Signs of hemorrhagic shock include: tachycardia, pale, cool clammy skin, capillary refill > 2 seconds
- e. Disability
  - i. Perform neurologic status assessment (see **Appendix VI**)
  - ii. Assess gross motor movement of extremities
  - iii. Evaluate for clinical signs of traumatic brain injury with herniation including: unequal pupils, lateralizing motor signs or posturing
- f. Exposure
  - i. Rapid evaluation of entire body to identify sites of penetrating wounds or other blunt injuries. Be sure to roll patient and view back
  - ii. Prevent hypothermia

### **Treatment and Interventions**

1. Airway
  - a. Establish patent airway with cervical spine precautions per **Airway Management** guideline and **Spinal Care** guideline
  - b. If respiratory efforts inadequate, assist with bag-mask ventilation, consider airway adjuncts
  - c. If impending airway obstruction or altered mental status resulting in inability to maintain airway patency, secure definitive airway
2. Breathing
  - a. If absent or diminished breath sounds in a hypotensive patient, consider tension pneumothorax, perform needle decompression
  - b. For open chest wound, place semi-occlusive dressing
  - c. Monitor oxygen saturation, provide supplemental oxygen
3. Circulation
  - a. Control external hemorrhage per **Extremity Trauma/External Hemorrhage Management** guideline
  - b. If pelvis unstable and patient is hypotensive, place pelvic binder or sheet to stabilize pelvis
  - c. Establish IV access
  - d. Fluid Resuscitation
    - i. Adults
      1. If SBP < 90 mmHg or HR > 120, give bolus of 1 liter crystalloid solution and reassess
      2. For adult patients with penetrating trauma target SBP 90mmHg (or palpable radial pulse)
      3. For adult patients with head injury, target SBP 110-120. Hypotension should be avoided to maintain cerebral perfusion
    - ii. Pediatrics
      1. If child demonstrates tachycardia for age with signs of poor perfusion (low BP, > 2 second capillary refill, altered mental status, hypoxia, weak pulses, pallor, or mottled/cool skin): give 20ml/kg crystalloid bolus and reassess.
      2. Target is normal BP for age (see **Normal Vital Signs, Appendix VII**)
4. Disability
 

If clinical signs of traumatic brain injury, see **Head Injury** guideline

## 5. Exposure

Avoid hypothermia. Remove wet clothing. Cover patient to prevent further heat loss

Note that patients with major hemorrhage, hemodynamic instability, penetrating torso trauma, or signs of traumatic brain injury often require rapid surgical intervention. Minimize scene time (goal 10 minutes or less) and initiate rapid transport to a trauma center

Decisions regarding transport destination should be based on the CDC Field Triage Guidelines for Trauma Patients (below)

### **Secondary Assessment, Treatment and Interventions**

#### 1. Assessment

##### a. Obtain medical history from patient or family including:

- i. Allergies
- ii. Medications
- iii. Past medical and surgical history
- iv. Events leading up to the injury

##### b. Secondary Survey: Head to toe physical exam

###### i. Head

1. Palpate head and scalp and face and evaluate for soft tissue injury or bony crepitus
2. Assess pupils

###### ii. Neck

1. Check for:
  - a. Contusions
  - b. Abrasions
  - c. Hematomas
  - d. JVD
2. Palpate for crepitus
3. Evaluate for spinal tenderness

###### iii. Chest

1. Palpate for instability/crepitus
2. Listen to breath sounds
3. Inspect for penetrating or soft tissue injuries

###### iv. Abdomen

1. Palpate for tenderness
2. Inspect for penetrating or soft tissue injuries

###### v. Pelvis

1. Inspect for penetrating or soft tissue injuries
2. Palpate once for instability by gentle AP pressure with the heels of the hands on the symphysis pubis and then medial pressure at the iliac crests bilaterally

###### vi. Back

1. Log roll patient to maintain spinal alignment
2. Inspect for penetrating or soft tissue injuries
3. Palpate for spinal tenderness

- vii. Neurologic status assessment (see **Appendix VI**)
  - 1. Serial assessment of mental status
  - 2. Gross exam of motor strength all four extremities
- viii. Extremities
  - 1. Assess for fracture/deformity
  - 2. Assess peripheral pulses/capillary refill
- c. Additional treatment considerations
  - i. Maintain spine precautions per **Spinal Care** guideline
  - ii. Splint obvious extremity fractures per **Extremity Trauma/External Hemorrhage Management** guideline
  - iii. Provide pain medication per **Pain Management** guideline

#### **Patient Safety Considerations**

1. Life threatening injuries identified on primary survey should be managed immediately and rapidly transported to a trauma center. Secondary survey should be performed while en route
2. Monitor patient for deterioration over time with serial vital signs and repeat neurologic status assessment
  - a. Patients with compensated shock may not manifest hypotension until severe blood loss has occurred
  - b. Patients with traumatic brain injury may deteriorate as intracranial swelling and hemorrhage increase
3. Anticipate potential for progressive airway compromise in patients with trauma to head and neck

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Optimal trauma care requires a structured approach to the patient, emphasizing ABCDE
2. Target scene time < 10 minutes for unstable patients or those likely to need surgical intervention
3. Provider training should include the CDC Guidelines for Field Triage
4. Frequent reassessment of the patient is important
  - a. If patient develops difficulty with ventilation, reassess breath sounds for development of tension pneumothorax
  - b. If extremity hemorrhage is controlled with pressure dressing or tourniquet, reassess for evidence of continued hemorrhage
  - c. If mental status declines, reassess ABCs
5. Withholding and termination of resuscitative efforts
  - a. Resuscitative efforts should be withheld for trauma patients with the following:
    - i. Decapitation
    - ii. Hemitorpectomy
    - iii. Signs of rigor mortis or dependent lividity
    - iv. Blunt trauma: apneic, pulseless, no organized activity on cardiac monitor
  - b. Resuscitative efforts may be terminated in patients with traumatic arrest who have no return to spontaneous circulation after 15-30 minutes of resuscitative efforts, including minimally interrupted CPR

## **Quality Improvement**

### **Key Documentation Elements**

1. Mechanism of injury
2. Serial vital signs and neurologic status assessments
3. Scene time
4. Procedures performed and patient response

### **Performance Measures**

1. Monitor scene time for unstable patients
2. Monitor appropriateness of procedures
3. Monitor appropriate airway management

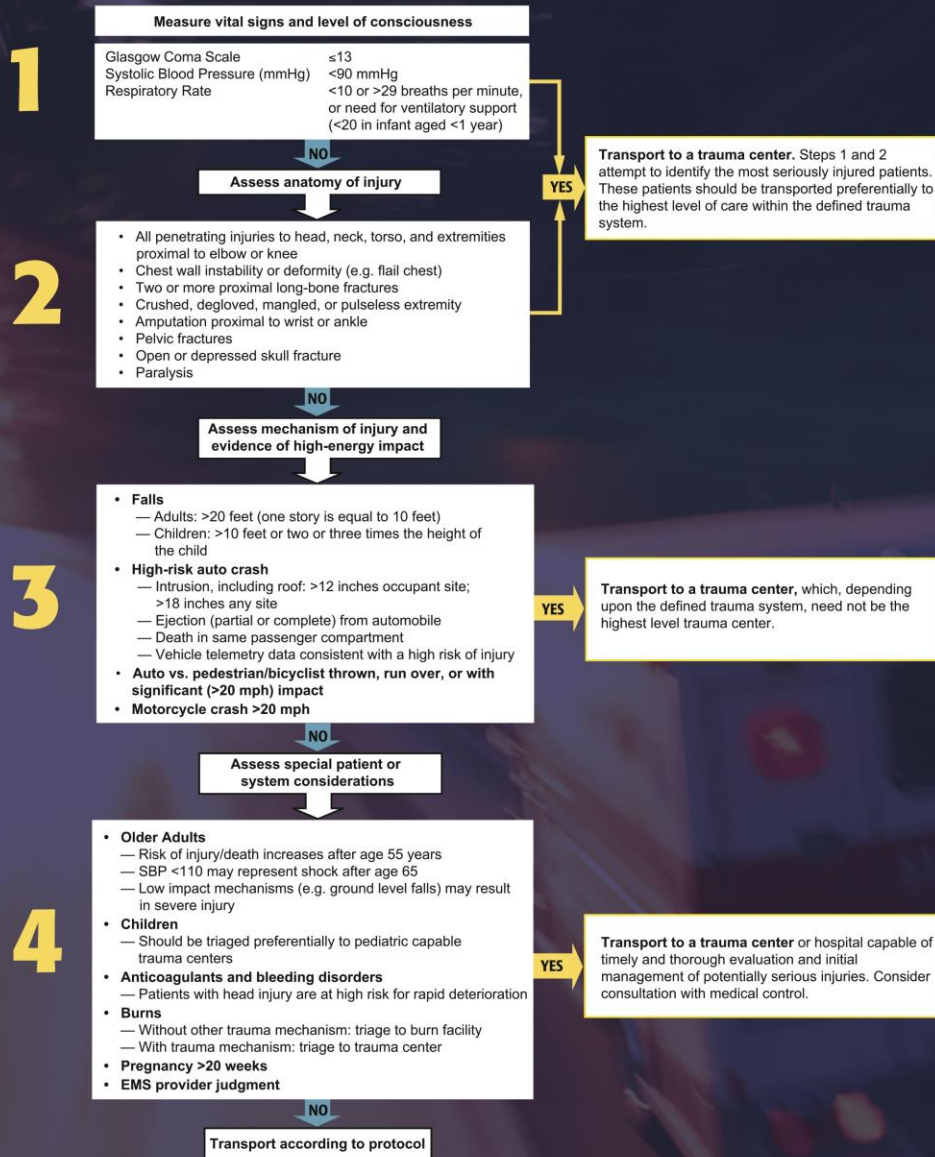
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## **Revision Date**

September 15, 2014

# 2011 Guidelines for Field Triage of Injured Patients



When in doubt, transport to a trauma center.

Find the plan to save lives, at [www.cdc.gov/FieldTriage](http://www.cdc.gov/FieldTriage)

National Center for Injury Prevention and Control  
Division of Injury Response



Source: Centers for Disease Control and Prevention, US Department of Health and Human Services

## Blast Injuries

(9914045 – Exposure – Explosive/Blast Injury)

### **Patient Care Goals**

1. Maintain patient and provider safety by identifying ongoing threats at the scene of an explosion
2. Identify multi-system injuries which may result from a blast, including possible toxic contamination
3. Prioritize treatment of multi-system injuries to minimize patient morbidity

### **Patient Presentation**

#### **Inclusion Criteria**

Patients exposed to explosive force (injuries may include any or all of the following: blunt and/or penetrating trauma, burns, pressure-related injuries (barotrauma), and toxic chemical contamination)

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Hemorrhage Control: Assess for and stop severe hemorrhage (see **Extremity Trauma/ External Hemorrhage Management** guideline) Airway: Assess airway patency. Consider possible thermal or chemical burns to airway
2. Breathing: Evaluate adequacy of respiratory effort, oxygenation, quality of lung sounds, and chest wall integrity. Consider possible pneumothorax or tension pneumothorax (as a result of penetrating/blunt trauma or barotrauma)
3. Circulation: Look for evidence of external hemorrhage. Assess BP, pulse, skin color/character, and distal capillary refill for signs of shock
4. Disability: Assess patient responsiveness (AVPU) and level of consciousness (GCS). Assess pupils. Assess gross motor movement of extremities
5. Exposure: Rapid evaluation of entire skin surface, including back (log roll), to identify blunt or penetrating injuries

#### **Treatment and Interventions**

1. Airway: Secure airway, utilizing airway maneuvers, airway adjuncts, supraglottic device, or endotracheal tube (see **Airway Management** guideline)  
If thermal or chemical burn to airway is suspected, early airway control is vital
2. Breathing:
  - a. Provide supplemental oxygen to maintain O<sub>2</sub> saturation  $\geq$  94%
  - b. Assist respirations as needed
  - c. Cover any open chest wounds with semi-occlusive dressing
  - d. If patient has evidence of tension pneumothorax (decreased or absent breath sounds and signs of shock), perform needle decompression

3. Circulation:
  - a. Control any external hemorrhage (see **Extremity Trauma/ External Hemorrhage Management** guideline)
  - b. Establish IV access with two large bore IVs or IOs
    - i. Administer NS or LR as per **General Trauma** guideline
    - ii. If patient is burned, administer NS or LR as per **Burn** guideline
4. Disability:
  - a. If evidence of head injury, treat as per Head Injury guideline
  - b. Apply spinal precautions as per **Spinal Care** guideline
  - c. Monitor GCS during transport to assess for changes
5. Exposure: Keep patient warm to prevent hypothermia

#### **Patient Safety Considerations**

1. Ensuring scene safety is especially important at the scene of an explosion. Consider possibility of subsequent explosions, structural safety, possible toxic chemical contamination, the presence of noxious gasses, and the like. In a possible terrorist event, consider the possibility of secondary explosive devices
2. Remove patient from the scene as soon as is practical and safe
3. If the patient has sustained burns (thermal, chemical, or airway), consider transport to specialized burn center

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Scene safety is of paramount importance when responding to an explosion or blast injury
2. Patients sustaining blast injury may sustain complex, multi-system injuries including: blunt and penetrating trauma, shrapnel, barotrauma, burns, and toxic chemical exposure
3. Consideration of airway injury, particularly airway burns, should prompt early and aggressive airway management
4. Minimize IV fluid resuscitation in patients without signs of shock
5. Consider injuries due to barotrauma
  - a. Tension pneumothorax
  - b. Tympanic membrane perforation resulting in deafness. This may complicate the evaluation of their mental status and their ability to follow commands

##### **Pertinent Assessment Findings**

Evidence of multi-system trauma, especially airway injury/burn, barotrauma to lungs, and toxic chemical contamination

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Documentation of scene safety
2. Airway status and intervention
3. Breathing status: quality of breath sounds (equal bilaterally), adequacy of respiratory effort, and oxygenation
4. Documentation of burns
5. Documentation of possible toxic chemical contamination



**Performance Measures**

1. Airway assessment and early and aggressive management
2. Appropriate IV fluid management
3. Transport to trauma or burn center

**References**

1. *Blast Injuries: Fact Sheets for Professionals*. Centers for Disease Control and Prevention.  
<http://emergency.cdc.gov/masscasualties/blastinjuryfacts.asp>

**Revision Date**

September 15, 2014

## Burns

(9914085 – Burns – Thermal)

### **Patient Care Goals**

Minimize tissue damage and patient morbidity from burns

### **Patient Presentation**

Observe and document:

1. Airway – stridor, hoarse voice
2. Mouth and nares – redness, blisters, soot, singed hairs
3. Breathing – rapid, shallow, wheezes, rales
4. Skin – Estimate Body Surface Area (BSA) and depth (partial v. full thickness)
5. Associated trauma – blast, fall, assault

### **Inclusion Criteria**

Patients sustaining thermal burns

### **Exclusion Criteria**

Electrical, chemical, and radiation burns (see **Toxins and Environmental** section)

### **Special transport considerations:**

1. Transport to most appropriate trauma center when there is airway or respiratory involvement, or when multi-trauma or blast injury is suspected
2. Consider transport directly to burn center if BSA > 20% partial thickness, BSA > 10% full thickness involvement of hands/feet, genitalia, face; circumferential burns
3. Consider air ambulance transportation for long transport times, pain control requiring deep sedation, and airway concerns that might necessitate advanced airway management

### **Scene Management:**

Assure crew safety: power off, electrical lines secure, gas off, no secondary devices, hazmat determinations made, proper protective attire including breathing apparatus may be required

### **Patient Management**

#### **Assessment**

1. Circumstances of event-- consider:
  - a. related trauma in addition to the burns
  - b. inhalation exposures such as CO and cyanide
  - c. pediatric or elder abuse
2. Follow ABCs of resuscitation
3. If evidence of possible airway burn, consider aggressive airway management.
4. Consider spinal immobilization (See **Spinal Care** guideline)
5. Estimate BSA burned and depth of burn (See burn related tables in **Appendix V**)
6. Document pain scale

### **Treatments and interventions**

1. Stop the burning:
  - a. Soak clothing and skin with water if burning or smoldering, then remove clothing if not stuck to the patient
  - b. Remove jewelry. It may be hot
  - c. Leave blisters intact
2. Minimize burn wound contamination. Cover burns with dry dressing or clean sheet.
3. Vital signs including SPO<sub>2</sub>, consider SPCO and ETCO<sub>2</sub> if available
  - a. ETCO<sub>2</sub> monitoring may be particularly useful to monitor respiratory status in patients receiving significant doses of narcotic pain medication
  - b. Cardiac monitor is important in chemical inhalations and electrical burns.
4. Supplement oxygen titrated to SPO<sub>2</sub>, if available. Give to all burn patients rescued from a confined space
5. Establish IV access, avoid placement through burned skin
6. Evaluate distal circulation in circumferentially burned extremities
7. Consider early management of pain and nausea/vomiting.
8. Initiate fluid resuscitation: Use lactated ringers or normal saline
  - a. If patient in shock, give fluid per shock protocol
  - b. If patient not in shock: Begin fluids based on estimated TBSA (see Initial Fluid Rate Chart for Burns in **Appendix V**). For children, use length-based tape for weight estimate
  - c. Initial fluid rate can also be calculated as:  $\text{body weight (kg)} \times \text{TBSA} = \text{cc of fluid to be given in first 2 hours}$
9. Prevent systemic heat loss – keep patient warm

### **Special treatment considerations**

1. If blast mechanism, see **Blast Injury** guideline
2. Airway burns can rapidly lead to upper airway obstruction and respiratory failure
3. Have a high index of suspicion for cyanide poisoning in a patient with depressed GCS, respiratory difficulty and cardiovascular collapse in the setting of an enclosed-space fire. Give antidote (hydroxocobalamin), if available, in this circumstance
4. Particularly in closed space fires, carbon monoxide toxicity is a consideration; pulse oximetry may not be accurate; see Carbon Monoxide Poisoning guideline
5. For specific chemical exposures (cyanide, hydrofluoric acid, other acids and alkali) see Chemical Burn guideline
6. Consider contamination and notification of receiving facility of potentially contaminated patient (e.g. meth lab incident)

### **Notes/Educational Pearls**

1. Onset of stridor and change in voice are sentinel signs of potentially significant airway burns, which may rapidly lead to airway obstruction or respiratory failure
2. If the patient is not in shock, the fluid rates recommended above will adequately maintain patient's fluid volume per the Parkland Formula
3. Pain management is critical in acute burns

### **Quality Improvement**

Burn trauma is relatively uncommon. Providers should receive regular training on burn assessment and management

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**Key Documentation Elements**

1. Initial airway status
2. Body surface area of second and third degree burns
3. Mechanism of burn injury
4. Pulse and capillary refill exam distally on any circumferentially burned extremity
5. Pain scale documentation and pain management

**Performance Measures**

1. Patient transported to most appropriate hospital, preferably a burn center
2. Pain scale documented and pain appropriately managed
3. Airway assessment and management appropriately documented

**References**

1. Mitra B, Fitzgerald M, Wasiak J et al. The Alfred pre-hospital fluid formula for major burns. *Burns*, 2011; 37:1134-1139
2. Fluid Rate charts (based on Parkland formula) and TBSA diagrams courtesy of the University of Utah Burn Center; 2014
3. American Burn Association. Advanced Burn Life Support (ABLS) Handbook; 2011

**Revision Date**

September 15, 2014

## Extremity Trauma / External Hemorrhage Management

(9914097 – Extremity)

### **Patient Care Goals**

1. Minimize blood loss from extremity hemorrhage
2. Avoid hemorrhagic shock as a result of extremity hemorrhage
3. Minimize pain in potential fractures or dislocations

### **Patient Presentation**

#### **Inclusion Criteria**

1. Traumatic extremity hemorrhage (external hemorrhage)
2. Potential extremity fractures or dislocations

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Evaluate for obvious deformity, shortening, rotation, or instability
2. Neuro status of extremity
  - a. Sensation to light touch
  - b. Distal movement of extremity
3. Vascular status of extremity
  - a. Pallor
  - b. Pulse
  - c. Capillary refill
  - d. Degree of bleeding/blood loss with assessment of the color of the blood (venous or arterial); if it is pulsatile or not

#### **Treatments and Interventions**

1. Manage bleeding
  - a. Apply direct pressure to bleeding site, followed by pressure dressing.
  - b. If direct pressure/pressure dressing is ineffective or impractical:
    - i. If the bleeding site is amenable to tourniquet placement, apply tourniquet to extremity
    - ii. If the bleeding site is not amenable to tourniquet placement (i.e. junctional injury), apply a topical hemostatic agent with direct pressure
    - iii. Tourniquet should be placed 2-3 cm proximal to wound, not over a joint, and tightened until bleeding stops. If bleeding continues, place a second tourniquet proximal to the first
    - iv. For thigh wounds, consider placement of two tourniquets, side-by-side, and tighten sequentially to eliminate distal pulse
  - c. Groin/axillary injury
    - i. Apply direct pressure to wound
    - ii. If still bleeding, pack wound tightly with gauze and continue direct pressure

- iii. Consider hemostatic adjuncts
- 2. Manage pain: See **Pain Management** guideline
  - a. Pain management should be strongly considered for patients with suspected fractures
  - b. If tourniquet placed, an alert patient will likely require pain medication to manage tourniquet pain
- 3. Stabilize suspected fractures/dislocations
  - a. If distal vascular function is compromised, gently attempt to restore normal anatomic position. Strongly consider pain management before attempting to move a suspected fracture
  - b. Use splints as appropriate to limit movement of suspected fracture
    - i. Reassess distal neurovascular status after any manipulation or splinting of fractures/dislocations
  - c. Elevate extremity fractures above heart level whenever possible to limit swelling
  - d. Apply ice/cool packs to limit swelling in suspected fractures or soft tissue injury. Do not apply ice directly to skin

#### **Patient Safety Considerations**

1. If tourniquet used, ensure that it is sufficiently tight to occlude the distal pulse, in order to avoid compartment syndrome
2. If tourniquet used, ensure that it is well marked and visible and that all subsequent providers are aware of the presence of the tourniquet. Do not cover with clothing or dressings
3. Time of tourniquet placement should be prominently marked on the patient
4. If pressure dressing or tourniquet used, frequently re-check to determine if bleeding has restarted. Check for blood soaking through the dressing or continued bleeding distal to the tourniquet. Do NOT remove tourniquet or dressing in order to assess bleeding

#### **Notes/Educational pearls**

##### **Key Considerations**

1. Tourniquet may be placed initially to stop obvious severe hemorrhage, then replaced later with pressure dressing after stabilization of ABCs and packaging of patient  
Tourniquet should NOT be removed if:
  - a. Transport time short (less than 30 minutes)
  - b. Amputation or near-amputation
  - c. Unstable or complex multiple-trauma patient
  - d. Unstable clinical or tactical situation
2. If tourniquet replaced with pressure dressing, leave loose tourniquet in place so it may be retightened if bleeding resumes. Survival markedly improved when tourniquet placed *before* shock ensues
3. Commercial/properly tested tourniquets are preferred over improvised tourniquets
4. Arterial pressure points are not effective in controlling hemorrhage

#### **Quality Improvement**

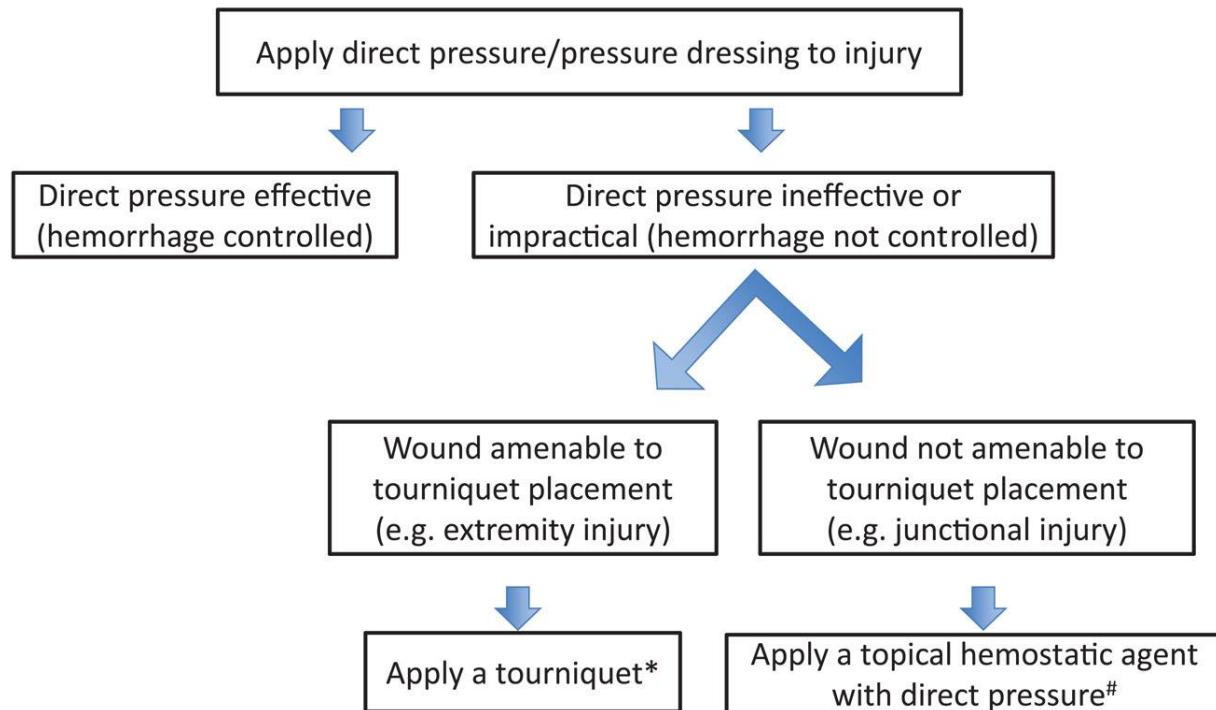
##### **Key Documentation Elements**

1. Vital signs and vascular status of extremity after placement of tourniquet, pressure dressing, or splint
2. Documentation of elimination of distal pulse after tourniquet placement
3. Time of tourniquet placement

### **Performance Measures**

1. Proper placement of tourniquet (location, elimination of distal pulse)
2. Proper marking and timing of tourniquet placement and notification of subsequent providers of tourniquet placement
3. Appropriate splinting of fractures

### **Prehospital External Hemorrhage Control Protocol**



From: Bulger, et al. 2014

### **References**

1. Bulger E et al. An evidence-based prehospital guideline for external hemorrhage control: American College of Surgeons Committee on Trauma. *Prehosp Emerg Care*, 2014 18:163
2. Doyle G and Taillac P. Tourniquets: A review of current use with proposals for expanded prehospital use. *Prehosp Emerg Care*, 2008 12(2):241
3. Kragh J et al. Battle casualty survival with emergency tourniquet use to stop limb bleeding. *J Emerg Med*, 2011 41(6): 590
4. *Prehospital Trauma Life Support*, Seventh Ed., Mosby, Inc. 2011

### **Revision Date**

September 15, 2014

## Facial Trauma

(No NEMSIS category)

### **Patient Care Goals**

1. Preservation of vision
2. Preservation of dentition
3. Preservation of a patent airway

### **Patient Presentation**

#### **Inclusion Criteria**

Isolated facial injury, including trauma to the eyes, nose, ears, midface, mandible, dentition

#### **Exclusion Criteria**

1. General Trauma (see **General Trauma Management** guideline)
2. Burn trauma (see **Burns** guideline)

### **Patient Management**

#### **Assessment**

1. Patient medications with focus on blood thinners/anti-platelet agents
2. ABCs with particular focus on ability to keep airway patent
  - a. Stable midface
  - b. Stable mandible
  - c. Stable dentition: poorly anchored teeth require vigilance for possible complete avulsion
3. Bleeding (which may be severe: epistaxis, oral trauma, facial lacerations)
4. Cervical spine pain or tenderness (see **Spinal Care** guideline)
5. Mental status assessment for possible traumatic brain injury (see **Head Injury** guideline)
6. Gross vision assessment
7. Dental avulsions
8. Any tissue or teeth avulsed should to be collected. Lost teeth not recovered on scene may be in the airway
9. Overall trauma assessment based on the mechanism of injury
10. Specific re-examination geared toward airway and ability to ventilate adequately

#### **Treatment and Interventions**

1. Oxygen supplementation based on hypoxia to maintain O<sub>2</sub> saturation  $\geq$  94%; use ETCO<sub>2</sub> to help monitor for hypoventilation and apnea
2. IV access, as needed for fluid or pain and anti-emetic medication (more likely) administration
3. Pain medication as per **Pain Management** guideline
4. Avulsed tooth:
  - a. Avoid touching the root of the avulsed tooth. Do not wipe off tooth
  - b. Pick up at crown end. If dirty, rinse off under cold water for 10 seconds
  - c. Place in milk or saline as the storage medium. Alternatively patient can hold tooth in mouth using own saliva as storage medium
5. Eye trauma:
  - a. Consider eye shield for any significant eye trauma



- b. If globe is avulsed do not put back into socket: cover with moist saline dressings and then place cup over it
- 6. Mandible unstable:
  - a. Expect patient cannot spit/swallow effectively. Have suction readily available.
  - b. If spine cleared (see **Spinal Care** guideline), transport sitting up with spit/emesis basin
- 7. Epistaxis:
  - a. Squeeze nose (or have patient do so) for 10 – 15 minutes continuously.
  - b. If oxymetazoline or neosynephrine is carried, it can be applied intra-nasally prior to applying nasal pressure
- 8. Nose/ear avulsion:
  - a. Recover tissue if it does not waste scene time
  - b. Transport with tissue wrapped in sterile gauze moistened with sterile saline
  - c. Severe ear and nose lacerations can be addressed with a protective sterile dressing

#### **Patient Safety Considerations**

- 1. Frequent reassessment of airway
- 2. Cervical spine clearance (per **Spinal Care** guideline) to enable transport sitting up for difficulty with bleeding, swallowing, or handling secretions

#### **Notes/Educational Pearls**

##### **Key Considerations**

- 1. Airway may be compromised because of fractures or bleeding
- 2. After nasal fractures, epistaxis may be posterior and may not respond to direct pressure over the nares. This may result in bleeding running down posterior pharynx, potentially compromising airway
- 3. Protect avulsed tissue and teeth. Avulsed teeth may be successfully re-implanted if done so in a very short period after injury. Use sterile dressing for ear and nose cartilage

#### **Pertinent Assessment Findings**

- 1. Unstable facial fractures that can abruptly compromise airway
- 2. Loose teeth and retro-pharynx bleeding

#### **Quality Improvement**

##### **Key Documentation Elements**

- 1. Airway patency and reassessment
- 2. Degree and location of hemorrhage
- 3. Mental status (GCS or AVPU)
- 4. Technique used to transport tissue or teeth
- 5. Eye exam documented, when applicable
- 6. Attempt to clear cervical spine
- 7. Recognition of risk of blood thinners

##### **Performance Measures**

- 1. Appropriate airway management and satisfactory oxygenation
- 2. Aspiration did not occur during EMS care
- 3. Tissue was usable or tooth could be re-implanted
- 4. Bleeding was properly addressed

5. Eye trauma was properly addressed

**References**

No specific recommendations

**Revision Date**

September 15, 2014

## Head Injury

(9914101 – Head)

### **Patient Care Goals**

Limit disability and mortality from head injury by:

1. Promoting adequate oxygenation
2. Promoting adequate cerebral perfusion
3. Limiting development of increased intracranial pressure
4. Limiting secondary brain injury

### **Patient Presentation**

#### **Inclusion Criteria**

Adult or pediatric patient with blunt or penetrating head injury  
(LOC or amnesia not required)

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Maintain cervical stabilization (see **Spinal Care** guideline)
2. Primary survey: Use “Approach to Injured Patient”
3. Monitoring:
  - a. Continuous pulse oximetry
  - b. Frequent systolic and diastolic blood pressure measurement
  - c. Initial neurologic status assessment (see Neurologic Status Assessment in Appendix VI) , and reassessment with any change in mentation
  - d. Moderate/severe head injury : apply continuous waveform ETCO<sub>2</sub> if available
4. Secondary survey pertinent to isolated head injury:
  - a. Head:  
Gently palpate skull to evaluate for depressed or open skull fracture
  - b. Eyes:
    - i. Evaluate pupil size and reaction to light to establish baseline
    - ii. Reassess if decrease in mentation
  - c. Nose/mouth/ears:  
Evaluate for blood/fluid drainage
  - d. Face:  
Evaluate for bony stability
  - e. Neck:  
Palpate for cervical spine step-off
  - f. Neurologic:
    - i. Perform neurologic status assessment (as above)
    - ii. Evaluate for focal neurologic deficit: motor and sensory

## **Treatment and Interventions**

Note that these are not necessarily the order they are to be done, but are grouped by conceptual areas

1. Airway:
  - a. Oxygen: prevent any desaturation < 90%; use supplemental O<sub>2</sub> as needed to maintain O<sub>2</sub> saturation ≥ 94%
  - b. If patient unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basal skull fracture)
  - c. Oral endotracheal intubation: use only if BVM ventilation ineffective in maintaining oxygenation or if airway is continually compromised. Nasal intubation should not be used in patients with head injury
2. Breathing:
  - a. Moderate / severe head injury: Continuous waveform capnography and EtCO<sub>2</sub> measurement if available
  - b. Supraglottic airway / endotracheal intubation only if BVM ventilation inadequate to maintain adequate oxygenation. Target EtCO<sub>2</sub> 35-40 mmHg
  - c. Severe head injury with signs of herniation: Hyperventilation to target EtCO<sub>2</sub> 30-35 mmHg. This is a short-term option, and is ONLY for severe head injury (GCS ≤ 8 or U (unresponsive) on AVPU scale) with signs of herniation
3. Circulation:
  - a. Wound care:
    - i. Control bleeding with direct pressure if no suspected open skull injury
    - ii. Moist sterile dressing to any potential open skull wound
  - b. Moderate / severe closed head injury:
    - i. Blood pressure: avoid hypotension
      1. Adult (age > 10 years): maintain SBP ≥ 110 mmHg
      2. Pediatric: maintain SBP:
        - a. < 1 month: > 60 mmHg
        - b. 1-12 months: > 70 mmHg
        - c. 1-10 years: > 70 + 2x age in years
  - c. Closed head injury: Consider administering NS/LR fluid bolus to maintain blood pressure to above numbers and maintain cerebral perfusion
  - d. Do not delay transport to initiate IV access
4. Disability:
  - a. Evaluate for other causes of altered mental status:
    - i. Evaluate blood glucose if indicated
  - b. Spinal stabilization
  - c. Perform and trend neurologic status assessment (moderate / severe: GCS ≤13, P (pain) or U (unresponsive) on AVPU scale)
    - i. Early signs of deterioration:
      1. Confusion
      2. Agitation
      3. Drowsiness
      4. Vomiting
      5. Severe headache
    - ii. Monitor for signs of herniation
  - d. Severe head injury: Elevate head of bed 30 degrees

5. Transport destination specific to head trauma
  - a. Preferential transport to highest level of care within trauma system:
    - i. GCS  $\leq$  13, P (pain) or U (unresponsive) on AVPU scale
    - ii. Penetrating head trauma
    - iii. Open or depressed skull fracture

#### **Patient Safety Considerations**

1. Do not hyperventilate patient unless signs of herniation
2. Assume concomitant cervical spine injury in patients with moderate/severe head injury

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Important that providers be specifically trained in accurate neurologic status assessment
2. If endotracheal intubation or invasive airways are used, continuous waveform capnography is required to document proper tube placement and assure proper ventilation rate
3. Signs of herniation
  - a. Decreasing mental status
  - b. Abnormal respiratory pattern
  - c. Asymmetric/unreactive pupils
  - d. Decorticate posturing
  - e. Cushing's response (bradycardia and hypertension)
4. Be alert for deterioration in patients with risk factors for potentially significant head injury:
  - a. GCS  $<$  15 at 2 hours post-injury, anything below A (alert) on AVPU scale
  - b. Age  $>$  55 years
  - c. Deterioration in neurologic status assessment
  - d. Post-traumatic seizure
  - e. Focal neurological deficit
  - f. LOC  $>$  5 min
  - g. Clinical suspicion of skull fracture
  - h. Recurrent vomiting
  - i. Known coagulopathy/bleeding disorder/anticoagulant therapy
  - j. Persistent severe headache
  - k. Persistent post-traumatic amnesia
  - l. Multisystem trauma
  - m. Large scalp hematoma/abrasion
  - n. Dangerous mechanism:
    - i. Fall  $>$  20 feet (adult)
    - ii. Fall  $>$  10 feet (pediatric)
    - iii. High risk auto crash
    - iv. Motor vehicle vs. pedestrian or bicyclist
    - v. Age
5. Do not delay transport for IV access placement
6. A "continually compromised" airway is one where basic airway maneuvers and suction do not protect the patient from significant aspiration
7. Note that in circulation section, "adult" designation was used at age  $\geq$  10 because at 10, the formula for pediatric SBP target = SBP 90 which is the same target as adult. These numbers are taken from 2010 AHA Guidelines, Part 14 (PALS) - Kleinman citation in References

### **Pertinent Assessment Findings**

1. Neurologic status assessment findings
2. Pupils
3. Trauma findings on physical exam

### **Quality Improvement**

#### **Key Documentation Elements**

1. Mechanism of injury documented
2. At least one full set of vital signs documented: SBP/DBP, P, R, SaO<sub>2</sub>, GCS
3. Pupil exam documented for moderate/severe head injury
4. EtCO<sub>2</sub> monitored and documented for moderate/severe head injury

#### **Performance Measures**

1. No oxygen desaturation < 90%
2. No hypotension < 90 mmHg
3. No EtCO<sub>2</sub> lower than 35 for mild head injury, 30 if severe head injury with signs of herniation
4. Appropriate triage to trauma center

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#### **Revision Date**

September 15, 2014

## Spinal Care

(Adapted from an evidence-based guideline created using the National Prehospital Evidence-Based Guideline Model Process)

(9914107 – Spinal Cord Injury)

### **Patient Care Goals**

1. Select patients for whom spinal immobilization is indicated
2. Minimize secondary injury to spine in patients who have, or may have, an unstable spinal injury
3. Minimize patient morbidity from immobilization procedures

### **Patient Presentation**

#### **Inclusion criteria**

Traumatic mechanism of injury

#### **Exclusion criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Assess the scene, to determine the risk of injury. Mechanism alone should not determine if a patient requires cervical spine immobilization. However, mechanisms that have been associated with higher risk of injury are the following:
  - a. Motor vehicle collisions, including automobiles, all-terrain vehicles, and snowmobiles
  - b. Axial loading injuries to the spine
  - c. Associated, substantial torso injuries
  - d. Falls >10 feet
2. Assess the patient in the position he/she was found. Initial assessment should focus on determining whether or not a cervical collar needs to be applied.
3. Assess for mental status, neurologic deficits, spinal pain or tenderness, any evidence of intoxication, or other severe injuries

#### **Treatment and Interventions**

1. Immobilize patient with cervical collar if there is any of the following:
  - a. Patient complains of midline neck or spine pain
  - b. Any midline neck or spinal tenderness with palpation
  - c. Any abnormal mental status (including extreme agitation) or neurologic deficit
  - d. Any evidence of alcohol or drug intoxication
  - e. Another severe or painful distracting injury is present
  - f. Torticollis in children
  - g. A communication barrier that prevents accurate assessment

If none of the above apply, patients should not have a cervical collar placed



2. Patients with penetrating injury to the neck should not receive spinal immobilization, regardless of whether they are exhibiting neurologic symptoms or not. Doing so can lead to delayed identification of injury or airway compromise, and has been associated with increased mortality
3. If extrication may be required
  - a. From a vehicle: After placing a cervical collar, if indicated, children in a booster seat and adults should be allowed to self-extricate. For infants and toddlers already strapped in a car seat with a built-in harness, extricate the child while strapped in his/her car seat
  - b. Other situations requiring extrication: A padded long board may be used for extrication, using the lift and slide (rather than a logroll) technique
4. Helmet removal
  - a. If a football helmet needs to be removed, it is recommended to remove the face mask followed by manual removal (rather than the use of automated devices) of the helmet while keeping the neck immobilized. Occipital padding should be applied, as needed, with the patient in a supine position, in order to maintain neutral cervical spine positioning
  - b. Evidence is lacking to provide guidance about other types of helmet removal
5. Patients should not routinely be transported on long boards, unless the clinical situation warrants long board use. An example of this may be facilitation of immobilization of multiple extremity injuries or an unstable patient where removal of a board will delay transport and/or other treatment priorities. In these rare situations, long boards should be padded or have a vacuum mattress applied to minimize secondary injury to the patient
6. Patients should be transported to the nearest appropriate facility, in accordance with the Centers for Disease Control “Guidelines for Field Triage of Injured Patients” (see **General Trauma Management** guideline)

#### **Patient Safety Considerations**

1. Be aware of potential airway compromise or aspiration in immobilized patient with nausea/vomiting, or with facial/oral bleeding
2. Excessively tight immobilization straps can limit chest excursion and cause hypoventilation
3. Prolonged immobilization on spine board can lead to ischemic pressure injuries to skin
4. Prolonged immobilization on spine board can be very uncomfortable for patient
5. Children are abdominal breathers, so immobilization straps should go across chest and pelvis and not across the abdomen, when possible
6. Children have disproportionately larger heads. When securing pediatric patients to a spine board, the board should have a recess for the head, or the body should be elevated approximately 1-2 cm to accommodate the larger head size and avoid neck flexion when immobilized

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Evidence is lacking to support or refute the use of manual stabilization prior to spinal assessment in the setting of a possible traumatic injury, when the patient is alert with spontaneous head/neck movement. Providers should not manually stabilize these alert and spontaneously moving patients, since patients with pain will self-limit movement, and forcing immobilization on children with this clinical appearance may unnecessarily increase

- discomfort and anxiety
2. Certain populations with musculoskeletal instability may be predisposed to cervical spine injury. However, evidence does not support or refute that these patients should be treated differently than those who do not have these conditions. These patients should be treated according to the spinal care guideline like other patients without these conditions
  3. Age alone should not be a factor in decision-making for prehospital spine care, yet the patient's ability to reliably be assessed at the extremes of age should be considered. Communication barriers with infants/toddlers or elderly patients with dementia may prevent the provider from accurately assessing the patient
  4. Spinal immobilization should be considered a treatment or preventive therapy
  5. Patients who are likely to benefit from immobilization should undergo this treatment
  6. Patients who are not likely to benefit from immobilization, who have a low likelihood of spinal injury, should not be immobilized
  7. Ambulatory patients may be safely immobilized on gurney with cervical collar and straps and will not generally require a spine board
  8. Long spine board should be reserved for patient movement in non-ambulatory patients who meet immobilization criteria and should be removed as soon as is practical

#### **Pertinent Assessment Findings**

1. Mental status
2. Normal neurologic examination
3. Evidence of intoxication
4. Evidence of multiple trauma with other severely painful injuries

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Patient complaint of neck or spine pain
2. Spinal tenderness
3. Mental status/GCS
4. Neurologic examination
5. Evidence of intoxication
6. Documentation of multiple trauma
7. Documentation of mechanism of injury

##### **Performance Measures**

1. Percentage of patients with high risk mechanisms of injury and signs or symptoms of cervical spine injury who are placed in a cervical collar
2. Percentage of patients without known trauma who have a cervical immobilization device placed (higher percentage creates a negative aspect of care)
3. Percentage of trauma patients who are transported on a long backboard (target is a low percentage)
4. Percentage of patients with a cervical spinal cord injury or unstable cervical fracture who did not receive cervical collar

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**Revision Date**

September 15, 2014

# Toxins and Environmental

## Poisoning/Overdose Universal Care

(9914135 – Overdose/Poisoning/Toxic Ingestion)

### **Patient Care Goals**

1. Remove patient from hazardous material environment/decontaminate to remove continued sources of absorption, ingestion, inhalation, or injection
2. Identify intoxicating agent by toxidrome or appropriate environmental testing
3. Assess risk for organ impairments (heart, brain, kidney)
4. Identify antidote or mitigating agent
5. Treat signs and symptoms in effort to stabilize patient

### **Patient Presentation**

#### **Inclusion Criteria**

Presentation may vary depending on the concentration and duration of exposure. Signs and symptoms may include, but are not limited to, the following:

1. Absorption:
  - a. Nausea
  - b. Vomiting
  - c. Diarrhea
  - d. Altered mental status
  - e. Abdominal pain
  - f. Rapid heart rate
  - g. Dyspnea
  - h. Seizures
  - i. Arrhythmias
  - j. Respiratory depression
  - k. Sweating
  - l. Tearing
  - m. Defecation
  - n. Constricted/dilated pupils
  - o. Rash
  - p. Burns to the skin
2. Ingestion:
  - a. Nausea
  - b. Vomiting
  - c. Diarrhea
  - d. Altered mental status
  - e. Abdominal pain
  - f. Rapid or slow heart rate
  - g. Dyspnea
  - h. Seizures

- i. Arrhythmias
  - j. Respiratory depression
  - k. Chemical burns around or inside the mouth
  - l. Abnormal breath odors
3. Inhalation:
- a. Nausea
  - b. Vomiting
  - c. Diarrhea
  - d. Altered mental status
  - e. Abnormal skin color
  - f. Dyspnea
  - g. Seizures
  - h. Burns to the respiratory tract
  - i. Stridor
  - j. Sooty sputum
  - k. Known exposure to toxic or irritating gas
  - l. Respiratory depression
  - m. Sweating
  - n. Tearing
  - o. Constricted/dilated pupils
  - p. Dizziness
4. Injection:
- a. Local pain
  - b. Puncture wounds
  - c. Reddening skin
  - d. Local edema
  - e. Numbness
  - f. Tingling
  - g. Nausea
  - h. Vomiting
  - i. Diarrhea
  - j. Altered mental status
  - k. Abdominal pain
  - l. Seizures
  - m. Muscle twitching
  - n. Hypoperfusion
  - o. Respiratory depression
  - p. Metallic or rubbery taste

#### **Exclusion Criteria**

No specific recommendations

#### **Patient Management**

##### **Assessment**

1. Make sure the scene is safe

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2. Consider Body Substance Isolation (BSI) or appropriate personal protective equipment (PPE)
3. Assess ABCD and if indicated expose and then cover to assure retention of body heat
4. Vital signs which include temperature
5. Place cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
6. Check blood glucose Level
7. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
8. Identify specific medication taken (including immediate release vs sustain release) time of ingestion, dose, and quantity
9. Pertinent cardiovascular history or other prescribed medications for underlying disease
10. Check for needle marks, paraphernalia, bites, bottles or evidence of agent involved, self-inflicted injury, or trauma
11. Law enforcement should have checked for weapons and drugs but you may decide to re-check
12. Patient pertinent history
13. Patient physical examination

### **Treatment and Interventions**

1. Assure a patent airway
2. Administer oxygen and if hypoventilation, toxic inhalation or desaturation noted, support breathing
3. Initiate IV access for infusion of lactated ringers or normal saline and obtain blood samples if EMS management might change value (e.g. glucose, lactate, cyanide)
4. Fluid bolus (20 ml/kg) if evidence of hypoperfusion
5. Administration of appropriate antidote or mitigating medication (refer to specific agent guideline if not listed below)
  - a. Acetaminophen overdose:
    - i. Consider activated charcoal without sorbitol (1 gm/kg) PO
    - ii. Based on suspected quantity and timing (Rumack-Matthew nomogram), consider acetylcysteine 140 mg/kg PO (pediatric and adult)
    - iii. If risk of rapidly decreasing mental status, do not administer oral agents
  - b. Aspirin overdose:
    - i. Consider activated charcoal without sorbitol (1 gm/kg) PO
    - ii. If risk of rapid decreasing mental status, do not administer oral agents
    - iii. As aspirin is erratically absorbed, charcoal is highly recommended to be administered early
  - c. Ingestion of caustic substances (acids and alkali)
    - i. In the few minutes immediately after ingestion, consider administration of water or milk if available (maximum of 250 ml)
    - ii. Symptomatic dystonia, extrapyramidal signs or symptoms, or mild allergic reactions Consider administration of diphenhydramine
      1. Adult: 25 mg IV or IM
      2. Pediatric: 1 mg/kg IVP/IO or IM (maximum single dose of 25 mg)
  - d. Symptomatic monoamine oxidase inhibitor overdose (MAOI; examples: Isocarboxazid (Marplan), Phenelzine (Nardil), Selegiline (Emsam), Tranylcypromine (Parnate))

- i. Consider administration of midazolam (benzodiazepine of choice) for temperature control
  - ii. Adult and Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)
- e. Oral ingestion poisoning:
  - i. Consider administration of activated charcoal without sorbitol (1 gm/kg) PO particularly if it is within the first 2 hour after ingestion (including acetaminophen)
  - ii. Patients who have ingested medications with extended release or delayed absorption should also be administered activated charcoal
  - iii. If there is a risk of rapidly decreasing mental status or for petroleum-based ingestions, do not administer oral agents

### **Patient Safety Considerations**

1. Scene/environmental safety patient and provider
2. Monitor patient airway, breathing, pulse oximetry, ETCO<sub>2</sub> for adequate ventilation as they will change over time
3. Repeat vital signs
4. Monitor level of consciousness
5. Monitor EKG with special attention to rate, rhythm, QRS and QT duration
6. Maintain or normalize patient temperature
7. Accurate ingestion history (as patient may become unconscious before arrival at ED):
  - a. Time of ingestion
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
8. Poison center should be engaged as early as reasonably possible to add in appropriate therapy and to track patient outcomes to improve knowledge of toxic effects. The national 24-hour toll-free telephone number to poison control centers is (800) 222-1222, and it is a resource for free, confidential expert advice from anywhere in the United States

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Each toxin or overdose has unique characteristics which must be considered in individual protocol
2. Activated charcoal is still a useful adjunct in the serious agent, enterohepatic, or extended release agent poisoning as long as the patient does not have the potential for rapid alteration of mental status or airway/ aspiration risk
3. Ipecac is no longer recommended for any poisoning or toxic ingestion. The manufacturer has stopped production of this medication

#### **Pertinent Assessment Findings**

1. Each toxin or overdose has unique characteristics which must be considered in individual guideline
2. Frequent reassessment is essential as patient deterioration can be rapid and catastrophic

## **Quality Improvement**

### **Key Documentation Elements**

1. Repeat evaluation and documentation of signs and symptoms as patient clinical conditions may deteriorate rapidly
2. Identification of possible etiology of poisoning
3. Initiating measures on scene to prevent exposure of bystanders when appropriate/indicated
4. Time of symptoms onset and time of initiation of exposure-specific treatments

### **Performance Measures**

1. Early airway management in the rapidly deteriorating patient
2. Accurate exposure history
  - a. Time of ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
3. Appropriate protocol selection and management
4. Multiple frequent documented reassessments

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## **Revision Date**

September 15, 2014

## Acetylcholinesterase Inhibitors (Carbamates, Nerve Agents, Organophosphates) Exposure

(9914047 – Nerve Agents)

### **Patient Care Goals**

Rapid recognition of the signs and symptoms of confirmed or suspected acetylcholinesterase inhibitor (AChEI) agents such as carbamates, nerve agents, or organophosphates exposure followed by expeditious and repeated administration of atropine, the primary antidote.

### **Patient Presentation**

#### **Inclusion Criteria**

**DUMBELS** is a mnemonic used to describe the signs and symptoms of AChEI agent poisoning. All patient age groups are included where the signs and symptoms exhibited are consistent with the toxidrome of DUMBELS.

- D** Diarrhea
- U** Urination
- M** Miosis/Muscle weakness
- B** Bronchospasm/Bronchorrhea
- E** Emesis
- L** Lacrimation
- S** Salivation/Sweating

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

1. Don the appropriate personal protective equipment (PPE)
2. Remove the patient's clothing and wash the skin with soap and water
  - a. AChEI agents can be absorbed through the skin
  - b. Contaminated clothing can provide a source of continued exposure to the toxin
3. Rapidly assess the patient's respiratory status, mental status, and pupillary status
4. Administer oxygen
5. Establish intravenous access (if possible)
6. Apply a cardiac monitor (if available)
7. The heart rate may be normal, bradycardic, or tachycardic
8. Clinical improvement should be based upon the drying of secretions and easing of respiratory effort rather than heart rate or pupillary response
9. Continuous and ongoing patient reassessment is critical

#### **Assessment**

1. AChEI agents are highly toxic chemical agents and can rapidly be fatal
2. Antidotes (atropine and pralidoxime) are effective if administered before circulation fails
3. The patient may develop:
  - a. Miosis (pinpoint pupils)

- b. Bronchospasm
  - c. Vomiting
  - d. Excessive secretions in the form of:
    - i. Tearing
    - ii. Salivation
    - iii. Rhinorrhea
    - iv. Diarrhea
    - v. Urination
4. Penetration of an AChEI agent into the central nervous system (CNS) will cause:
    - a. Headache
    - b. Confusion
    - c. Generalized muscle weakness
    - d. Seizures
    - e. Lethargy or unresponsiveness
  5. Estimated level of exposure based upon signs and symptoms
    - a. Mild
      - i. Miosis alone
      - ii. Miosis and severe rhinorrhea
    - b. Mild to moderate (in addition to symptoms of mild exposure)
      - i. Localized swelling
      - ii. Muscle fasciculations
      - iii. Nausea and vomiting
      - iv. Weakness
      - v. Shortness of breath
    - c. Severe (in addition to symptoms of mild to moderate exposure)
      - i. Unconsciousness
      - ii. Convulsions
      - iii. Apnea or severe respiratory distress requiring assisted ventilation
      - iv. Flaccid paralysis
  6. Onset of symptoms can be immediate with an exposure to a large amount of the AChEI
  7. Signs and symptoms with large AChEI agent exposures (regardless of route)
    - a. Sudden loss of consciousness
    - b. Seizures
    - c. Copious secretions
    - d. Apnea
    - e. Death
      - i. There is usually an asymptomatic interval of minutes after liquid exposure before these symptoms occur
      - ii. Effects from vapor exposure occur almost immediately
  8. Patients with low-dose chronic exposures may have a more delayed presentation of symptoms
  9. Identify:
    - a. Specific agent taken (if possible)
    - b. Time of exposure
    - c. Quantity
    - d. Pertinent cardiovascular history or other prescribed medications for underlying disease

10. The patient can manifest any or all of the signs and symptoms of the toxidrome based on the route of exposure, agent involved, and concentration of the agent:
  - a. Vapor exposures will have a direct effect on the eyes and pupils causing miosis
  - b. Patients with isolated skin exposures will have normally reactive pupils
  - c. Certain AChEI agents can place the patient at risk for both a vapor and skin exposure

### **Treatment and Interventions**

#### **Medications:**

1. Atropine

Atropine is the primary antidote for organophosphate, carbamate, or nerve agent exposures, and repeated doses should be administered liberally to patients who exhibit signs and symptoms of exposure or toxicity

- a. Atropine may be provided in multi-dose vials, pre-filled syringes, or auto-injectors
- b. Commercially available atropine auto-injectors include:
  - i. Atro-Pen® 1 mg of atropine (dark red container)
  - ii. Atro-Pen® 2 mg of atropine (green container)
  - iii. Pediatric Atro-Pen® 0.25 mg of atropine (yellow container)
  - iv. Pediatric Atro-Pen® 0.5 mg of atropine (blue container)

2. Pralidoxime Chloride (2-PAM)

Pralidoxime chloride is a secondary treatment and should be given concurrently in an effort to reactivate the acetylcholinesterase

- a. Pralidoxime chloride may be provided in a single dose vial, pre-filled syringes, or auto-injectors
- b. Auto-injectors contain 600 mg of pralidoxime chloride
- c. In order to be beneficial to the victim, a dose of pralidoxime chloride should be administered shortly after the nerve agent or organophosphate poisoning as it has minimal clinical effect if administration is delayed

3. Benzodiazepines

Benzodiazepines are administered as an anticonvulsant for those patients who exhibit seizure activity (see the **Seizures** guideline for doses and routes of administration)

- a. Lorazepam, diazepam, and midazolam are the most frequently used benzodiazepines in the prehospital setting
- b. In the scenario of an AChEI agent exposure, the administration of diazepam or midazolam is preferable due to their more rapid onset of action
- c. Benzodiazepines may be provided in multi-dose or single-dose vials, pre-filled syringes, or auto-injectors
- d. Cana® is a commercially available auto-injector of diazepam

4. Mark I® Kits

- a. A commercially available kit of nerve agent/organophosphate antidote auto-injectors
- b. A Mark I® kit consists of one auto-injector containing 2 milligrams of atropine and a second auto-injector containing 600 milligrams of pralidoxime chloride

5. Duodote®

- a. A commercially available auto-injector of nerve agent/organophosphate antidote
- b. Duodote® is one auto-injector that contains 2.1 milligrams of atropine and 600 milligrams of pralidoxime chloride

#### Medication Administration:

1. Atropine in extremely large, and potentially multiple, doses is the antidote for an AChEI agent poisoning
2. Atropine should be administered immediately followed by repeated doses until the patient's secretions resolve
3. Pralidoxime chloride (2-PAM) is a secondary treatment and, when possible, should be administered concurrently with atropine
4. The stock of atropine and pralidoxime chloride available to EMS providers is usually not sufficient to fully treat the victim of an AChEI agent exposure; however, EMS providers should initiate the administration of atropine and, if available, pralidoxime chloride
5. Seizures should be treated with benzodiazepines  
There is some emerging evidence that, for midazolam, the intranasal route of administration may be preferable to the intramuscular route
6. The patient should be emergently transported to the closest appropriate medical facility as directed by direct medical oversight

#### Recommended Doses

The medication dosing tables that are provided below are based upon the severity of the clinical signs and symptoms exhibited by the patient. There are several imperative factors to note:

1. For organophosphate or severe AChEI agent exposure, the required dose of atropine necessary to dry secretions and improve the respiratory status is likely to exceed 20 mg. Atropine should be administered rapidly and repeatedly until the patient's clinical symptoms diminish
2. Since the antidotes in the Mark I® kit are in two separate vials, the atropine auto-injector in the kit can be administered to the patient in the event that Atro-Pen® or generic atropine auto-injectors are not available and/or intravenous atropine is not an immediate option
3. Due to the fact that Duodote® auto-injectors contain pralidoxime chloride, they should not be used for additional dosing of atropine beyond the recommended administered dose of pralidoxime chloride
4. All of the medications below can be administered intravenously in the same doses cited for the intramuscular route. However, due to the rapidity of onset of signs, symptoms, and potential death from AChEI agents, intramuscular administration is highly recommended to eliminate the inherent delay associated with establishing intravenous access
5. Atropine and diazepam can be administered via the intraosseous route. However, due to the rapidity of onset of signs, symptoms, and potential death from AChEI agents, intramuscular administration remains the preferable due to the inherent delay associated with establishing intraosseous access and the limited use of this route of administration for other medications

**Mild AChEI Agent Exposure**

<b>Patient (Weight)</b>	<b>Atropine Dose IM or via Auto-injector</b>
Infant: 0-2 years	0.05 mg/kg IM or via auto-injector (e.g. 0.25 and/or 0.5 mg auto-injector(s))
Child: 3-7 years (13-25 kg)	1 mg IM or via auto-injector (e.g. one 1 mg or two 0.5 mg auto-injectors)
Child: 8-14 years (26-50 kg)	2 mg IM or via auto-injector (e.g. one 2 mg or two 1 mg auto-injectors)
Adolescent/Adult	2 mg IM or via auto-injector
Pregnant women	2 mg IM or via auto-injector
Geriatric or frail	1 mg IM or via auto-injector

**Mild to Moderate AChEI Agent Exposure**

<b>Patient (Weight)</b>	<b>Atropine Dose IM or via Auto-injector</b>	<b>Pralidoxime Chloride Dose IM or via 600 mg Auto-injector</b>
Infant: 0-2 years	0.05 mg/kg IM or via auto-injector (e.g. 0.25 mg and/or 0.5 mg auto-injector)	15 mg/kg IM
Child: 3-7 years (13-25 kg)	1 mg IM or via auto-injector (e.g. one 1 mg auto-injector or two 0.5 mg auto-injectors)	15 mg/kg IM or One auto-injector (600 mg)
Child: 8-14 years (26-50 kg)	2 mg IM or via auto-injector (e.g. one 2 mg auto-injector or two 1 mg auto-injectors)	15 mg/kg IM or One auto-injector (600 mg)
Adolescent/Adult	2-4 mg IM or via auto-injector	600 mg IM or One auto-injector (600 mg)
Pregnant Women	2-4 mg IM or via auto-injector	600 mg IM or One auto-injector (600 mg)
Geriatric or frail	2 mg IM or via auto-injector	10 mg/kg IM or One auto-injector (600 mg)



**Severe AChEI Agent Exposure**

<b>Patient (Weight)</b>	<b>Atropine Dose IM or via Auto-injector</b>	<b>Pralidoxime Chloride Dose IM or via 600 mg Auto-injector</b>
Infant: 0-2 years	0.1 mg/kg IM or via auto-injector ( <i>e.g. 0.25 mg and/or 0.5 mg auto-injector</i> )	45 mg/kg IM
Child: 3-7 years (13-25 kg)	0.1 mg/kg IM or 2 mg via auto-injector ( <i>e.g. one 2 mg auto-injectors or four 0.5 mg auto-injectors</i> )	45 mg/kg IM or One auto-injector (600mg)
Child: 8-14 years (26-50 kg)	4 mg IM or via auto-injector ( <i>e.g. two 2 mg auto-injectors or four 1 mg auto-injectors</i> )	45 mg/kg IM or Two auto-injectors (1200 mg)
Adolescent: > 14 years	6 mg IM or 6 mg via auto-injector ( <i>e.g. three 2 mg auto-injectors</i> )	Three auto-injectors (1800 mg)
Adult	6 mg IM or 6 mg via auto-injector ( <i>e.g. three 2 mg auto-injectors</i> )	Three auto-injectors (1800 mg)
Pregnant Women	6 mg IM or 6 mg via auto-injector ( <i>e.g. three 2 mg auto-injectors</i> )	Three auto-injectors (1800 mg)
Geriatric or frail	2-4 mg IM or 2-4 mg via auto-injector ( <i>e.g. one to two 2 mg auto-injectors</i> )	25 mg/kg IM or Two to three auto-injectors (1200 mg-1800 mg)

### **Guideline for the Treatment of Seizures Secondary to AChEI Agent Exposure**

<b>Patient</b>	<b>Diazepam</b>	<b>Midazolam</b>
Infant (0-2 years)	0.2-0.5 mg/kg IM, repeat every 2-5 minutes	0.15 mg/kg IM, repeat prn in 10 minutes
	0.2-0.5 mg/kg IV every 15-30 minutes; may repeat twice as needed	May repeat dose once
	Total maximum dose: 5 mg	Total maximum dose: 0.3 mg/kg
Child (3-13 years)	0.2-0.5 mg/kg IM repeat every 2-5 minutes	0.15 mg/kg IM, not to exceed 10 mg, repeat prn in 10 minutes
	0.2-0.5 mg/kg IV every 15-30 minutes; may repeat dose twice if needed	May repeat dose once
	Total maximum dose: 5 mg if < 5 years	Total maximum dose: 0.3 mg/kg, not to exceed 20 mg
	Total maximum dose: 10 mg if age ≥5 years 1 CANA auto-injector	
Adolescent (≥14 years)	2-3 CANA auto-injectors	0.15 mg/kg IM to a maximum dose of 10 mg, repeat prn in 10 minutes
	5-10 mg IV every 15 minutes	May repeat dose once
	Total maximum dose: 30 mg	Total maximum dose: 20 mg
Adult	2-3 CANA auto-injectors	10 mg IM, repeat prn in 10 minutes
	5-10 mg IV every 15 minutes	May repeat dose once
	Total maximum dose: 30 mg	Total maximum dose: 20 mg
Pregnant Women	2-3 CANA auto-injectors	10 mg IM, repeat prn in 10 minutes
	5-10 mg IV every 15 minutes	May repeat dose once
	Total maximum dose: 30 mg	Total maximum dose: 20 mg
Geriatric	2-3 CANA auto-injectors	10 mg IM, repeat prn in 10 minutes
	5-10 mg IV every 15 minutes	May repeat dose once
	Total maximum dose: 30 mg	Total maximum dose: 20 mg

Tables Adapted from: U.S. Department of Health and Human Services, ASPR, National Library of Medicine, *Chemical Hazards Emergency Medical Management: Nerve Agents- Prehospital Management*, [www.chemm.nlm.nih.gov](http://www.chemm.nlm.nih.gov)

### **Patient Safety Considerations**

1. Continuous and ongoing patient reassessment is critical
2. Clinical response to treatment is demonstrated by the drying of secretion and the easing of respiratory effort
3. Initiation of and ongoing treatment should not be based upon heart rate or pupillary response
4. Precautions for pralidoxime chloride administration:  
Although Duodote® contains atropine, the primary antidote for an AChEI agent poisoning, the inclusion of pralidoxime chloride in the auto-injector can present challenges if additional doses of atropine are warranted by the patient condition and other formulations of atropine are unavailable:
  - a. In the pediatric population, an overdose of pralidoxime chloride may cause profound neuromuscular weakness and subsequent respiratory depression
  - b. In the adult population, especially for the geriatric victim, excessive doses of pralidoxime chloride may cause severe systolic and diastolic hypertension, neuromuscular weakness, headache, tachycardia, and visual impairment
  - c. For the geriatric victim who may have underlying medical conditions, particularly impaired kidney function or hypertension, the EMS provider should consider administering the lower recommended adult dose of intravenous pralidoxime chloride
5. Considerations during the use of auto-injectors
  - a. If an auto-injector is administered, a dose calculation prior to administration is not necessary
  - b. For atropine, additional auto-injectors should be administered until secretions diminish
  - c. Mark I® kits and Duodote® have not been approved for pediatric use by the Food and Drug Administration (FDA), but they can be considered for the initial treatment for children of any age with severe symptoms of an AChEI agent poisoning especially if other formulations of atropine are unavailable
  - d. Pediatric Atro-Pen® auto-injectors are commercially available in a 0.25 mg auto-injector (yellow) and a 0.5 mg auto-injector (red). Atro-Pen® auto-injectors are commercially available in a 1 mg auto-injector (blue) and a 2 mg auto-injector (green)
  - e. A pralidoxime chloride 600 mg auto-injector may be administered to an infant that weighs greater than 12 kg

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Clinical Effects of AChEI Agents
  - a. The clinical effects are caused by the inhibition of the enzyme acetylcholinesterase which allows excess acetylcholine to accumulate in the nervous system
  - b. The excess accumulated acetylcholine causes hyperactivity in muscles, glands, and nerves
2. Organophosphates
  - a. Can be legally purchased by the general public
  - b. Toxic chemicals that are readily available for purchase by the general public as pesticides penetrate tissues and bind to the patient's body fat producing a prolonged period of illness and ongoing toxicity even during aggressive treatment
3. Nerve agents
  - a. Traditionally classified as weapons of mass destruction (WMD)

- b. Not readily accessible to the general public
- c. Extremely toxic and rapidly fatal with any route of exposure
- d. GA (tabun), GB (sarin), GD (soman), GF, and VX are types of nerve agents and are WMDs

#### **Pertinent Assessment Findings**

The signs and symptoms exhibited with the toxidrome of DUMBELS. (See Patient Presentation Inclusion Criteria listed above)

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Time to recognize initial signs and symptoms
2. Number of repeated doses of atropine required for the secretions diminish and respirations to improve
3. Patient reassessments
4. Patient responses to therapeutic interventions
5. Measures taken to decontaminate the patient
6. Measures taken to protect clean environments from contamination

##### **Performance Measures**

1. Ability of the EMS system to rapidly locate additional and adequate antidote assets
2. Ability of the EMS system to rapidly deploy additional and adequate antidote assets
3. Survival rates of victims
4. Complication rates from the toxin
5. Complication rates from the antidotes
6. Long-term clinical sequelae of the victims

#### **References**

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5. Tintinalli JE et al. *Tintinalli's Emergency Medicine*, 2011 1298-1300
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#### **Revision Date**

September 15, 2014

## Radiation Exposure

(9914049 – Radiologic Agent)

### **Patient Care Goals**

1. Identify the patient with a confirmed or suspected radiation exposure or radioactive contamination
2. Minimize the resultant mortality and morbidity
3. Prevent ongoing or additional contamination

### **Patient Presentation**

#### **Inclusion criteria**

1. Patients exposed to a known or suspected source of radiation
2. All ages are included particularly patients exhibiting the signs and symptoms of acute radiation toxicity:
  - a. Nausea
  - b. Vomiting
  - c. Petechiae
  - d. External bleeding
  - e. Suspected internal bleeding
  - f. Dizziness
  - g. Headache
  - h. Altered mental status

#### **Exclusion criteria**

No specific recommendations

### **Patient Management**

1. Don personal protective equipment (PPE)
2. Exercise universal precautions at all times
3. Place contaminated towels, waste water, and body fluids in secured containers denoted for radioactive waste materials
4. Place all body fluids released from vomiting, urination, salivation, and defecation in plastic bags and secure them in containers denoted for radioactive waste materials

#### **Assessment**

Radiation does not produce any immediate symptoms unless the exposure is severe  
Most patients with radiation will be asymptomatic initially

#### **Treatment and Interventions**

1. Confirmed or suspected skin exposures
  - a. Wash all exposed areas repeatedly with soap and water
  - b. Continue irrigation of the skin dosimetry readings decrease to an acceptable level
2. Confirmed or suspected inhalation contamination
  - a. Administer oxygen
  - b. Maintain the airway and, if necessary, perform intubation
  - c. Support respirations and consider administration of albuterol aerosols if necessary

3. Confirmed or suspected radioactive ingestions
  - a. Gastric emptying will not provide significant benefit
  - b. Do not administer ipecac
4. Inform personnel at the receiving facility of a confirmed or suspected radioactive inhalation and/or ingestion as bronchopulmonary lavage and/or urgent administration of chelating or blocking agents may be indicated to minimize tissue damage
5. Potassium iodide (KI) may protect the thyroid in the rare event where radioactive iodine is released. If deemed necessary, the public health agency with jurisdictional authority will direct the distribution and administration of potassium iodide to the appropriate patient and emergency responder populations

#### **Patient Safety Considerations**

1. Monitor patient dosimetry readings frequently
2. Monitor EMS provider dosimetry readings frequently
3. For persons with high levels of radiation or an increasing trend in dosimetry readings:
  - a. Remove from the scene
  - b. Perform decontamination
  - c. Move to a cold zone

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Sources of radiation
  - a. Legal
    - i. Industrial plants
    - ii. Healthcare facilities that provide radiologic services
    - iii. Nuclear power plants
    - iv. Mobile engineering sources (e.g. construction sites that are installing cement)
  - b. Illegal
    - i. Weapons of mass destruction
    - ii. “Dirty bomb” design to contaminate widespread areas
2. Physiology of Radiation Poisoning
  - a. Contamination – Poisoning from direct exposure to a radioactive source, contaminated debris, liquids, or clothing where radiation continues to be emitted from particles on surface
  - b. Exposure – Poisoning from radioactivity, in the form of ionizing rays, penetrating through the bodily tissues of the patient
3. Common types of radioactivity that cause poisoning
  - a. Gamma rays
    - i. Highest frequency of ionizing rays
    - ii. Penetrates the skin deeply
    - iii. Causes the most severe radiation toxicity
  - b. Beta rays
 

Can penetrate up to 1 cm of the skin’s thickness
  - c. Alpha rays
    - i. Lowest frequency of ionizing rays

- ii. Short range of absorption
  - iii. Dangerous only if ingested or inhaled
- d. Radioactive daughters
  - i. Products of decay of the original radioactive substance
  - ii. Can produce gamma and beta rays (e.g. uranium decays into a series of radon daughters)
- 4. In general, trauma patients who have been exposed to or contaminated by radiation should be triaged and treated on the basis of the severity of their conventional injuries
- 5. A patient who is contaminated with radioactive material (e.g. flecks of radioactive material embedded in their clothing and skin) generally poses a minimal exposure risk to medical personnel.

#### **Pertinent Assessment Findings**

1. Earliest symptoms
  - a. Tissues with rapid cell growth produce initial signs and symptoms
  - b. Gastrointestinal tract elicited as nausea and vomiting
2. Delayed symptoms (days to weeks after exposure or contamination)
  - a. Skin burns with direct contact with radioactive source
  - b. Skin burns or erythema from ionizing rays
  - c. Fever
  - d. Bone marrow suppression presenting as:
    - i. Immunosuppression
    - ii. Petechiae
    - iii. Spontaneous internal and external bleeding

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Proper decontamination methods
2. Proper management of contaminated objects and substances
3. Appropriate treatment of patient's signs and symptoms
4. Serial dosimetry readings

##### **Performance Measures**

1. Ability to acquire and distribute adequate numbers of dosimeters
2. Ability to acquire adequate assets and containers for decontamination
3. Mortality and morbidity rates of patients with early symptoms of radiation toxicity
4. Mortality and morbidity rates of patient with late symptoms of radiation toxicity
5. Established response plans to interface and coordinate with public health
6. Incidence of long-term sequelae in survivors
7. Incidence of long-term sequelae in EMS providers

#### **References**

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**Revision Date**

September 15, 2014



## Topical Chemical Burn

(No NEMSIS category)

### **Patient Care Goals**

1. Rapid recognition of a topical chemical burn
2. Initiation of emergent and appropriate intervention and patient transport

### **Patient Presentation**

#### **Inclusion Criteria**

Patients of all ages who have sustained exposure to a chemical that can cause a topical burn in a delayed clinical presentation

#### **Exclusion criteria**

None

### **Patient Management**

1. Don the appropriate protective personal equipment (PPE)
2. Remove the patient's clothing, if necessary
3. Contaminated clothing should preferably be placed in bags
4. If deemed necessary and manpower resources permit, the patient should be transported by EMS providers who did not participate in the decontamination process, and in an emergency response vehicle that has not been exposed to the chemical
5. Information regarding the chemical should be gathered while on scene
6. Communicate all data regarding the chemical to the receiving facility

### **Assessment**

1. Clinical effects and severity of a topical chemical burn is dependent upon:
  - a. Type of burn
  - b. Concentration of the chemical
  - c. pH of the chemical
  - d. Onset of burn
    - i. Immediate
    - ii. Delayed (e.g. hydrofluoric acid)
2. Calculate the estimated total body surface area that is involved
3. Prevent further contamination

### **Treatment and Interventions**

1. Carefully brush off solid chemical prior to flushing the site as the irrigating solution may activate a chemical reaction
2. Flush the patient's skin (and eyes, if involved) with copious amounts of water or normal saline
3. Provide adequate analgesia via the pain management protocol provided by EMS direct medical oversight
4. Consider the use of topical anesthetic eye drops (e.g. tetracaine) for chemical burns of the eye

5. Consider the use of a Morgan lens to facilitate continuous flushing of chemical burns of the eye
6. Take measures to minimize hypothermia
7. Initiate intravenous fluid resuscitation if necessary to obtain hemodynamic stability

### **Hydrofluoric acid**

Hydrofluoric acid (HF) is a highly corrosive substance that is primarily used for automotive cleaning products, rust removal, porcelain cleaners, etching glass, cleaning cement or brick, or as a pickling agent to remove impurities from various forms of steel. Patients who are initially exposed to low concentration of HF are pain-free. However, as HF penetrates and binds to the proteins in the skin, significant tissue damage and necrosis results hours after the initial exposure

For all patients in whom a hydrofluoric acid exposure is confirmed or suspected:

1. Vigorously irrigate all affected areas with water or normal saline
2. Apply a cardiac monitor for significant HF exposures as hypocalcemia may occur
3. Apply calcium preparation:
  - a. Calcium prevents tissue damage from hydrofluoric acid
  - b. Calcium gluconate is preferred over calcium chloride as it is less irritating
  - c. Topical calcium preparations:
    - i. Commercially manufactured calcium gluconate gel
    - ii. If commercially manufactured calcium gluconate gel is not available, a topical calcium gluconate gel preparation can be made by combining 25 ml of calcium gluconate 10% solution in 75-150 ml of a sterile water soluble gel (e.g. Surgilube® or KY® jelly)
    - iii. If calcium gluconate is not available, 10 ml of calcium chloride 10% solution in 75-150 ml in sterile water soluble gel (e.g. Surgilube® or KY® jelly)
    - iv. Apply generous amounts of calcium gluconate gel to the exposed skin sites to neutralize the cutaneous effects of the hydrofluoric acid and to prevent tissue damage and necrosis
    - v. If fingers are involved, apply the calcium gel to the hand, squirt additional calcium gel into a surgical glove, and then insert the affected hand into the glove.
    - vi. For patients who have sustained a significant exposure to hydrofluoric acid and are exhibiting clinically significant signs and symptoms of hypocalcemia, calcium chloride 10% solution should be administered intravenously

### **Patient safety considerations**

1. Don PPE
2. Take measures to prevent the patient from further contamination through decontamination
3. Take measures to protect the EMS provider and others from contamination
4. Do not attempt to neutralize an acid with an alkali or an alkali with an acid as a serious exothermic reaction will occur and cause serious harm to the patient
5. Expedient transport or transfer to a designated burn center should be considered for burns that involve a significant percentage of total body surface area or burns that involve the eyes, face, hands, feet or genitals

### **Key Considerations**

1. IV fluid resuscitation should be guided by patient age, percentage of body surface area involved in burn, body habitus and calculated by the Parkland Formula (see Appendix V)
2. Since the severity of topical chemical burns is largely dependent upon the type, concentration, and pH of the chemical involved as well as the body site and surface area involved, it is imperative to obtain as much information as possible while on scene about the chemical substance by which the patient was exposed. The information gathering process will often include:
  - a. Transport of the container of the chemical to the receiving facility
  - b. Transport of the original or a copy of the Material Safety Data Sheet (MSDS) of the substance to the receiving facility
  - c. Contacting the reference agency to identify the chemical agent and assist in management (e.g. CHEMTREC®)
3. Decontamination from chemicals with a low pH (acids) is more easily accomplished than chemicals with a high pH (alkalis) because alkalis tend to penetrate and bind to deeper tissues
4. Some chemicals will also manifest local and systemic signs, symptoms, and bodily damage

### **Pertinent Assessment Findings**

1. An estimate of the total body surface area that is involved
2. Patient response to therapeutic interventions
3. Patient response to fluid resuscitation
4. Patient response to analgesia

### **Quality Improvement**

#### **Key Documentation Elements**

1. Burn site
2. Body surface area involved
3. Identification of the chemical
4. Reported or measured pH of the chemical
5. Acquisition and transfer of MSDS, chemical container, or other pertinent substance information to the receiving the facility

#### **Performance Measures**

1. Overtriage/undertriage of patients to designated burn centers
2. Early recognition of a topical burn with appropriate treatment
3. Early recognition of hydrofluoric acid burns followed by expeditious initiation of treatment with calcium gluconate and/or calcium chloride
4. Measures taken to prevent further contamination

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**Revision Date**

September 15, 2014

## Stimulant Poisoning/Overdose

(No NEMSIS category)

### **Patient Care Goals**

1. Identify intoxicating agent
2. Protect organs at risk for injury such as heart, brain, liver, kidney
3. Determine if there is an antidote
4. Treat the symptoms which may include anxiety, hallucinations, chest pain, seizure, arrhythmia, excited delirium

### **Patient Presentation**

#### **Inclusion Criteria**

1. Cocaine
2. Amphetamines
3. Phencyclidine (PCP)
4. Derivatives
  - a. Ecstasy
  - b. Methamphetamine
  - c. Bath salts

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

Begin with the ABCDs:

1. Airway is patent
2. Breathing is oxygenating
3. Circulation is perfusing
4. Mental status is coherent
5. Treat any compromise of these parameters
6. Ask about chest pain and difficulty breathing

#### **Assessment**

1. Vital signs including temperature
2. Apply a cardiac monitor and examine rhythm strip for arrhythmias
3. Check blood glucose level
4. Monitor ETCO<sub>2</sub> for respiratory decompensation
5. Check for trauma, self-inflicted injury
6. Law enforcement should have checked for weapons and drugs, but you may decide to repeat the inspection

#### **Treatment and Interventions**

1. Need IV access for any fluids and meds
2. Give fluids for poor perfusion; cool fluids for hyperthermia (see **Shock** and **Hyperthermia/Heat Exposure** guidelines)
3. Treat chest pain as ACS and follow STEMI protocol if there is EKG is consistent with STEMI

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4. Consider treating shortness of breath as atypical ACS; apply oxygen per **Universal Care** guideline to maintain oxygen saturation  $\geq 94\%$
5. Consider soft restraints especially if law enforcement has been involved in getting patient to cooperate (see **Agitated or Violent Patient/Behavioral Emergency** guideline)
6. Consider medications to reduce stimulation and anxiety, and to improve behavior and compliance. (See **Agitated or Violent Patient/Behavioral Emergency** guideline). If haloperidol or droperidol is used, monitor 12-lead for QT-interval if feasible
7. Consider prophylactic use of anti-emetic: ondansetron. Do not use promethazine if haloperidol or droperidol are to be or have been given
8. As a last resort consider diphenhydramine to induce drowsiness
9. If hyperthermia suspected, begin external cooling

#### **Patient Safety Considerations**

1. Apply soft restraints if necessary
2. Explain to the patient that his/her safety and the safety of all of the ambulance occupants is a priority during transport
3. Administer medications for chemical restraint when violence or threatening behavior is present or imminent

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. If law enforcement has placed the patient in handcuffs, this patient needs ongoing physical restraint for safe transport. Have law enforcement in back of ambulance for the handcuffed patient or make sure proper physical restraints are in place before law enforcement leaves and ambulance departs from scene
2. If patient has signs and symptoms of ACS, strive to give nitroglycerin SL q 3-5 minutes as long as SBP  $> 100$  and until pain resolves (if range not desired, use q 3 minutes). Vasospasm is often the problem in this case as opposed to a fixed coronary artery lesion
3. Maintaining IV access, cardiac monitor, and SPO<sub>2</sub>/ETCO<sub>2</sub> monitors are key to being able to catch and intervene decompensations in a timely manner. Restrain the patient to facilitate patient assessment and lessen likelihood of vascular access or monitor displacements

##### **Pertinent Assessment Findings**

1. History is as important as the physical examination
2. If the patient is on psychiatric medication, but has failed to be compliant, this fact alone puts the patient at higher risk for excited delirium
3. If the patient is found naked, this may elevate the suspicion for stimulant use or abuse and increase the risk for excited delirium
4. If polypharmacy is suspected, hypertension and tachycardia are expected hemodynamic findings secondary to increased dopamine release. Stimulus reduction from benzodiazepines, anti-psychotics, and ketamine will improve patient's vital signs and behavior
5. Be prepared for the potential of cardiovascular collapse as well as respiratory arrest
6. If a vasopressor is needed, epinephrine or norepinephrine is recommended over dopamine

## **Quality Improvement**

### **Key Documentation Elements**

1. Reason for restraints and neurologic/circulatory exams with restraint use
2. Reason for medications selected
3. Documentation of QT interval when haloperidol or droperidol is used and result conveyed to ED staff

### **Performance Measures**

1. Recognition of need for monitoring cardiovascular and respiratory status of patient with stimulant toxicity
2. ACS evaluation and treatment considered for chest pain and shortness of breath
3. Respiratory compromise quickly recognized and treated
4. Cardiovascular compromise quickly recognized and treated
5. Patient and medics did not suffer any harm
6. Access and monitoring were not lost during transport

### **References**

1. ACEP September 10, 2009 White Paper Report on Excited Delirium Syndrome
2. Warrick B. A nine state analysis of designer stimulant, "Bath Salt," hospital visits reported to poison control centers. *Ann Emerg Med*, 2013 62; 244-251

### **Revision Date**

September 15, 2014

## Cyanide Exposure

(9914043 – Cyanide)

### **Patient Care Goals**

1. Remove patient from toxic environment
2. Assure adequate ventilation, oxygenation and correction of hypoperfusion

### **Patient Presentation**

Cyanide is a colorless, “bitter almond smell” (genetically only 40% of population can smell) gas or white crystal which attaches to tissues at the cellular mitochondria (cytochrome oxidase) level, thus preventing the use of oxygen, leading to cellular hypoxia

### **Inclusion Criteria**

Depending on its form, cyanide can enter the body through inhalation, ingestion, or absorption through the skin. Cyanide should be suspected in occupational or smoke exposures (i.e. firefighting), industrial accidents, natural catastrophes, suicide and murder attempts, chemical warfare and terrorism (whenever there are multiple casualties of an unclear etiology). Non-specific and early signs of cyanide exposure (inhalation, ingestion, or absorption) include the following signs and symptoms: anxiety, vertigo, weakness, headache, tachypnea, nausea, dyspnea, vomiting, and tachycardia

High concentrations of cyanide will produce:

1. Markedly altered level of consciousness
2. Seizure
3. Respiratory depression or respiratory arrest
4. Cardiac dysrhythmia (other than sinus tachycardia)

The rapidity of onset is related to the severity of exposure (inhalation or ingestion) and may have dramatic, immediate effects causing early hypertension with subsequent hypotension, sudden cardiovascular collapse or seizure/coma

### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose and then cover the patient to assure retention of body heat
3. Vital signs which include temperature
4. Put on cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
5. Check blood glucose Level
6. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation.
7. Identify specific agent taken, time of ingestion/ inhalation, and quantity
8. Pertinent cardiovascular history or other prescribed medications for underlying disease



9. Patient pertinent history
10. Patient physical exam

### **Treatment and Interventions**

There is no widely available, rapid, confirmatory cyanide blood test. Treatment decisions must be made on the basis of clinical history and signs and symptoms of cyanide intoxication. For the patient with an appropriate history and manifesting one or more of high concentrations of cyanide signs or symptoms, treat with:

1. 100% oxygen via non-rebreather mask or bag valve mask
2. Hydroxocobalamin
  - a. Collect a pre-treatment blood sample in the appropriate tube for lactate and cyanide levels
  - b. Adult: Administer hydroxocobalamin. Initial dose is 5 gm administered over 15 minutes slow IV. Each 5 gm vial of hydroxocobalamin for injection is to be reconstituted with 200 ml of LR (25 mg/ ml) and administered at 10 - 15 ml/minute. An additional 5 gm dose may be administered with medical consultation
  - c. Pediatric: Administer hydroxocobalamin 70 mg/kg (reconstitute concentration is 25 mg/ml). Each 5 gm vial of hydroxocobalamin for injection is to be reconstituted with 200 ml of LR (25 mg/ml) and administered at 10 - 15 ml/minute. Maximum single dose is 5 gm
3. Amyl nitrite inhaled ampule (do not use in conjunction with carbon monoxide poisoning)
  - a. Adult only: one ampule (0.3mL) inhaled
4. Sodium nitrite (do not use in conjunction with carbon monoxide poisoning)
  - a. Adult: 300 mg (10 ml of 3%) IV over two to four minutes
  - b. Pediatric: 6 mg/kg (0.2 ml/kg of 3%) [This dosing strategy has been established as safe in children with a hemoglobin concentration of  $\geq 7$  g/dl]
5. Sodium thiosulfate
  - a. Adult: 12.5 gm IV (50 ml of 25% solution)
  - b. Pediatric: 0.5 gm/kg IV (2 ml/kg of 25% solution)
6. If seizure, consider midazolam (benzodiazepine of choice)
  - a. Adult : 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)
  - b. Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg or 0.2 mg/kg IN to max dose of 4 mg

### **Patient Safety Considerations**

1. In the event of multiple casualties, be sure to wear appropriate PPE during rescue evacuation from the toxic environment
2. If patient has ingested cyanide liquid or crystals, the cyanide will react with the stomach acids to generate hydrogen cyanide gas which may be released into provider breathing air with belching, vomiting or gastric lavage
3. Do not use nitrites in conjunction with suspected carbon monoxide poisoning as it worsens the hemoglobin oxygen carrying capacity even more than CO)
4. Hydroxocobalamin is only agent safe for treatment of cyanide poison in pregnant patient

## **Notes/Educational Pearls**

### **Key Considerations**

1. Pulse oximetry accurately reflects serum levels of oxygen but does not accurately reflect tissue oxygen levels therefore should not be relied upon
2. After hydroxocobalamin has been administered, pulse oximetry levels are no longer accurate
3. If the patient has taken an oral ingestion of cyanide salt, the cyanide salt will react to the acids in the stomach generating hydrogen cyanide. Be sure to maximize air circulation in closed space (back compartment of ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching

### **Pertinent Assessment Findings**

Early and repeated assessment is essential

## **Quality Improvement**

### **Key documentation elements**

1. Repeat evaluation and documentation of signs and symptoms as patient clinical conditions may deteriorate rapidly
2. Identification of possible etiology of poisoning
3. Time of symptoms onset and time of initiation of exposure-specific treatments
4. Therapy and response to therapy

### **Performance measures**

1. Early airway management in the rapidly deteriorating patient
2. Accurate exposure history
  - a. Time of ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
3. Appropriate protocol selection and management
4. Multiple frequent documented reassessments

## **References**

1. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8<sup>th</sup> edition, McGraw-Hill, 2006 1689-1691
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4. Shepherd G, Velez LI. Role of hydroxocobalamin in acute cyanide poisoning. *Ann Pharmacotherapy*, 2008 42(5): 661-9
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**Revision Date**

September 15, 2014

## Beta Blocker Poisoning/Overdose

(No NEMSIS category)

### **Patient Care Goals**

1. Reduce GI absorption of oral agents with some form of binding
2. Assure adequate ventilation, oxygenation and correction of hypoperfusion

### **Patient Presentation**

Beta blocker or beta adrenergic antagonist medication to reduce the effects of epinephrine/adrenaline

### **Inclusion Criteria**

Patients present with:

1. Bradycardia
2. Hypotension
3. Lethargy
4. Weakness
5. Shortness of breath
6. Possible seizures

### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Assess ABCDs and if indicated expose and then cover to assure retention of body heat
2. Vital signs which include temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose level
5. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
6. Identify specific medication taken (noting immediate release vs. sustained release formulations), time of ingestion, and quantity
7. Pertinent cardiovascular history or other prescribed medications for underlying disease
8. Patient pertinent history
9. Patient physical

#### **Treatment and Interventions**

1. Consider activated charcoal without sorbitol (1 gm/kg) PO. If risk of rapid decreasing mental status, do not administer oral agent without adequately protecting the airway
2. Perform blood glucose determination on all patients but especially on pediatric patients as beta blockers can cause hypoglycemia in pediatric population
3. Consider atropine sulfate for symptomatic bradycardia
  - a. Adult: 1 mg IV q 5 minutes to max of 3 mg

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- b. Pediatric: 0.02 mg/kg (0.5 mg max) q 5 minutes, max total dose 1 mg
- 4. Consider fluid challenge (20 ml/kg) for hypotension with associated bradycardia
- 5. Consider glucagon for symptomatic patient
  - a. Adult: 1 mg every 5 minutes IVP (may require 6 mg to see clinical effects)
  - b. Pediatric:
    - i. 1 mg IVP (25-40 kg); every 5 minutes as necessary
    - ii. 0.5 mg IVP (less than 25 kg); every 5 minutes as necessary
- 6. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient
  - a. Norepinephrine (start 2 mcg/minute and titrate)
  - b. Dopamine (start 2 mcg/kg/minute and titrate)
- 7. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
- 8. If seizure, consider midazolam (benzodiazepine of choice)
  - a. Adult : 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)
  - b. Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg or 0.2 mg/kg IN to max dose of 4 mg

#### **Patient Safety Considerations**

- 1. Ipecac is contraindicated
- 2. Transcutaneous pacing may not always capture nor correct hypotension when capture is successful

#### **Notes/Educational Pearls**

##### **Key Considerations**

- 1. Pediatric patient may develop hypoglycemia from beta blocker overdose therefore it is important to perform glucose evaluation
- 2. Glucagon has a side effect of increased vomiting
- 3. Atropine may have little or no effect (likely to be more helpful in mild overdoses)

##### **Pertinent Assessment Findings**

- 1. Certain beta blockers, such as acebutolol and propranolol may increase QRS duration
- 2. Certain beta blockers such as acebutolol and pindolol may produce tachycardia and hypertension
- 3. Sotalol can produce increase in QTc interval and ventricular dysrhythmia
- 4. Frequent reassessment is essential as patient deterioration can be rapid and catastrophic

#### **Quality Improvement**

##### **Key documentation elements**

- 1. Repeat evaluation and documentation of signs and symptoms and vital signs as patient clinical conditions may deteriorate rapidly
- 2. Identification of possible etiology of poisoning
- 3. Time of symptoms onset and time of initiation of exposure-specific treatment
- 4. Therapy and response to therapy

### **Performance Measures**

1. Early airway management in the rapidly deteriorating patient
2. Accurate exposure history
  - a. Time of ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
3. Appropriate protocol selection and management
4. Multiple frequent documented re-assessments
5. Blood glucose checks (serial if long transport, especially in children)
6. Good evaluation of the EKG and the segment intervals

### **References**

1. Wax PM. b-Blocker ingestion: An evidence-based consensus guideline for out-of-hospital management, *Clinical Toxicology*, 2005 43: 131–146 ISSN: 0731-3810 print/1097-9875 online doi: 10.1081/CLT-200062475
2. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8<sup>th</sup> edition, McGraw-Hill 2006 902, 903
3. Kerns W II. Management of b-adrenergic blocker and calcium channel antagonist toxicity, *Emerg Med Clin N Am*, 25 (2007) 309–331
4. Hephherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm*, 2006 Oct 1; 63(19): 1828-35
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6. Boyd R, Ghosh A. Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. Glucagon for the treatment of symptomatic beta blocker overdose. *Emerg Med J*, 2003 May; 20(3):266-7
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### **Revision Date**

September 15, 2014

## Bites and Envenomation

(9914079 – Bites and Envenomation – Land; 9914081 – Bites and Envenomation – Marine)

### **Patient Care Goals**

Bites, stings, and envenomations can come from a variety of insects, marine and terrestrial animals. There is a spectrum of toxins or envenomations with very limited EMS interventions.

1. Assure adequate ventilation, oxygenation and correction of hypoperfusion
2. Pain control which also includes limited external interventions to reduce pain

### **Patient Presentation**

#### **Inclusion Criteria**

Bites, stings, and envenomations can come from a variety of marine and terrestrial animals and insects causing local or systemic effects. Patients may present with toxin specific reactions which may include:

1. Site pain
2. Swelling
3. Erythema
4. Discoloration
5. Bleeding
6. Nausea
7. Abdominal pain
8. Hypotension
9. Tachycardia
10. Tachypnea
11. Muscle incoordination
12. Confusion
13. Anaphylaxis/allergic reactions

There is a spectrum of toxins or envenomations and limited EMS interventions that will have any mitigating effect on the patient in the field. The critical intervention is to get the patient to a hospital that has access to the antivenin if applicable.

#### **Exclusion Criteria**

None

### **Patient Management**

#### **Assessment**

1. Assess ABCDs and if indicated expose and then cover to assure retention of body heat
2. Vital signs which include temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose Level
5. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
6. Patient pertinent history

## 7. Patient physical

### **Treatment and Interventions**

1. Consider an IV fluid bolus (normal saline or Ringers Lactate) 20 ml /kg up to 2 liters
2. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient
  - a. Dopamine (start 2 mcg/kg/minute and titrate)
  - b. Norepinephrine (start 2 mcg/minute and titrate)
3. If seizure, see **Seizures** guideline
4. Specific therapy for select bites, stings, or envenomation
  - a. Envenomations that are known to have antivenin or antitoxin: e.g. black widow spider, certain scorpions, octopi, fanged snakes and lizards. For these envenomations, consider transport to hospital that has access to antivenin if feasible
  - b. Jellyfish (Cnidarians): Scrape off any remaining tentacles or nematocysts, then immerse affected body part in hot water (113 °F/45 °C) or, for non-USA jellyfish, use vinegar (acetic acid) to reduce pain due to deactivation of the nematocysts
  - c. Lionfish, scorpionfish, stingray: Immerse affected body part in hot water to reduce the pain associated with the toxin

### **Patient Safety Considerations**

1. Do not perform any of the following:
  - a. Tourniquets, tight Ace/crepe bandage, or constricting bands above or below the site of the envenomation
  - b. Incision and/or suction
  - c. Application of cold packs (cryotherapy)
2. EMS providers should not try to capture the offending marine or terrestrial animal or insect
3. If the offending organism has been killed, beware that many dead insect, marine or fanged animals can continue to bite or sting with venom and should be safely placed in a hard sided and closed container for future identification
4. Patient may still have an imbedded stinger, tooth, nematocyst or barb which may continue to deliver toxin if left imbedded. Consider safe removal without squeezing the toxin delivery apparatus

### **Notes/Educational Pearls**

#### **Key Considerations**

Vinegar (acetic acid) has potential to increase pain associated jelly fish as it can increase nematocysts discharge. Use of vinegar should be avoided within the United States

#### **Pertinent Assessment Findings**

1. Assess for signs and symptoms of local and systematic impact of the suspected toxin
2. Patient may still have an imbedded stinger, tooth, nematocysts or barb which may continue to deliver toxin if left imbedded

### **Quality Improvement**

#### **Key Documentation Elements**

1. It is helpful to accurately describe the suspect bite or sting source without risking patient or EMS provider
2. Only transport source animal or insect if can be done safely in a hard sided container



3. Repeat evaluation and documentation of signs and symptoms as patient clinical conditions may deteriorate rapidly
4. Time of symptoms onset and time of initiation of exposure-specific treatments
5. Therapy and response to therapy

#### **Performance Measures**

1. Offending organism was managed appropriately without secondary exposure
2. Appropriate and timely definitive treatment was provided

#### **References**

1. American College of Medical Toxicology; American Academy of Clinical Toxicology; American Association of Poison Control Centers; European Association of Poison Control Centres and Clinical Toxicologists; International Society on Toxinology; Asia Pacific Association of Medical Toxicology. Pressure immobilization after North American Crotalinae snake envenomation. *Clin Toxicol*, (Phila). 2011 Dec; 49(10): 881-2
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3. Prestwich H, Jenner R. Best evidence topic report. Treatment of jellyfish stings in UK coastal waters: vinegar or sodium bicarbonate? *Emerg Med J*, 2007 Sep 24(9): 664
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#### **Revision Date**

September 15, 2014

## Calcium Channel Blocker Poisoning/Overdose

(No NEMSIS category)

### **Patient Care Goals**

1. Reduce GI absorption of oral agents with some form of binding agent (activated charcoal) especially for extended release
2. Early airway protection is required as patients may have rapid mental status deterioration
3. Assure adequate ventilation, oxygenation and correction of hypoperfusion

### **Patient Presentation**

Calcium channel blocker medication interrupts the movement of calcium across cell membranes. Calcium channel blockers are used to manage hypertension, certain rate-related arrhythmias, prevent cerebral vasospasm, and angina pectoris

### **Inclusion Criteria**

Patients present with:

1. Bradycardia
2. Hypotension
3. Decreased AV Nodal conduction
4. Cardiogenic shock

### **Exclusion criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Assess ABCDs and, if indicated, expose and then cover to assure retention of body heat
2. Vital signs including temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose Level
5. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
6. Identify specific medication taken (noting immediate release vs. sustained release formulations), time of ingestion, and quantity
7. Pertinent cardiovascular history or other prescribed medications for underlying disease
8. Patient pertinent history
9. Patient physical

#### **Treatment and Interventions**

1. Consider activated charcoal without sorbitol (1 gm/kg) PO. If risk of rapid decreasing mental status, do not administer oral agent without adequately protecting the airway
2. Consider atropine sulfate for symptomatic bradycardia
  - a. Adult: 1 mg IV q 5 minutes to max of 3 mg
  - b. Pediatric: 0.02 mg/kg (0.5 mg max) q 5 minutes, max total dose 1 mg
3. Consider calcium chloride or calcium gluconate

- a. Calcium Chloride
  - i. Adult: 0.5 - 1 gm slow IVP (50 mg/minute)
  - ii. Pediatric: 20 mg/kg (0.2 ml/kg) slow IVP/IO (50 mg/ml) Maximum dose 1 gm or 10 ml
- b. Calcium gluconate
  - i. Adult: 2-6 gm slow IVP over 10 minutes
  - ii. Pediatric: 60 mg/kg IV over 10 minutes
4. Consider glucagon for symptomatic bradycardia patient
  - a. Adult: 1 mg every 5 minutes IVP (may require 5-15 mg to see effect)
  - b. Pediatric:
    - i. 1 mg IVP (25-40 kg); every 5 minutes as necessary
    - ii. 0.5 mg IVP (less than 25 kg); every 5 minutes as necessary
5. Consider IV fluid bolus (normal saline or Ringers Lactate) 20 ml /kg up to 2 liters
6. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient
  - a. Norepinephrine (start 2 mcg/minute and titrate)
  1. Dopamine (start 2 mcg/kg/minute and titrate)
7. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
8. If seizure, consider midazolam (benzodiazepine of choice)
  - a. Adult : 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)
  - b. Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg or 0.2 mg/kg IN to max dose of 4 mg

#### **Patient Safety Considerations**

1. Ipecac is contraindicated
2. Transcutaneous pacing may not always capture nor correct hypotension when capture is successful

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Certain calcium channel blockers generate a variety of dysrhythmias. Especially concerning are:
  - a. Bradycardia
  - b. Torsade de pointes
2. The avoidance of administering calcium chloride or calcium gluconate to a patient on cardiac glycosides (e.g. digoxin) as this may precipitate toxicity and associate fatal arrhythmias is felt to be a historical belief and not supported
3. Glucagon has a side effect of increased vomiting

##### **Pertinent Assessment Findings**

1. Close monitoring of EKG changes and dysrhythmias
2. Serial frequent assessments are essential as these patient often have rapid deterioration with profound hypotension

## **Quality Improvement**

### **Key Documentation Elements**

1. Repeat evaluation and documentation of signs and symptoms as patient clinical conditions may deteriorate rapidly
2. Identification of possible etiology of poisoning
3. Time of symptoms onset and time of initiation of exposure-specific treatments
4. Therapy and response to therapy

### **Performance Measures**

1. Early airway management in the rapidly deteriorating patient
2. Accurate exposure history
  - a. Time ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
3. Appropriate protocol selection and management
4. Multiple frequent documented reassessments

## **References**

1. Shepherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm*. 2006 Oct 1; 63(19): 1828-35. Review. Erratum in: *Am J Health Syst Pharm*, 2008 Sep 1; 65(17): 1592
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## **Revision Date**

September 15, 2014

## Carbon Monoxide/Smoke Inhalation

(9914039 – Carbon Monoxide/Smoke Inhalation)

### **Patient Care Goals**

1. Remove patient from toxic environment
2. Assure adequate ventilation, oxygenation and correction of hypoperfusion

### **Patient Presentation**

Carbon monoxide is a colorless, odorless gas which has a high affinity for binding to red cell hemoglobin thus preventing the binding of oxygen to the hemoglobin leading to hypoxia. A significant reduction in oxygen delivery to tissues and organs occurs with carbon monoxide poisoning. With any form of combustion [fire/smoke (e.g. propane or charcoal stoves or heaters), combustion engines (e.g. generators, lawn mowers, motor vehicles, home heating systems)], carbon monoxide will be generated

### **Inclusion Criteria**

Patients exposed to carbon monoxide source may present with a spectrum of symptoms:

1. Mild intoxication:
  - a. Nausea
  - b. Fatigue
  - c. Headache
  - d. Vertigo
  - e. Lightheadedness
2. Moderate to severe:
  - a. Altered mental status
  - b. Tachypnea
  - c. Tachycardia
  - d. Convulsion
  - e. Cardiopulmonary arrest

### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose and then cover to assure retention of body heat
3. Vital signs which include temperature
4. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
5. Check blood glucose level
6. Monitor pulse oximetry and ET $\text{CO}_2$  for respiratory decompensation
7. Patient pertinent history
8. Patient physical

### **Treatment and Interventions**

1. 100% oxygen via non-rebreather mask or bag valve mask
2. If seizure, see **Seizures** guideline
3. Consider transporting patients with severe carbon monoxide poisoning directly to a facility with hyperbaric oxygen capabilities if feasible

### **Patient Safety Considerations**

1. Consider affixing a carbon monoxide detector to an equipment bag that is routinely taken into scene (if it signals alarm, don appropriate respiratory protection)
2. Remove patient and response personnel from potentially hazardous environment as soon as possible
3. Provide instruction to the patient, the patient's family, and other appropriate bystanders to not enter the environment (e.g. building, car) where the carbon monoxide exposure occurred until the source of the poisoning has been eliminated
4. Do not look for cherry red skin coloration as an indication of carbon monoxide poisoning as this is usually a morgue finding
5. CO oximeter devices may yield inaccurate low/normal results for patients with CO poisoning. All patients with probable or suspected CO poisoning should be transported to the nearest appropriate hospital, based on their presenting signs and symptoms

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Pulse oximetry is inaccurate due to the carbon monoxide binding with hemoglobin
2. As maternal carboxyhemoglobin levels do not accurately reflect fetal carboxyhemoglobin levels, pregnant patients are more likely to be treated with hyperbaric oxygen
3. A patient light wavelength analysis device to detect carboxyhemoglobin is useful to indicate if there is a carbon monoxide exposure in a non-arrested patient. Do not anticipate an immediate change in readings with oxygen administration

#### **Pertinent Assessment Findings**

1. Early and repeat assessment of patient's mental status and motor function are extremely useful in determining response to therapy and the need for hyperbaric therapy
2. Identification of possible etiology of poisoning
3. Time of symptoms onset and time of initiation of exposure-specific treatment
4. Therapy and response to therapy

### **Quality Improvement**

#### **Key Documentation Elements**

1. If using an environmental carbon monoxide detector, record the level detected
2. Evidence of soot or burns around the face, nares or pharynx
3. Early and repeat assessment of patient's mental status and motor function are extremely useful in determining response to therapy and the need for hyperbaric therapy
4. Accurate exposure history
  - a. Time of ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible mediations or agents)
  - d. Alcohol or other intoxicant taken

5. Signs and symptoms of other patients encountered at same location, if present

#### **Performance Measures**

1. Early airway management in the rapidly deteriorating patient
2. Accurate exposure history
  - a. Time of ingestion/exposure
  - b. Route of exposure
  - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - d. Alcohol or other intoxicant taken
3. Appropriate protocol selection and management
4. Multiple frequent documented reassessments

#### **References**

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#### **Revision Date:**

September 15, 2014

## Opioid Poisoning/Overdose

(No NEMSIS category)

### **Patient Care Goals**

1. Rapid recognition and intervention of a clinically significant opioid poisoning or overdose
2. Prevention of respiratory and/or cardiac arrest

### **Patient Presentation**

#### **Inclusion Criteria**

Patients of all age groups with access to opioids and known or suspected opioid use or abuse

#### **Exclusion Criteria:**

Patients with altered mental status exclusively from other causes (e.g. head injury, hypoxia, or hypoglycemia)

### **Patient Management**

1. Don the appropriate personal protective equipment (PPE)
2. Therapeutic interventions to support the patient's airway, breathing, and circulation should be initiated prior to the administration of naloxone
3. Identify specific medication taken (including immediate release vs sustained release) if possible, time of ingestion, and quantity
4. Obtain and document pertinent cardiovascular history or other prescribed medications for underlying disease
5. Be aware that unsecured hypodermic needles may be on scene if the intravenous route may have been used by the patient, and that there is a higher risk of needle sticks during the management of this patient population which may also have an increased incidence of blood-borne pathogens
6. Naloxone, an opioid antagonist, should be considered for administration to patients with a confirmed or suspected opioid overdose, especially those that are exhibiting respiratory depression
7. Naloxone administration via the intranasal or intramuscular routes or as a nebulized solution provide additional options of medication delivery

### **Assessment**

1. Assess the patient's airway, breathing, circulation, and mental status
2. Support the patient's airway by positioning, oxygen administration, and ventilator assistance with a bag valve mask if necessary
3. Assess the patient for other etiologies of altered mental status including hypoxia, hypoglycemia, hypotension, and traumatic head injury

### **Treatments and Interventions**

1. Critical resuscitation (opening and/or maintaining the airway, provision of oxygen, ensuring adequate circulation) should be performed prior to naloxone administration



2. If the patient is symptomatic from a confirmed or suspected opioid overdose, consider naloxone administration. The administration of the initial dose or subsequent doses can be incrementally titrated until respiratory depression is reversed
3. Naloxone can be administered via the IV, IM, IN, or ETT routes with the typical initial adult dose ranging between 0.4-2 mg
  - a. For the intranasal route, divide administration of the dose equally between the nostrils to a maximum of 1 ml per nostril
  - b. The intranasal administration can also be titrated until adequate respiratory effort is achieved.
  - c. The pediatric dose of naloxone is 0.1 mg/kg IV, IM, IN, or ETT with a maximum dose of 2 mg
  - d. Naloxone auto-injectors contain 0.4 mg. The cartons of naloxone prescribed to laypersons contain two naloxone 0.4 mg auto-injectors and one trainer

#### **Patient Safety Considerations**

1. Clinical duration of naloxone
  - a. The clinical opioid reversal effect of naloxone is limited and may end within an hour whereas opioids often have a duration of 4 hours or longer
  - b. Monitor the patient for recurrent respiratory depression and decreased mental status
2. Opioid withdrawal
  - a. Patients with altered mental status secondary to an opioid overdose may become agitated or violent following naloxone administration due to opioid withdrawal
  - b. Be prepared for this potential scenario and take the appropriate measures in advance to ensure and maintain scene safety
3. EMS providers should be prepared to initiate airway management before, during, and after naloxone administration and to provide appropriate airway support until the patient has adequate respiratory effort

#### **Notes /Educational Pearls:**

##### **Key Considerations**

1. The essential feature of opioid overdose requiring EMS intervention is respiratory depression or apnea
2. Overuse and abuse of prescribed and illegal opioids has led to an increase in accidental and intentional opioid overdoses
3. DEA and opioids:
  - a. Opioids, most of which are controlled under the Drug Enforcement Administration (DEA), have a high potential for abuse, but have an accepted medical use in patient treatment and can be prescribed by a physician
  - b. Frequent legally prescribed opioids include codeine, fentanyl, hydrocodone, morphine, hydromorphone, methadone, morphine, oxycodone, and oxymorphone
  - c. Opioid derivatives, such as heroin, are illegal in the United States
4. Opioid combinations:
  - a. Some opioids are manufactured as a combination of analgesics with acetaminophen, acetylsalicylic acid (aspirin), or other substances
  - b. In the scenario of an overdose, there is a potential for multiple drug toxicities
  - c. Examples of opioid combination analgesics:

- i. Vicodin® is a combination of acetaminophen and hydrocodone
  - ii. Percocet® is a combination of acetaminophen and oxycodone
  - iii. Percodan® is a combination of aspirin and oxycodone
  - iv. Suboxone® is a combination of buprenorphine and naloxone
5. The IN route has the benefit of no risk of needle stick to the provider

#### **Pertinent Assessment Findings**

1. The primary clinical indication for the use of opioid medications is analgesia
2. In the opioid overdose scenario, signs and symptoms include:
  - a. Miosis (pinpoint pupils)
  - b. Decreased intestinal motility
  - c. Respiratory depression
  - d. Decreased mental status
3. Additional assessment precautions:
  - a. The risk of respiratory arrest with subsequent cardiac arrest from an opioid overdose as well as hypoxia, hypercarbia, and aspiration may be increased when other substances such as alcohol, benzodiazepines, or other medications have also been taken by the patient
  - b. The signs and symptoms of an opioid overdose may also be seen in newborns who have been delivered from a mother with recent or chronic opioid use. Neonates who have been administered naloxone for respiratory depression due to presumed intrauterine opioid exposure should be monitored closely for seizures

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Rapid and accurate identification of signs and symptoms of opioid poisoning
2. Pulse oximetry (oxygen saturation) and, if available, capnography
3. Blood glucose
4. Naloxone dose and route of administration
5. Clinical response to medication administration

##### **Performance Measures**

1. Clinical improvement after prehospital administration of naloxone
2. Frequency of patients who develop adverse effects or complications (recurrent respiratory depression or decreased mental status, aspiration pneumonia or pulmonary edema)
3. Number of patients who refuse transport following naloxone administration

#### **References**

1. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 2047-2048, 2050
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3. United States Department of Justice, Drug Enforcement Administration, United States Code Controlled Substance Act, Title 21, Section 812

#### **Revision Date:**

September 15, 2014

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## Hyperthermia/Heat Exposure

(9914027 – Heat Exposure/Heat Exhaustion; 9914029 – Heat Exposure/Heat Stroke)

### Definitions:

1. **Heat cramps** are minor muscle cramps usually in the legs and abdominal wall. Temperature is normal
2. **Heat exhaustion** has both salt and water depletion usually of a gradual onset. As it progresses tachycardia, hypotension, elevated temperature, and very painful cramps occur. Symptoms of headache, nausea and vomiting occur. Heat exhaustion can progress to heat stroke
3. **Heat stroke** occurs when the cooling mechanism of the body (sweating) ceases due to temperature overload and/or electrolyte imbalances. Temperature is usually > 104 F. When no thermometer is available, it is distinguished from heat exhaustion by altered level of consciousness

### Patient Care Goals

1. Cooling and rehydration
2. Mitigate high risk for decompensation
3. Mitigate high risk for agitation and uncooperative behavior

### Patient Presentation

#### Inclusion Criteria

1. Heat cramps
2. Heat exhaustion
3. Heat stroke
4. Stimulant drug abuse
5. Excited delirium (see also **Agitated or Violent Patient/Behavioral Emergency** guideline)

#### Exclusion Criteria

1. Fever from infectious or inflammatory conditions
2. Malignant hyperthermia
3. Neuroleptic malignant syndrome

### Patient Management

#### Assessment

1. Patient assessment:
  - a. Age
  - b. Oral intake
  - c. Medications
  - d. Alcohol
  - e. Illicit drugs
  - f. Overdose
  - g. Withdrawal risk
2. Environmental assessment:
  - a. Ambient temperature and humidity

- b. Exertion level
  - c. Length of time at risk
  - d. Attire (clothing worn)
  - e. Children left in cars with evidence of altered mental status and elevated body temperature are likely suffering from hyperthermia
- 3. Associated symptoms:
  - a. Cramps
  - b. Headache
  - c. Orthostatic symptoms
  - d. Nausea
  - e. Weakness
- 4. Vital signs:
 

Temperature: usually 104 degrees Fahrenheit or greater (if thermometer available)
- 5. Mental status:
  - a. Confusion
  - b. Coma
  - c. Seizures
  - d. Psychosis
- 6. Skin:
  - a. Flushed and hot
  - b. Dry or sweaty
  - c. Signs of first or second degree burns from sun exposure
- 7. Other signs of poor perfusion/shock

#### **Treatment and Interventions**

- 1. Move victim to a cool area and shield from the sun or any external heat source
- 2. Remove as much clothing as is practical and loosen any restrictive garments
- 3. If alert and oriented, give small sips of cool liquids
- 4. If altered mental status, check blood glucose level
- 5. Maintain airway vigilance for emesis, seizure
- 6. Place on cardiac monitor and record ongoing vital signs and level of consciousness
- 7. If temperature is > 104 degrees F (40 degrees C) or if altered mental status is present, begin active cooling by:
  - a. Continually misting the exposed skin with tepid water while fanning the victim (most effective)
  - b. Truncal ice packs may be used, but are less effective than evaporation
  - c. Shivering should be treated as soon as possible
  - d. Ice bath immersion provides the most rapid cooling mechanism but may not be available to EMS
- 8. Establish IV access for heat stroke
- 9. Give cool fluids at 20 ml/kg boluses and reduce to 10 ml/kg/hr boluses when vitals are stable
- 10. Monitor for shivering and seizures; treat as below
- 11. Adult:
 

Consider 500 ml normal saline IV fluid bolus for dehydration even if vital signs are normal

If uncontrolled shivering occurs during cooling:

  - a. Midazolam 2.5mg IV/IN, may repeat once in 5 minutes or; 5mg IM may repeat once in 10 minutes

- b. Lorazepam 1mg IV, may repeat once in 5 minutes or; 2mg IM, may repeat once in 10 minutes
  - c. Diazepam 2mg IV, may repeat once in 5 minutes
- 12. Pediatric:
  - Consider 10 – 20ml/kg normal saline IV fluid bolus for dehydration even if vital signs are normal
  - If uncontrolled shivering occurs during cooling:
    - a. Midazolam 0.1mg/kg IV or 0.2mg/kg IN/IM (single maximum dose 1mg); Note: a 5mg/ml concentration is recommended for IN/IM administration)
    - b. Lorazepam 0.1mg/kg IV/IM (single maximum dose 1mg)
    - c. Diazepam 0.2mg/kg IV or 0.5mg/kg PR (single maximum dose 2mg IV or 4mg PR)
- 13. Monitor for arrhythmia and cardiovascular collapse, (see **Cardiovascular** section)

### **Patient Safety Considerations**

Use soft restraints, consider chemical restraints, and protect your IV access sites

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Patients at risk for heat emergencies include neonates, infants, geriatric patients, and patients with mental illness
2. Contributory risk factors may come from:
  - a. Prescription and over-the-counter herbal supplements
  - b. Cold medications
  - c. Heart medications
  - d. Diuretics
  - e. Psychiatric medications
  - f. Drug abuse
  - g. Accidental or intentional drug overdose
3. Heat exposure can occur either due to increased environmental temperatures or prolonged exercise or a combination of both. Environments with temperature > 90° F and humidity > 60% present the most risk
4. Heat stroke is associated with cardiac arrhythmias independent of drug ingestion/overdose. Heat stroke has also been associated with cerebral edema
5. Do not forget to look for other causes of altered mental status such as low blood glucose level
6. Controversy: shivering is thought to worsen outcomes in treating heat stroke. It is controversial about whether to stop active cooling if shivering occurs and ALS care with IV access and anti-shivering drugs are not available. Risk of shivering versus risk of stopping active cooling must be weighed by the team. Research does not demonstrate the value of one benzodiazepine over another in shivering patients
7. Hyperthermia not from environmental factors has a differential that includes the following:
  - a. Fever and delirium
  - b. Hyperthyroid storm
  - c. Delirium tremens (DTs)
  - d. CNS lesion or tumor
  - e. Adverse drug event: neuroleptic malignant syndrome, malignant hyperthermia
8. There is no evidence supporting EMS utilizing orthostatic vital signs

### **Pertinent Assessment Findings**

1. Warning signs: fever, altered mental status
2. Blood glucose level for AMS

### **Quality Improvement**

#### **Key Documentation Elements**

1. Patient assessment includes all types of medication/drug use
2. Environmental assessment done
3. Cooling treatments options considered and implemented
4. Decision-making regarding restraints
5. Decision-making regarding monitoring ABCs

#### **Performance Measures**

1. Blood glucose level done for altered mental status
2. Fluids given for hypotension
3. All decompensations during EMS care reviewed

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2. Bouchama A, Dehbi M, Chaves-Carballo E. Cooling and hemodynamic management in heatstroke: practical recommendation. *Crit Care Lond Engl*, 2007; 11(3):R54
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5. <http://lifeinthefastlane.com/futility-orthostatic-measurements/>; accessed August 9, 2014
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### **Revision Date**

September 15, 2014

## Hypothermia/Cold Exposure

(9914023 – Cold Exposure; 9914031 – Hypothermia)

### **Patient Care Goals**

1. Maintain hemodynamic stability
2. Prevent further heat loss
3. Aggressive management of cardiac arrest
4. Prevent loss of limbs

### **Patient Presentation**

Patients may suffer from hypothermia from exposure to a cold environment (increased heat loss) or may suffer from a primary illness or injury that, in combination with cold exposure (heat loss in combination with decreased heat production), leads to hypothermia. Patients may suffer systemic effects from cold (hypothermia) or localized effects, such as in frostbite. Patients with mild hypothermia will have normal mental status, shivering and may have normal vital signs while patients with moderate to severe hypothermia will manifest mental status changes, eventual loss of shivering and progressive bradycardia, hypotension, and decreased respiratory status. Patients with frostbite will develop numbness involving the affected body part along with a “clumsy” feeling along with areas of blanched skin. Later findings include a “woody” sensation, decreased or loss of sensation, bruising or blister formation, or a white and waxy appearance to affected tissue

### **Inclusion Criteria**

Patients suffering systemic or localized cold injuries

### **Exclusion Criteria**

Patients without cold exposure, or patients with cold exposure but no symptoms referable to hypothermia or frostbite

### **Patient Management**

#### **Assessment**

1. Patient assessment should begin with attention to the primary survey, looking for evidence of circulatory collapse and ensuring effective respirations. The patient suffering from moderate or severe hypothermia may have severe alterations in vital signs including weak and extremely slow pulses, profound hypotension and decreased respirations. The rescuer may need to evaluate the hypothermic patient for longer than the normothermic patient (up to 60 seconds)
2. History – Along with standard SAMPLE-type history, additional patient history should include attention to any associated injury or illness, duration of cold exposure, ambient temperature, and treatments initiated before EMS arrival
3. There are several means to categorize the severity of hypothermia based on either core body temperature readings or clinical evaluation. If possible and reliable, EMS providers should perform core body temperature measurements and categorize patients into one of the three follow levels of hypothermia:
  - a. Mild – normal body temperature 35-32.1° C/95-89.8°F

- b. Moderate - 32°-28°C – 89.7°-82.5°F
- c. Severe - 28°-22° C (or lower) – 82.4°- 68.1° F (or lower)
- 4. Equally important is the patient's clinical presentation and the signs or symptoms the patient is experiencing. The above temperature based categorization should be balanced against these clinical findings
  - a. Mild - vital signs not depressed normal mental status, shivering is preserved. Body maintains ability to control temperature
  - b. Moderate/Severe – progressive bradycardia, hypotension and decreased respirations, alterations in mental status with eventual coma, shivering will be lost in moderate hypothermia (generally between 31-30° C), and general slowing of bodily functions. The body loses ability to thermo-regulate

### **Treatment and Interventions**

1. Maintain patient and rescuer safety. The patient has fallen victim of cold injury and rescuers have likely had to enter the same environment. Maintain rescuer safety by preventing cold injury to rescuers
2. Manage airway as indicated
3. In Mild Hypothermia :
  - a. Remove the patient from the environment and prevent further heat loss by removing wet clothes and drying skin, insulate from the ground, shelter the patient from wind and wet conditions and insulate the patient with dry clothing or a hypothermia wrap/blankets, cover the patient with a vapor barrier and, if available, move the patient to a warm environment
  - b. Hypothermic patients have decreased oxygen needs and may not require supplemental oxygen. If oxygen is deemed necessary, it should be warmed, to a maximum temperature between 104-108° F (40-42° C) and humidified if possible
  - c. Provide beverages or foods containing glucose if feasible and patient is awake and able to manage airway independently.
  - d. Vigorous shivering can substantially increase heat production. Shivering should be fueled by caloric replacement
  - e. Consider field-rewarming methods such as placement of large heat packs or heat blankets (chemical or electric if feasible) to the anterior chest or wrapped around the patient's thorax if large enough. Forced air warming blankets (e.g. Bair Hugger®) can be an effective field rewarming method if available
  - f. Monitor frequently. If temperature or level of consciousness decreases, refer to severe hypothermia, below
  - g. Consider IV access. Indications for IV access and IV fluids in the mildly hypothermic patient are similar to those of the non-hypothermic patient. IV fluids, if administered, should be warmed, ideally to 42° C. Bolus therapy is preferable to continuous drip. The recommended fluid for volume replacement in the hypothermic patient is normal saline
  - h. If alterations in mental status, consider measuring finger stick blood glucose and treat as indicated (follow **Hypoglycemia/Hyperglycemia** guideline) and assess for other causes of alterations of mentation
  - i. Transport to a hospital capable of rewarming the patient
4. In Moderate or Severe Hypothermia:
  - a. Perform ABCs. Pulse checks for patients suffering hypothermia should be performed for 60 seconds. Obtain core temperature if possible for patients exhibiting signs or



symptoms of moderate/severe hypothermia. Core temperatures are best measured by esophageal probe, if one is available and the provider has been trained in its insertion and use. If esophageal temperature monitoring is not available or appropriate, e tympanic or rectal temperatures should be used. Of note, rectal temperatures are not reliable or suitable for taking temperatures in the field and should only be done in a warm environment (such as a heated ambulance)

- b. Manage airway as needed. Care must be taken not to hyperventilate the patient as hypocarbia may reduce the threshold for ventricular fibrillation in the cold patient. Indications and contraindications for advanced airway devices are similar in the hypothermic patient as in the normothermic patient
  - c. Prevent further heat loss using the above methods
  - d. Initiate field-rewarming methods such as placement of large heat packs or heat blankets (chemical or electric if feasible) to the anterior chest or wrapped around the patient's thorax if large enough. Forced air warming blankets (e.g. Bair Hugger®) can be an effective field rewarming method if available
  - e. Handle the patient gently. Attempt to keep the patient in the horizontal position, especially limiting motion of the extremities to avoid increasing return of cold blood to the heart. Once in a warm environment, clothing should be cut off (rather than removed by manipulating the extremities). Move the patient only when necessary such as to remove the patient from the elements
  - f. Apply cardiac monitor or AED if available
  - g. Establish IV and provide warmed NS bolus. Repeat as necessary
  - h. If alterations in mental status, consider measuring finger stick blood glucose and treat as indicated (follow **Hypoglycemia/Hyperglycemia** guideline) and assess for other causes of alterations of mentation
  - i. Transport as soon as possible to a hospital capable of aggressive resuscitation. If cardiac arrest develops consider transport to a center capable of extracorporeal circulation (if feasible)
5. Frostbite:
- If the patient has evidence of frostbite, and ambulation/travel is necessary for evacuation or safety, avoid rewarming of extremities until definitive treatment is possible. Additive injury occurs when the area of frostbite is rewarmed then inadvertently refrozen. Only initiate rewarming if refreezing is absolutely preventable
- a. If rewarming is feasible and refreezing can be prevented use circulating warm water (98.6 - 102° F/37 - 39° C) to rewarm effected body part, thawing injury completely. If warm water is not available, rewarm frostbitten parts by contact with non-affected body surfaces. Do not rub or cause physical trauma
  - b. After rewarming, cover injured parts with loose sterile dressing. If blisters are causing significant pain, and the provider is so trained, these may be aspirated, however, should not be de-roofed. Do not allow injury to refreeze. Follow the **Pain Management** guideline

#### **Patient Safety Considerations**

- 1. Given the additive effects of additional cold stress, the patient should be removed from the cold environment as soon as operationally feasible.

2. In patients suffering from moderate to severe hypothermia, it is critical to not allow these patients to stand or exercise as this may cause circulatory collapse

### Notes/Educational Pearls

#### Key Considerations

Considerations in cardiac arrest

1. The mainstay of therapy in severe hypothermia and cardiac arrest should be effective chest compressions and attempts at rewarming
2. The temperature at which defibrillation should first be attempted in the severely hypothermic cardiac arrest victim and the number of defibrillation attempts is unclear. There are different approaches regarding resuscitation of the hypothermic arrest patient. Per the American Heart Association, if the patient has a shockable rhythm (VF/VT), defibrillation should be attempted. It is reasonable to continue defibrillation attempts per AHA protocols concurrently with rewarming strategies. The state of Alaska's 2014 guidance on management of hypothermic patients in cardiac arrest advises that defibrillation should be attempted once, followed by 2 minutes of chest compressions, then rhythm and pulse checks. If defibrillation is unsuccessful and the patient's core temperature is  $< 30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ), do not make further attempts at defibrillation until the core temperature has increased to  $> 30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ). Continue CPR and attempt to rewarm the patient. If defibrillation is unsuccessful and the patient's core temperature is  $> 30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ), follow guidelines for normothermic patients. It is noted that the likelihood of successful defibrillation increases with every one-degree increase in temperature. If available monitors reveal asystole, CPR alone is the mainstay of therapy. If monitoring reveals an organized rhythm (other than VF or VT), but no pulses are detected, do not start CPR, but continue to monitor. While this may represent Pulseless Electrical Activity (PEA), this may also represent situations in which the patient's pulses are not detectable, but remain effective due to decreased metabolic needs. In the case of PEA, the rhythm will deteriorate rapidly to asystole, in which case, CPR should be initiated. Given the potential to cause VF with chest compressions, the AK guidance offers that it is better to maintain effective cardiac activity than to start CPR and cause VF
3. Manage the airway per standard care in cardiac arrest victims. (see cardiac arrest guideline)
4. There is little evidence to guide use of medications in severe hypothermia with cardiac arrest, however 2010 AHA updates to advanced cardiac life support recommend use of vasopressors according to standard ACLS protocols while the Alaska 2014 guidelines for the management of hypothermic patients advises medications should be withheld until the patient's core temperature is  $> 30^{\circ}\text{C}$  ( $86^{\circ}\text{F}$ ). Above  $30^{\circ}\text{C}$ , intervals between medication provision should be doubled until the patient reaches  $35^{\circ}\text{C}$ , at which time, normal medication intervals may be adopted
5. Upon ROSC, follow the **Adult Post-ROSC** guideline
6. Patients with severe hypothermia and arrest may benefit from resuscitation even after prolonged downtime, and survival with intact neurologic function has been observed even after prolonged resuscitation. Patients should not be considered deceased until aggressive rewarming has been attempted
7. If a hypothermic patient clearly suffered cardiac arrest and subsequently became hypothermic afterward with prolonged down time between arrest and rescue, there is no rationale for initiating resuscitation and warming the patient
8. The following are contraindications for initiation of resuscitation in the hypothermic patient:

- a. Submersion for greater than one hour
- b. Core temperature less than 50° F
- c. Obvious fatal injuries (such as decapitation)
- d. The patient exhibits signs of being frozen (such as ice formation in the airway)
- e. Chest wall rigidity such that compressions are impossible
- f. Danger to rescuers or rescuer exhaustion

#### **Pertinent Assessment Findings**

- 1. Identification of associated traumatic injuries (when present)
- 2. Identification of localized freezing injuries
- 3. Patient core temperature (when available)

#### **Quality Improvement**

##### **Key Documentation Elements**

- 1. Duration of cold exposure
- 2. Ambient temperature and recent range of temperatures
- 3. Rewarming attempts or other therapies performed prior to EMS arrival

##### **Performance Measures**

- 1. Patient core temperature and means of measurement (when available)
- 2. Presence of cardiac dysrhythmias
- 3. Documentation of associated trauma (when present)

#### **References**

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**Revision Date**

September 15, 2014

## Drowning

(9914093 – Drowning/Near Drowning)

### **Patient Care Goals**

1. Rapid assessment and management of life-threatening injuries
2. Rescue from the water-based environment
3. Transport all patients suffering from drowning for hospital evaluation

### **Patient Presentation**

#### **Inclusion Criteria**

Patients suffering from drowning or drowning events independent of presence or absence of symptoms.

#### **Exclusion Criteria**

Patients without history of drowning.

### **Patient Management**

#### **Assessment**

1. Follow general patient care guideline
2. History should include circumstances leading to the submersion, details of mechanism of injury, time under water, and water temperature (if available)
3. Primary survey should include aggressive airway management and restoration of adequate oxygenation and ventilation. Unlike the CAB strategy used in standard cardiac arrest, patients suffering cardiac arrest from drowning require an ABC approach with prompt airway management and supplemental breathing
4. History, mechanism of injury and exam should include consideration of possible c-spine injury. If evaluation suggests injury to the cervical spine, manage c-spine
5. Assess for other associated injury such as injury to the head or dive-related emergency

#### **Treatment and Interventions**

1. Ensure scene safety for patient and rescuers. Remove patient from water as soon as possible. Practice the safest water rescue technique possible, given circumstances on scene. Evacuate to land or a water craft as soon as possible. If there is a delay to accessing shore or a rescue boat, initiate in-water basic life support consisting of ventilation only
2. Manage airway as indicated
3. Follow cardiac arrest guideline as indicated with consideration of ABC strategy for drowning victims in cardiac arrest. Initiate 5 rescue breaths followed by 30 chest compressions. After the initial 5 breaths, use a 2 breaths to 30 compression ratio
4. If mechanism or history suggest cervical spine injury, manage c-spine
5. Monitor vital signs including oxygen saturations
6. If O<sub>2</sub> saturations are less than 92%, provide supplemental oxygen to maintain saturation  $\geq 94\%$ . Consider positive pressure ventilation in patients with signs or symptoms of respiratory difficulty
7. Consider hypothermia and treat per **Hypothermia/Cold Exposure** guideline

8. If the victim was involved in underwater diving with diving equipment and uncertainty exists regarding the most appropriate therapy, consider contacting direct medical oversight and discussing need for hyperbaric treatment. Include discussion regarding:
  - a. Submersion time
  - b. Greatest depth achieved
  - c. Ascent rate
9. Establish IV access
10. Fluid bolus as indicated
11. Advanced airway management as indicated. Consider CPAP in awake patients with respiratory distress
12. Cardiac monitor

#### **Patient Safety Considerations**

1. Avoidance of hyperoxygenation of the drowning victim
2. Rescuer safety considerations

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. The World Health Organization definition of drowning is “the process of experiencing respiratory impairment from submersion/immersion in liquid”
2. Drowning is further defined in the following categories:
  - a. Non-fatal drowning – patients rescued from drowning
  - b. Fatal drowning – any death, acutely or subacutely, resultant from drowning
3. Submersion refers to situations in which the patient’s airway is underwater. Immersion refers to situations in which the patient’s body is in water but the patient’s airway remains out of the water
4. Drowning is a common cause of death in children. Risk factors for drowning include male gender, age less than 14 years old, alcohol use, lack of supervision, and risky behavior
5. Rescue efforts should be coordinated between all responding agencies to ensure patient is rapidly accessed and removed from the water
6. Initiation of in-water ventilations may increase survival. In-water chest compressions are futile
7. The European Resuscitation Council recommends 5 initial breaths be provided to the drowning victim. The initial ventilations may be more difficult to achieve as water in the airways may impede alveolar expansion. After the initial 5 breaths and 30 compressions, the standard ratio of 2 breaths to 30 compressions may be resumed
8. Active efforts to expel water from the airway (by abdominal thrusts or other means) should be avoided as they delay resuscitative efforts and increase the potential for vomiting and aspiration
9. Longstanding teaching has suggested that rescuers should always assume c-spine injury in victims of drowning. The 2010 American Heart Association update on special circumstances in cardiac arrest notes that routine c-spine precautions in all victims of drowning is likely unnecessary unless the mechanism or injury, history or physical exam suggests a cervical spine injury. Mechanisms of injury highly suggestive of cervical spine injury include diving, water skiing, surfing or watercraft accidents
10. Uncertainty exists regarding survival in cold water drowning, however, recent literature suggests the following:

- a. If water temperature is less than 43° F (6° C) and the patient is submerged with evidence of cardiac arrest:
    - i. Survival is possible for submersion time less than 90 minutes and resuscitative efforts should be initiated
    - ii. Survival is not likely for submersion time greater than 90 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene
  - b. If water temperature is greater than 43° F (6° C) and the patient is submerged with evidence of cardiac arrest:
    - i. Survival is possible for submersion time less than 30 minutes and resuscitative efforts should be initiated
    - ii. Survival is not likely for submersion time greater than 30 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene
11. Patients may develop subacute respiratory difficulty after drowning and therefore all victims of drowning should be transported for observation

### **Quality Improvement**

#### **Key Documentation Elements**

1. Mechanism of injury or history suggesting cervical spine injury
2. Submersion time
3. Water temperature
4. Activities leading to drowning
5. Consider a standardized data collection metrics such as the Utstein drowning data reporting elements

#### **Performance Measures**

Compliance with this guideline

### **References**

1. Olshaker J. Submersion. *Emerg Med Clin N Am*, 2004
2. Szpilman et al. Current Concepts Drowning. *NEJM*, 2012
3. Idris et al. Recommended guidelines for uniform reporting of data from drowning: The "Utstein Style". *Circulation*, 2003
4. Harris M. ABC of resuscitation, near drowning. *BMJ*, 2003
5. Layon J et al. Drowning, update 2009. *Anesthesiology*, 2009
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### **Revision Date**

September 15, 2014

## SCUBA Injury/Accidents

(No NEMSIS category)

### **Patient Care Goals**

1. Rapid assessment and management of life-threatening injuries
2. Rescue from the water-based environment
3. Transport patients suffering from SCUBA diving injury/illness for hospital evaluation and consideration of repressurization/hyperbaric oxygen therapy (HBOT)

### **Patient Presentation**

#### **Inclusion Criteria**

Patients with recent history of SCUBA diving exhibiting potential signs and/or symptoms of dive related illness/injury, regardless of dive table compliance

#### **Exclusion Criteria**

Patients without history of recent SCUBA diving exposure

### **Patient Management**

#### **Assessment**

1. Follow **Universal Care** guideline
2. History should include circumstances leading to the complaint, details of mechanism of injury, time under water, and water temperature (if available)
3. Be alert for signs of pulmonary injury (e.g. unequal or abnormal lung sounds, subcutaneous emphysema)
4. Assess for other associated injury such as injury to the head or spine, if mechanism and symptoms suggest

#### **Treatment and Interventions**

1. If SCUBA accident includes associated drowning/near-drowning, see **Drowning** guideline
2. Manage airway as indicated
3. If air embolism suspected, place in left lateral recumbent position
4. Monitor vital signs including oxygen saturations
5. If O<sub>2</sub> saturations are less than 92%, provide supplemental oxygen to maintain saturations  $\geq 94\%$ . Use positive pressure ventilation (e.g. CPAP) carefully in patients for whom pulmonary barotrauma is a consideration
6. Patients with symptoms suspicious for decompression illness (DCI), should be placed on supplemental oxygen regardless of saturations to enhance washout of inert gasses
7. Consider hypothermia and treat per **Hypothermia/Cold Exposure** guideline
8. Consider contacting direct medical oversight and discussing need for hyperbaric treatment and primary transport to facility with HBOT capability. Include discussion regarding factors such as submersion time, greatest depth achieved, ascent rate
9. Establish IV access
10. Fluid bolus as indicated
11. Advanced airway management as indicated
12. Cardiac monitor



**Patient Safety Considerations**

1. If patient still in the water, seek safest and most rapid means of removal (within your scope of training)
2. Seek assistance early for special rescue/extrication needs
3. Check for multiple patients (e.g. group dive table calculation error(s) or contaminated dive gases)

**Notes/Educational Pearls****Key Considerations**

1. Rescue efforts should be coordinated between all responding agencies to ensure patient is rapidly accessed and removed from the water if diver unable to do so himself/herself
2. If air medical transport necessary, patient should be transported in cabin pressurized to lowest possible altitude. If transported in unpressurized aircraft (e.g. most helicopter (HEMS) services), patient should be flown at the lowest safe altitude possible
3. Decompression illness may have a variety of presentations depending on system affected (e.g. skin, joint(s), pulmonary, neurologic)
4. SCUBA accidents/incidents can result in a variety of issues, including barotrauma, air embolism and decompression illness (DCI)

**Pertinent Assessment Findings**

1. Vital signs findings
2. Neurologic status assessment findings
3. Respiratory assessment findings (e.g. oxygen saturation, respiratory rate)
4. Subcutaneous emphysema

**Quality Improvement****Key Documentation Elements**

1. Water temperature, if available
2. Dive history
  - a. Number of dives in recent history (days)
  - b. "Bottom time" in dives
  - c. Dive profiles
  - d. Maximum depth
  - e. Rate of ascent
  - f. Safety stops utilized, if any
  - g. Dive gas (e.g. air vs. mixed gases such as Nitrox, Heliox or Trimix)
3. Timing of onset of symptoms
4. History of altitude exposure after diving

**Performance Measures**

1. Recognition and appropriate care of pulmonary/respiratory complaints
2. Patient transported to nearest appropriate facility (HBOT if available)
3. Need for HBOT recognized and communicated to receiving facility

## **References**

1. Doolette DJ, Mitchell SJ. Recreational technical diving part 2: Decompression from deep technical dives. *Diving and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 96–104
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11. Vann, RD, Gerth, PJ, Denoble, CF. Pieper and Thalmann, eds. Experimental trials to assess the risks of decompression sickness in flying after diving. *Divers Alert Network, Department of Anesthesiology, Duke University Medical Center, Durham, NC; Center for Hyperbaric Medicine and Environmental Physiology, Department of Anesthesiology, Duke University Medical Center, Durham, NC; U.S. Navy Experimental Diving Unit, Panama City, FL; Center for Aging, Division of Biostatistics, Department of Community and Family Medicine, Duke University Medical Center, Durham, NC*

## **Revision Date**

September 15, 2014

## Altitude Illness

(9914021 – Altitude Sickness)

### **Patient Care Goals**

1. Improve oxygenation through a combination of descent and supplemental O<sub>2</sub>
2. Safe but rapid transport from the high altitude environment to a lower altitude environment

### **Patient Presentation**

#### **Inclusion Criteria**

Patients suffering from altitude illness, including

1. Acute mountain sickness
2. High altitude pulmonary edema
3. High altitude cerebral edema

#### **Exclusion Criteria**

Patients who have not been exposed to altitude

### **Patient Management**

#### **Assessment**

1. The definition of altitude illnesses are as follows:
  - a. Acute mountain sickness – Headache plus one or more of the following: anorexia, nausea or vomiting, fatigue or weakness, dizziness or lightheadedness or difficulty sleeping. These symptoms must occur in the setting of recent arrival to high altitude (generally considered greater than 5000 – 7000 feet)
  - b. High altitude pulmonary edema (HAPE) – Progressive dyspnea, cough, hypoxia, and weakness in high altitude environments (considered 8000 feet or greater). Patients may or may not exhibit symptoms if acute mountain sickness precedes symptoms of HAPE
  - c. High altitude cerebral edema (HACE) – Heralded by mental status changes in patients with symptoms of acute mountain sickness including altered mentation, ataxia, or stupor and progressing to coma. Typically seen in high altitude environments (greater than 8000 feet)
2. Assessment should target the signs and symptoms of altitude illness but should also consider alternate causes of these symptoms

#### **Treatment and Interventions**

1. Ensure scene safety for rescuers
2. Stop ascent. Patients with acute mountain sickness only may remain at their current altitude and initiate symptomatic therapy. Patients with HACE or HAPE should initiate descent
3. Perform ABCs and manage airway as necessary
4. Administer supplemental oxygen with goal to keep oxygen saturations  $\geq 94\%$
5. Descend to lower altitude. Descent is the mainstay of therapy and is the definitive therapy for all altitude related illnesses. Descent should be initiated as soon as scene conditions permit
  - a. If severe respiratory distress is present and pulmonary edema is found on exam, provider should start positive pressure ventilation
  - b. Establish IV and perform fluid bolus with goal to maintain systolic BP > 90 mm Hg

- c. Monitor cardiac rhythm

### **Patient Safety Considerations**

1. The high altitude environment is inherently dangerous. Rescuers must balance patient needs with patient safety and safety for the responders
2. Rapid descent by a minimum of 500-1000 feet is a priority, however rapidity of descent must be balanced by current environmental conditions and other safety considerations

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Patients suffering from altitude illness have exposed themselves to a dangerous environment. By entering the same environment, providers are exposing themselves to the same altitude exposure. Be vigilant in looking for symptoms of altitude illness amongst rescuers
2. Descent of 500-1000 feet is often enough to see improvements in patient conditions
3. Patients with HAPE are suffering from non-cardiogenic pulmonary edema and may benefit from positive pressure ventilation via either bag assisted ventilation, CPAP or other means of positive pressure ventilation
4. Patients suffering from altitude illness are commonly dehydrated and require IV fluids. Once resuscitation is complete and the patient requires no further fluid boluses, maintain IV fluids at 125 ml/hr
5. HAPE is the most lethal of all altitude illnesses
6. Consider alternate causes of symptoms of AMS. The symptoms of AMS may be caused by alternate etiologies such as carbon monoxide poisoning (in patients cooking within enclosed areas), dehydration, exhaustion, hypoglycemia, hyponatremia
7. Descent should always be the primary treatment strategy for patients suffering from altitude illness, especially patients suffering from HACE and HAPE. If descent is not possible, or if direct medical oversight permits, the EMS provider may consider the following possible therapies:
  - a. Portable hyperbaric chambers are effective for the management of severe altitude illness. However, they should not be used in lieu of descent, only as an alternative should descent be unfeasible
  - b. Acute mountain sickness
    - i. Ibuprofen or acetaminophen for pain
    - ii. Ondansetron 4 mg IV, PO, or sublingual every 6 hours for vomiting
    - iii. Acetazolamide – up to 250 PO mg twice a day
      1. Pediatric dosing is 2.5 mg/kg up to a max of 250 mg twice a day
      2. Acetazolamide speeds acclimatization and therefore helps in treating acute mountain sickness
    - iv. Dexamethasone - 8 mg IM, IV, or PO followed by 4 mg IM, IV, or PO every 6 hours until symptoms resolve
      1. Pediatric dosing is 0.15 mg/kg IM, IV, or PO every 6 hours
      2. Dexamethasone helps treat the symptoms of acute mountain sickness and may be used as an adjunctive therapy in severe acute mountain sickness when the above measures alone do not ameliorate the symptoms. In these circumstances, patients should also initiate descent, as dexamethasone does not facilitate acclimatization

- c. HACE – All below listed therapies should be considered as adjunctive to descent. Descent should always be the primary treatment modality
  - i. Dexamethasone – at above adult and pediatric doses
    - 1. Dexamethasone helps treat the symptoms of HACE and should be initiated in HACE. In these circumstances, patients should also initiate descent
  - ii. Consider use of acetazolamide at the above dosing
- d. HAPE - All below listed therapies should be considered as adjunctive to descent. Descent should always be the primary treatment modality
  - i. Nifedipine SR 60 mg PO once a day may be added to the patient's regimen
  - ii. Tadalafil (20-40 mg PO once daily) or sildenafil (20 mg PO three times a day) may be used if nifedipine is not available. Multiple pulmonary vasodilators should not be used concurrently

#### **Pertinent Assessment Findings**

1. Consider airway management needs in the patient with severe alteration in mental status
2. HAPE will present with increasing respiratory distress and rales on exam
3. HACE will present with mental status changes, ataxia, and progressing to coma

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Patient's itinerary, including starting altitude, highest altitude gained and rate of ascent
2. Presence (or absence) of prophylaxis against altitude (including medications such as acetazolamide, sildenafil)
3. Total altitude descended

##### **Performance Measures**

1. Mechanism of treatment for acute mountain sickness, HACE or HAPE
2. Medical decision-making regarding treatment choice (e.g. weather, inability to descend)

#### **References**

1. Luks A et al. Wilderness Medical Society consensus guidelines for the prevention and treatment of acute altitude illness. *Wilderness and Environmental Medicine*, 2010
2. Imray C et al. Acute mountain sickness: pathophysiology, prevention and treatment. *Progress in Cardiovascular Diseases*, 2010
3. Barry P et al. Clinical review: altitude illness. *BMJ*, 2003
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5. Bartsch P et al. Acute high-altitude illness. *NEJM*, 2013
6. West J. Concise clinical review: high altitude medicine. *American Journal of Respiratory and Critical Care Medicine*, 2012
7. Gallagher S et al. High altitude illness. *Emerg Med Clin N Am*, 2004

#### **Revision Date**

September 15, 2014

## Conducted Electrical Weapon (e.g. TASER®)

(No NEMSIS category)

### **Patient Care Goals**

1. Manage the condition that triggered the application of the conducted electrical weapon with special attention to patients meeting criterion for excited delirium
2. Make sure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and staff
3. Perform comprehensive trauma and medical assessment as patients who have received conducted electrical weapon may have already been involved in physical confrontation
4. If discharged from a distance, two single barbed darts (13mm length) should be located. Do not remove barbed dart from sensitive areas (head, neck, hands, feet or genitals)

### **Patient Presentation**

#### **Inclusion Criteria**

1. Patient received either the direct contact discharge or the distance two barbed dart discharge of the conducted electrical weapon
2. Patient may have sustained fall or physical confrontation trauma
3. Patient may be under the influence of toxic substances and or may have underlying medical or psychiatric disorder

#### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Once patient has been appropriately secured or restrained with assistance of law enforcement, perform primary and secondary assessment including 3-lead EKG, pulse oximeter, and consider 12-lead EKG
2. Evaluate patient for evidence of excited delirium manifested by varied combination of agitation, reduced pain sensitivity, elevated temperature, persistent struggling, or hallucinosis

#### **Treatment and Interventions**

1. Make sure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and staff. Consider chemical sedation if patient struggling against physical restraints and may harm themselves or others
2. Conservative programs treat all barbed darts as a foreign body and leave them for physician removal while more progressive programs allow EMS or law enforcement to remove barbed darts except for sensitive areas (head, neck, hands, feet or genitals)
3. Treat medical and traumatic injury

### **Patient Safety Considerations**

1. Before removal of the barbed dart, make sure the cartridge has been removed from the conducted electrical weapon
2. Patient should not be restrained in the prone, face down or hog tied position as respiratory compromise is a significant risk
3. Conducted electrical weapon patient may have underlying pathology before being tased (refer to other guidelines for managing the underlying medical/traumatic pathology)
4. Perform a comprehensive assessment with special attention looking for to signs and symptoms that may indicate agitated delirium
5. Transport the patient to the hospital if they have concerning signs or symptoms
6. EMS providers who respond for a conducted electrical weapon patient should not perform a “medical clearance” for law enforcement

### **Notes/Educational Pearls**

#### **Key Considerations**

Conducted electrical weapon can be discharged in three fashions: direct contact without the use of the darts, a single dart with addition contact by direct contact of weapon or from a distance up to 35 feet with two darts. The device delivers 19 pulses per second with an average current per pulse of 2.1 milliamps which in combination with toxins/drugs, patient’s underlying diseases, excessive physical exertion, and trauma may precipitate arrhythmias, thus consider EKG monitoring and 12-lead EKG assessment

Drive Stun is a direct weapon two-point contact which is designed to generate pain and not incapacitate the subject. Only local muscle groups are stimulated with the Drive Stun technique

#### **Pertinent Assessment Findings**

Thoroughly assess the tased patient for trauma as the patient may have fallen from standing or higher. Ascertain if more than one TASER® cartridge was used (by one or more officers, in effort to identify total number of possible darts and contacts)

### **Quality Improvement**

#### **Key Documentation Elements**

1. If darts removed, document the removal location in the patient care report
2. Physical exam trauma findings
3. Cardiac rhythm and changes
4. Neurologic status assessment findings

#### **Performance Measures**

1. Comprehensive patient documentation as this is a complex patient
2. Abnormal findings or vital signs were addressed
3. Patient received EKG or 12-lead EKG evaluation
4. If indicated, review for appropriate restraint technique

### **References**

1. TASER electronic control devices: field data and risk management. Available at: <http://www.taser.com/images/research-and-safety/research-library/downloads/CEWIndex5-29-13.pdf>

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**Revision Date**

September 15, 2014



## Electrical Injuries

(9914095 – Electrical Injuries)

### **Patient Care Goals**

1. Prevent additional harm to patient
2. Identify life threatening issues such as dysrhythmias and cardiac arrest
3. Identify characteristics of electrical source to communicate to receiving facility (voltage, amperage, alternating current (AC) versus direct current (DC))
4. Understand that deep tissue injury can be far greater than external appearance
5. Have high index of suspicion for associated trauma due to patient being thrown
6. Determine most appropriate disposition for the patient as many will require burn center care and some may require trauma center care

### **Patient Presentation**

#### **Inclusion Criteria**

Exposure to electrical current (AC or DC)

#### **Exclusion Criteria**

None

### **Patient Management**

#### **Assessment**

1. Verify scene is secure. The electrical source must be disabled prior to assessment
2. Assess primary survey with specific focus on dysrhythmias or cardiac arrest. Apply a cardiac monitor
3. Identify all sites of burn injury. If the patient became part of the circuit, there will be an additional site near the contact with ground
  - a. Electrical burns are often full thickness and involve significant deep tissue damage
4. Assess for potential associated trauma and note if the patient was thrown from contact point
  - a. If patient has altered mental status, assume trauma was involved and treat accordingly
5. Assess for potential compartment syndrome from significant extremity tissue damage
6. Determine characteristics of source if possible – AC or DC, voltage, amperage and also time of injury

#### **Treatment and Interventions**

1. Identify dysrhythmias or cardiac arrest – even patients who appear dead (particularly dilated pupils) may have good outcomes with prompt intervention – see appropriate protocol for additional information
2. Immobilize if associated trauma suspected. See **Trauma** section guidelines
3. Apply dry dressing to any wounds
4. Remove constricting clothing and jewelry since additional swelling is possible
5. Administer fluid resuscitation per burn protocol
  - a. Remember that external appearance will underestimate the degree of tissue injury
6. Electrical injury patients should be taken to a burn center whenever possible since these injuries can involve considerable tissue damage

7. When there is significant associated trauma this takes priority, if local trauma resources and burn resources are not in the same facility

#### **Patient Safety Considerations**

1. Verify no additional threat to patient
2. Shut off electrical power
3. Move patient to shelter if electrical storm activity still in area

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Electrical current causes injury through three main mechanisms:
  - a. Direct tissue damage, altering cell membrane resting potential, and eliciting tetany in skeletal and/or cardiac muscles
  - b. Conversion of electrical energy into thermal energy, causing massive tissue destruction and coagulative necrosis
  - c. Mechanical injury with direct trauma resulting from falls or violent muscle contraction
2. Anticipate atrial and/or ventricular dysrhythmias as well as cardiac arrest
3. The mortality related to electrical injuries is impacted by several factors:
  - a. Route current takes through the body – current traversing the heart has higher mortality
  - b. Type of current: AC vs. DC
    - i. AC is more likely to cause cardiac dysrhythmias while DC is more likely to cause deep tissue burns however either type of current can cause any injury
    - ii. DC typically causes one muscle contraction while AC can cause repeated contractions
    - iii. Both types of current can cause involuntary muscle contractions that do not allow the victim to let go of the electrical source
    - iv. AC is more likely to cause ventricular fibrillation while DC is more likely to cause asystole
  - c. The amount of current impacts mortality more than the voltage

Current level (Milliamperes)	Probable Effect on Human Body of 120 V, 60 Hz AC for 1 second
1 mA	Perception level. Slight tingling sensation. Still dangerous if wet conditions.
5mA	Slight shock felt; not painful but disturbing. Average individual can let go. However, strong involuntary reactions to shocks in this range may lead to injuries.
6mA - 16mA	Painful shock, begin to lose muscular control. Commonly referred to as the freezing current or "let-go" range.
17mA - 99mA	Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible.
100mA - 2000mA	Ventricular fibrillation (uneven, uncoordinated pumping of the heart.) Muscular contraction and nerve damage begins to occur. Death is likely.
> 2,000mA	Cardiac arrest, internal organ damage, and severe burns. Death is probable.

Source: [https://www.osha.gov/SLTC/etools/construction/electrical\\_incidents/eleccurrent.html](https://www.osha.gov/SLTC/etools/construction/electrical_incidents/eleccurrent.html)

#### **Pertinent Assessment Findings**

1. Identification of potential trauma concomitant with electrical injury
2. Presence of cardiac dysrhythmias

#### **Quality Improvement**

##### **Key Documentation Elements**

1. Characteristics of electrical current
2. Downtime if found in cardiac arrest
3. Positioning of the patient with respect to the electrical source
4. Accurate description of external injuries
5. Document presence or absence of associated trauma

##### **Performance Measures**

1. Confirmation of scene safety
2. Documentation of electrical source and voltage if known
3. Documentation of cardiac monitoring
4. Documentation of appropriate care of associated traumatic injuries

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**Revision Date**

September 15, 2014

## Lightning/Lightning Strike Injury

(No NEMSIS category)

### **Patient Care Goals**

1. Identify patient(s) as lightning strike victim(s)
2. Move to safe area
3. Initiate immediate resuscitation on cardiac arrest victim(s), within limits of mass casualty care
4. Cardiac monitoring during transport
5. Treat associated traumatic injuries

### **Patient Presentation**

1. Lightning strikes may happen in a variety of environmental conditions. Most commonly they occur in outdoor or wilderness circumstances. Golf courses, exposed mountains or ledges and farms/fields all present conditions that increase risk of lightning strike, when hazardous meteorological conditions exist
2. Lacking bystander observations or history, it is not always immediately apparent that patient has been the victim of a lightning strike. Subtle findings such as injury patterns might suggest lightning injury

### **Inclusion Criteria**

Patients of all ages who have been the victim of lightning strike injury

### **Exclusion Criteria**

No specific recommendations

### **Patient Management**

#### **Assessment**

1. Cardiovascular
  - a. Dysrhythmias
  - b. Transient hypertension
2. Respiratory
  - a. Apnea
  - b. Agonal respirations
  - c. Respiratory paralysis
3. Neurologic
  - a. Seizures
  - b. Confusion
  - c. Paralysis
  - d. Paraplegia
  - e. Vertigo/dizziness
  - f. Parasthesias
  - g. Amnesia
  - h. Memory deficits
  - i. Anxiety
4. EENT

- Fixed/dilated pupils possible (autonomic dysfunction)
5. Skin
    - a. Ferning or fern-like superficial skin burn (“Lichtenberg figures”)
    - b. Vascular instability may result in cool, mottled extremities
    - c. Frequent first and/or second degree burns
    - d. Third degree burns less common
  6. Patient may be in full cardiopulmonary arrest or have only respiratory arrest, as injury is a result of DC current
  7. May have stroke-like findings as a result of neurologic insult
  8. May have secondary traumatic injury as a result of overpressurization, blast or missile injury.
  9. Fixed/dilated pupils may be a sign of neurologic insult, rather than a sign of death/impending death. Should not be used as a solitary, independent sign of death for the purpose of discontinuing resuscitation in this patient population

#### **Treatment and Interventions**

1. Assure patent airway  
If in respiratory arrest only, manage airway as appropriate
2. If in cardiopulmonary arrest, refer to **Cardiac Arrest (VF/VT/Asystole/PEA)** guideline
3. Consider IV initiation. Avoid initiation through burned skin
4. Monitor EKG. Be alert for potential arrhythmias  
Consider 12-lead EKG, when available
5. Consider early pain management for burns or associated traumatic injury. See **Pain Management** guideline

#### **Patient Safety Considerations**

1. Recognize that repeat strike is a risk. Patient and rescuer safety is paramount
2. Victims do not carry or discharge a current, so the patient is safe to touch and treat

#### **Notes/Educational Pearls**

##### **Key Considerations**

1. Lightning strike cardiopulmonary arrest patients have a high rate of successful resuscitation, if initiated early, in contrast to general cardiac arrest statistics
2. There may be multiple victims
3. If multiple victims, cardiac arrest patients whose injury was witnessed or thought to be recent should be treated first and aggressively (reverse triage)
4. It may not be immediately apparent that the patient is a lightning strike victim
5. Injury pattern and secondary physical exam findings may be key in identifying patient as a victim of lightning strike
6. Lightning strike is a result of very high voltage, very short duration DC current exposure

##### **Pertinent Assessment Findings**

1. Presence of thermal or non-thermal burns
2. Evidence of trauma
3. Evidence of focal neurologic deficits

## **Quality Improvement**

### **Key Documentation Elements**

1. Initial airway status
2. Initial cardiac rhythm
3. Neurologic exam (initial and repeat)
4. Associated/secondary injuries
5. Pain scale documentation/pain management

### **Performance Measures**

1. Cardiopulmonary issues addressed early and documented appropriately
2. Patient transported to closest appropriate facility
3. Pain scale documented and treated per guidelines (when appropriate)

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#### **Revision Date**

September 15, 2014

## APPENDICES

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### III. Medications

The project team considered the use of Institute for Safe Medication Practices (ISMP) Tall Man Letters methodology to avoid the miscommunication of lookalike drug names. Upon review of the list and the limited number of medications carried by EMS, as well as the expected use of this document, it was elected not to institute this measure into our medication list. We recommend EMS agencies consider incorporating these measures into practice where appropriate.

Additional information regarding Tall Man Letters can be found on the ISMP website: <http://www.ismp.org/tools/tallmanletters.pdf> and the US Food and Drug Administration website: <http://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm164587.htm>.

**Reference:** Trade names, class, pharmacologic action and contraindications (relative and absolute) information from the website <http://www.medscape.com>, accessed July 14, 2014 and July 15, 2014. Additional references include the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and position statements from the American Academy of Clinical Toxicology and the European Association of Poison Control Centers (<http://clintox.org/documents/positionpapers/Cathartics.pdf>). *NOTE:* Not all contraindications listed on the <http://www.medscape.com> website were included for the purposes of this document. Contraindications which were not pertinent to EMS providers were not included for the purposes of streamlining this document.

#### **MEDICATIONS**

##### **Name, Class, Pharmacologic Action, Indications, Contraindications**

(The indications cited for the medications are specific to the EMS/prehospital setting.)

##### **Acetazolamide**

**Name** – Diamox Sequels®

**Class** – Carbonic anhydrase inhibitors

**Pharmacologic Action** - Inhibits hydrogen ion excretion in renal tubule, increasing sodium, potassium, bicarbonate, and water excretion and producing alkaline diuresis

**Indications** – Acute mountain sickness

**Contraindications** – Known hypokalemia/hyponatremia, hypersensitivity to acetazolamide or sulfa, liver disease, renal disease, cirrhosis, long term administration in patients with chronic, noncongestive angle-closure glaucoma

### **Acetaminophen**

**Name** – There are multiple over-the-counter medications, as well as scheduled drugs, that include acetaminophen (Tylenol®) as an active ingredient

**Class** – Analgesics, antipyretic, other

**Pharmacologic Action** - May work peripherally to block pain impulse generation; may also inhibit prostaglandin synthesis in CNS

**Indications** - Pain control, fever control

**Contraindications** - Hypersensitivity, severe acute liver disease

### **Acetic acid (vinegar)**

**Name** - Vinegar

**Class** – Other

**Pharmacologic Action** – Stabilizes nematocyst discharge in non-United States jellyfish thus decreasing pain

**Indications** – Pain control for jellyfish envenomation (outside of the United States (US))

**Contraindications** – May increase nematocyst discharge for US jellyfish and therefore should be used outside of the US only

### **Acetylcysteine**

**Name** - Mucomyst®, Acetadote®

**Class** – Antidotes, other

**Pharmacologic Action** - Acts as sulfhydryl group donor to restore liver glutathione; may also scavenge free radicals to prevent delayed hepatotoxicity as antioxidant; encourages sulfation pathway of metabolism for acetaminophen

**Indications** – Antidote for acetaminophen overdose

**Contraindications** – Acute asthma

**WARNING:** Nausea and vomiting are common adverse effects following the oral administration of acetylcysteine

### **Activated Charcoal**

**Name** – Actidose-Aqua®

**Class** – Antidotes, other

**Pharmacologic Action** - Adsorbs a variety of drugs and chemicals (e.g. physical binding of a molecule to the surface of charcoal particles); desorption of bound particles may occur unless the ratio of charcoal to toxin is extremely high

**Indications** – Overdose and poisoning

**Contraindications** – Unprotected airway (beware of aspiration), caustic ingestions, intestinal obstruction

### **Adenosine**

**Name** – Adenocard®

**Class** - Antidysrhythmics

**Pharmacologic Action** - Slows conduction through AV node and interrupts AV reentry pathways, which restore normal sinus symptoms

**Indications** – Conversion of regular, narrow complex tachycardia – stable supraventricular tachycardia (SVT) or regular, monomorphic wide complex tachycardia

**Contraindications** – Hypersensitivity, second or third degree AV Block (except those on pacemakers), sick sinus syndrome, atrial flutter or fibrillation, ventricular tachycardia

### **Albuterol**

**Name** – Proventil®, Ventolin®, Proair®, Accuneb®

**Class** – Beta-2 agonist

**Pharmacologic Action** – Beta-2 receptor agonist with some beta-1 activity; relaxes bronchial smooth muscle with little effect on heart rate

**Indications** – Bronchospastic lung disease

**Contraindications** – Hypersensitivity, tachycardia secondary to heart condition

### **Amiodarone**

**Name** – Pacerone®, Cordarone®, Nexterone®

**Class** - Class III antidysrhythmics

**Pharmacologic Action** - Class III antidysrhythmic agent, which inhibits adrenergic stimulation; affects sodium, potassium, and calcium channels; markedly prolongs action potential and repolarization; decreases AV conduction and sinus node function

**Indications** – Management of regular wide complex tachycardia in stable patients, irregular wide complex tachycardia in stable patients, and as antidysrhythmic for the management of ventricular fibrillation (VF) and pulseless ventricular tachycardia (VT)

**Contraindications** – Hypersensitivity, Severe sinus node dysfunction, second degree or third degree heart block or bradycardia causing syncope (except with functioning artificial pacemaker), cardiogenic shock

**WARNING:** Avoid during breastfeeding

### **Amyl Nitrite**

**Name** – component of the Cyanide Antidote Kit®

**Class** – Cyanide antidote

**Pharmacologic Action** - Reacts with hemoglobin to form methemoglobin, an oxidized form of hemoglobin incapable of oxygen transport but with high affinity for cyanide. Cyanide preferentially binds to methemoglobin over cytochrome a3, forming the nontoxic cyanomethemoglobin

**Indications** - Acute cyanide toxicity

**Contraindications** – None in the case of suspected pure cyanide toxicity noted, documented hypersensitivity, suspected or confirmed smoke inhalation and/or carbon monoxide poisoning  
**WARNING:** There is a risk of worsening hypoxia due to methemoglobin formation

### **Aspirin**

**Name** – Multiple over-the-counter medications, as well as scheduled drugs, include aspirin as an active ingredient. These include, but are not limited to, Bayer Buffered Aspirin®, Alka-Seltzer with Aspirin®, Ascriptin®, Bayer Women's Low Dose®, Ecotrin®

**Class** – Antiplatelet agent, non-steroidal anti-inflammatory drug (NSAID)

**Pharmacologic Action** - Inhibits synthesis of prostaglandin by cyclooxygenase; inhibits platelet aggregation; has antipyretic and analgesic activity

**Indications** – Antiplatelet agent for the care of patients suspected of suffering from an acute coronary syndrome

**Contraindications** - Hypersensitivity to aspirin or NSAIDs (aspirin-associated hypersensitivity reactions include aspirin-induced urticarial or aspirin-intolerant asthma), bleeding GI ulcers, hemolytic anemia from pyruvate kinase (PK) and glucose-6-phosphate dehydrogenase (G6PD) deficiency, hemophilia, hemorrhagic diathesis, hemorrhoids, lactating mother, nasal polyps associated with asthma, sarcoidosis, thrombocytopenia, ulcerative colitis

### **Atropine**

**Name** - Atropen®, a component of Mark I® kits and DuoDote®

**Class** – Anticholinergic, toxicity antidotes

**Pharmacologic Action** - Competitively inhibits action of acetylcholinesterase on autonomic effectors innervated by postganglionic nerves

**Indications** – Management of nerve agent toxicity, symptomatic bradycardia (primary or related to toxin ingestion), organophosphate and carbamate insecticide toxicity

**NOTE:** Ineffective in hypothermic bradycardia

**Contraindications** - No absolute contraindications for ACLS, documented hypersensitivity in non-ACLS/nerve agent/organophosphate scenarios

**RELATIVE CONTRAINDICATIONS:** Narrow-angle glaucoma, GI obstruction, severe ulcerative colitis, toxic megacolon, bladder outlet obstruction, myasthenia gravis, hemorrhage w/ cardiovascular instability, thyrotoxicosis

### **Calcium Chloride**

**Name** – Calcium Chloride

**Class** – Antidotes, other; calcium salts

**Pharmacologic Action** - Bone mineral component; cofactor in enzymatic reactions, essential for neurotransmission, muscle contraction, and many signal transduction pathways

**Indications** – For use in topical burns (hydrofluoric acid) or for use in calcium channel blocker overdose

**Contraindications** – Hypercalcemia, documented hypersensitivity, life-threatening cardiac arrhythmias may occur in known or suspected severe hypokalemia  
**WARNING:** There is a risk for digitalis toxicity. Be cautious of peripheral IV use as significant tissue necrosis at injection site may occur

### **Calcium Gluconate**

**Name** – Gluconate®

**Class** – Antidotes, other; calcium salts

**Pharmacologic Action** - Bone mineral component; cofactor in enzymatic reactions, essential for neurotransmission, muscle contraction, and many signal transduction pathways

**Indications** - For use in topical burns (hydrofluoric acid) or for use in calcium channel blocker overdose

**Contraindications** – Hypercalcemia, documented hypersensitivity, sarcoidosis, life-threatening cardiac arrhythmias may occur in known or suspected severe hypokalemia

**WARNING:** There is a risk for digitalis toxicity

### **Cimetidine**

**Name** - Tagamet®

**Class** – Histamine H2 antagonist

**Pharmacologic Action** - blocks H2-receptors of gastric parietal cells, leading to inhibition of gastric secretions

**Indications** – For the management of gastric or duodenal ulcers, gastroesophageal reflux, as an adjunct in the treatment of urticarial and/or pruritis in patients suffering from allergic reaction

**Contraindications** - Hypersensitivity to cimetidine or other H2-receptor antagonists

### **Dexamethasone**

**Name** – Decadron®, Dexasone®

**Class** – Corticosteroid, anti-inflammatory drugs

**Pharmacologic Action** - Potent glucocorticoid with minimal to no mineralocorticoid activity  
Decreases inflammation by suppressing migration of polymorphonuclear leukocytes (PMNs) and reducing capillary permeability; stabilizes cell and lysosomal membranes, increases surfactant synthesis, increases serum vitamin A concentration, and inhibits prostaglandin and proinflammatory cytokines; suppresses lymphocyte proliferation through direct cytolysis, inhibits mitosis, breaks down granulocyte aggregates, and improves pulmonary microcirculation

**Indications** - Used in the management of croup and bronchospasm, as well as the management of patients suffering from high altitude cerebral edema (HACE)

**Contraindications** – Documented hypersensitivity, systemic fungal infection, cerebral malaria

### **Dextrose**

**Name** – D50W, DGlucose®, glucose

**Class** – Glucose-elevating agents; metabolic and endocrine, other

**Pharmacologic Action** - Parenteral dextrose is oxidized to carbon dioxide and water, and provides 3.4 kilocalories/gram of d-glucose

**Indications** – Used for the management of hypoglycemia

**Contraindications** - Hyperglycemia, anuria, diabetic coma, intracranial or intraspinal hemorrhage, dehydrated patients with delirium, glucose-galactose malabsorption syndrome, and documented hypersensitivity

### **Diazepam**

**Name** – Valium®, Diastat®, AcuDial®

**Class** – Benzodiazepine, anticonvulsants, skeletal muscle relaxants, anxiolytic

**Pharmacologic Action** - Modulates postsynaptic effects of GABA-A transmission, resulting in an increase in presynaptic inhibition. Appears to act on part of the limbic system, as well as on the thalamus and hypothalamus, to induce a calming effect

**Indications** – For use in agitated or violent patients, as well as for the management of seizures

**Contraindications** – Documented hypersensitivity, severe respiratory depression

### **Diltiazem**

**Name** – Includes Cardizem®, Dilacor®, Diltiaz®

**Class** – Calcium channel blocker, antidysrhythmic type IV

**Pharmacologic Action** - Inhibits extracellular calcium ion influx across membranes of myocardial cells and vascular smooth muscle cells, resulting in inhibition of cardiac and vascular smooth muscle contraction and thereby dilating main coronary and systemic arteries; no effect on serum calcium concentrations; substantial inhibitory effects on cardiac conduction system, acting principally at AV node, with some effects at sinus node

**Indications** – For management of narrow complex tachycardias

**Contraindications** – Documented hypersensitivity, Wolff-Parkinson-White syndrome, Lown-Ganong-Levine syndrome, symptomatic severe hypotension (systolic BP < 90 mm Hg), sick sinus syndrome (if no pacemaker), second and third degree heart block (if no pacemaker present), and complete heart block. Contraindications for IV administration: Use in newborns (because of benzyl alcohol), concomitant beta-blocker therapy, cardiogenic shock, ventricular tachycardia (must determine whether origin is supraventricular or ventricular)

### **Diphenhydramine**

**Name** – Benadryl®

**Class** - Antihistamine – first generation

**Pharmacologic Action** - Histamine H1-receptor antagonist of effector cells in respiratory tract, blood vessels, and GI smooth muscle

**Indications** – For urticarial and/or pruritis in the management of patients suffering from allergic reaction as well as for the management of patients suffering from dystonia/akathisia

**Contraindications** – Documented hypersensitivity, use controversial in lower respiratory tract disease (such as acute asthma), premature infants and neonates

### **Dopamine**

**Name** - Intropin®

**Class** – Inotropic agent; catecholamine; pressor

**Pharmacologic Action** - Endogenous catecholamine, acting on both dopaminergic and adrenergic neurons. Low dose stimulates mainly dopaminergic receptors, producing renal and mesenteric vasodilation; higher dose stimulates both beta-1-adrenergic and dopaminergic receptors, producing cardiac stimulation and renal vasodilation; large dose stimulates alpha-adrenergic receptors

**Indications** – As a pressor agent used in the management of shock

**Contraindications** - Hypersensitivity to dopamine, pheochromocytoma, ventricular fibrillation, uncorrected tachyarrhythmias

**WARNING:** Dopamine is a vesicant and can cause severe tissue damage if extravasation occurs

### **Droperidol**

**Name** - Inapsine®

**Class** – Antiemetic agents; antipsychotic

**Pharmacologic Action** - Antiemesis: dopamine receptor blockade in brain, predominantly dopamine-2 receptor. When reuptake is prevented, a strong antidopaminergic, antiserotonergic response occurs. Droperidol reduces motor activity, anxiety, and causes sedation; also possesses adrenergic-blocking, antifibrillatory, antihistaminic, and anticonvulsive properties

**Indications** – For use in the patient with acute delirium or psychosis

**Contraindications** – Hypersensitivity, known or suspected prolonged QT interval; QTc interval > 450 msec in females or  $\geq 440$  msec in males

**WARNING:** Use with caution in patients with bradycardia, cardiac disease, concurrent MAO inhibitor therapy, Class I and Class III dysrhythmics or other drugs that prolong the QT interval and cause electrolyte disturbances due to its adverse cardiovascular effects, i.e. QT prolongation, hypotension, tachycardia, and torsades de pointes

### **Epinephrine**

**Name** – EpiPen®, TwinJect®, Adrenaclick®, Auvi-Q, Adrenalin®, AsthmaNefrin®, Vaponefrin®

**Class** - Alpha/beta adrenergic agonist

**Pharmacologic Action** - Strong alpha-adrenergic effects, which cause an increase in cardiac output and heart rate, a decrease in renal perfusion and peripheral vascular resistance, and a variable effect on BP, resulting in systemic vasoconstriction and increased vascular permeability. Strong beta-1- and moderate beta-2-adrenergic effects, resulting in bronchial smooth muscle relaxation

Secondary relaxation effect on smooth muscle of stomach, intestine, uterus, and urinary bladder

**Indications** – For use in the management of patients suffering anaphylaxis, shock, cardiac arrest, bradycardia, or in the nebulized form for croup/bronchiolitis and IM form for refractory acute asthma

**Contraindications** – Hypersensitivity, cardiac dilatation and coronary insufficiency

### **Famotidine**

**Name** - Pepcid®

**Class** – Histamine H2 antagonist

**Pharmacologic Action** - Blocks H2 receptors of gastric parietal cells, leading to inhibition of gastric secretions

**Indications** - For the management of gastric or duodenal ulcers, gastroesophageal reflux, as an adjunct in the treatment of urticarial and/or pruritus in patients suffering from allergic reaction

**Contraindications** - Hypersensitivity to famotidine or other H2-receptor antagonists

### **Fentanyl**

**Name** –Currently only available in the generic form (formerly Sublimaze®)

**Class** – Synthetic opioid, opioid analgesics

**Pharmacologic Action** - Narcotic agonist-analgesic of opiate receptors; inhibits ascending pain pathways, thus altering response to pain; increases pain threshold; produces analgesia, respiratory depression, and sedation

**Indications** – Management of acute pain

**Contraindications** – Hypersensitivity

**WARNING:** Should be used with caution in the elderly and in patients with hypotension, suspected gastrointestinal obstruction, head injury, and concomitant CNS depressants

### **Glucagon**

**Name** – GlucaGen®, Glucagon Emergency Kit®, GlucaGen HypoKit®

**Class** - Hypoglycemia antidotes, glucose-elevating agents, other antidotes (e.g. beta-blocker or calcium channel blocker overdose)

**Pharmacologic Action** - Insulin antagonist. Stimulates cAMP synthesis to accelerate hepatic glycogenolysis and gluconeogenesis. Glucagon also relaxes smooth muscles of GI tract

**Indications** – For the management of hypoglycemic patients as well as patients suffering symptomatic bradycardia after beta blocker or calcium channel blocker overdose

**Contraindications** – Hypersensitivity, pheochromocytoma, insulinoma

**WARNING:** Nausea and vomiting are common adverse effects following the administration of glucagon

### **Haloperidol**

**Name** – Haldol®, Haldol Decanoate®, Haloperidol LA®, Peridol®

**Class** – First generation antipsychotic

**Pharmacologic Action** - Antagonizes dopamine-1 and dopamine-2 receptors in brain; depresses reticular activating system and inhibits release of hypothalamic and hypophyseal hormones

**Indications** – For the management of acute psychosis or agitated/violent behavior refractory to non-pharmacologic interventions

**Contraindications** – Documented hypersensitivity, Severe CNS depression (including coma), neuroleptic malignant syndrome, poorly controlled seizure disorder, Parkinson's disease



**WARNING:** Risk of sudden death, torsades de pointes, and prolonged QT interval from off-label IV administration of higher than recommended dose. Continuous cardiac monitoring is required if administering IV

### **Hydrocortisone succinate**

**Name** – Cortef®, SoluCortef®

**Class** - Corticosteroid

**Pharmacologic Action** - Glucocorticoid; elicits mild mineralocorticoid activity and moderate anti-inflammatory effects; controls or prevents inflammation by controlling rate of protein synthesis, suppressing migration of polymorphonuclear leukocytes (PMNs) and fibroblasts, and reversing capillary permeability

**Indications** – For the management of adrenal insufficiency

**Contraindications** - Untreated serious infections (except tuberculous meningitis or septic shock), idiopathic thrombocytopenic purpura, intrathecal administration (injection), documented hypersensitivity

### **Hydroxocobalamin**

**Name** – Cyanokit®

**Class** – Cyanide antidote

**Pharmacologic Action** - Vitamin B12 with hydroxyl group complexed to cobalt which can be displaced by cyanide resulting in cyanocobalamin that is renally excreted

**Indications** – For the management of cyanide toxicity

**Contraindications** – Documented hypersensitivity

**WARNING:** Will cause discoloration of the skin and urine, can interfere with pulse oximetry. Due to its interference with certain diagnostic blood tests, the performance of prehospital phlebotomy is preferable prior to the administration of hydroxocobalamin

### **Ibuprofen**

**Name** – There are multiple over-the-counter medications that include ibuprofen, such as Advil®, Motrin®

**Class** – Non-steroidal anti-inflammatory drug (NSAID)

**Pharmacologic Action** - Inhibits synthesis of prostaglandins in body tissues by inhibiting at least 2 cyclo-oxygenase (COX) isoenzymes, COX-1 and COX-2. May inhibit chemotaxis, alter lymphocyte activity, decrease proinflammatory cytokine activity, and inhibit neutrophil aggregation; these effects may contribute to anti-inflammatory activity

**Indications** – For the acute management of pain or as an antipyretic

**Contraindications** - Aspirin allergy; perioperative pain in setting of coronary artery bypass graft (CABG) surgery; preterm infants with untreated proven or suspected infection; bleeding with active intracranial hemorrhage or GI bleed; thrombocytopenia, coagulation defects, proven or necrotizing enterocolitis, significant renal impairment, congenital heart disease where patency or the patent ductus arteriosus (PDA) is necessary for pulmonary or systemic blood flow

### **Ipratropium**

**Name** – Atrovent®

**Class** – Anticholinergics, respiratory

**Pharmacologic Action** - Anticholinergic (parasympatholytic) agent; inhibits vagally mediated reflexes by antagonizing acetylcholine action; prevents increase in intracellular calcium concentration that is caused by interaction of acetylcholine with muscarinic receptors on bronchial smooth muscle

**Indications** – For the management of asthma and COPD

**Contraindications** - Documented hypersensitivity to ipratropium, atropine, or derivatives.

### **Ketamine**

**Name** – Ketalar®

**Class** – General anesthetics, systemic

**Pharmacologic Action** - Produces dissociative anesthesia. Blocks N-methyl D-aspartate (NMDA) receptor

**Indications** – For the management of agitated or violent behavior

**Contraindications** – Hypersensitivity

*RELATIVE/CONTROVERSIAL CONTRAINDICATIONS:* Head trauma, intracranial mass/hemorrhage, hypertension, angina, and stroke, underlying psychiatric disorder

*WARNING:* Overdose may lead to panic attacks and aggressive behavior; rarely seizures, increased ICP, and cardiac arrest. Very similar in chemical makeup to PCP (phencyclidine), but it is shorter acting and less toxic

### **Ketorolac**

**Name** - Toradol®

**Class** – Non-steroidal anti-inflammatory drug (NSAID)

**Pharmacologic Action** - Inhibits synthesis of prostaglandins in body tissues by inhibiting at least 2 cyclo-oxygenase (COX) isoenzymes, COX-1 and COX-2. May inhibit chemotaxis, alter lymphocyte activity, decrease proinflammatory cytokine activity, and inhibit neutrophil aggregation; these effects may contribute to anti-inflammatory activity

**Indications** – For the acute management of moderately severe pain

**Contraindications** – Allergy to aspirin, ketorolac, or other NSAIDs; women who are in active labor or are breastfeeding, significant renal impairment particularly when associated with volume depletion, previous or current GI bleeding, intracranial bleeding, coagulation defects, patients with a high risk of bleeding

### **Lidocaine**

**Name** – Lidocaine CV®, Lidopen®, Xylocaine®

**Class** – Class Ib antidysrhythmics

**Pharmacologic Action** - Class 1b antidysrhythmic; combines with fast sodium channels and thereby inhibits recovery after repolarization, resulting in decreasing myocardial excitability and conduction velocity

**Indications** – For the management of refractory or recurrent ventricular fibrillation or pulseless VT

**Contraindications** - Hypersensitivity to lidocaine or amide-type local anesthetic, Adams-Stokes syndrome, SA/AV/intraventricular heart block in the absence of artificial pacemaker. CHF, cardiogenic shock, second and third degree heart block (if no pacemaker is present), Wolff-Parkinson-White Syndrome

### **Lorazepam**

**Name** - Ativan®

**Class** – Anticonvulsants, other; antianxiety agent; anxiolytics; benzodiazepines

**Pharmacologic Action** - Sedative hypnotic with short onset of effects and relatively long half-life; by increasing the action of gamma-aminobutyric acid (GABA), which is a major inhibitory neurotransmitter in the brain, lorazepam may depress all levels of the CNS, including limbic and reticular formation

**Indications** – For the management of seizures, uncontrolled shivering in hypothermia, and for the management of agitated or violent patients suffering behavioral emergencies

**Contraindications** - Documented hypersensitivity, acute narrow angle glaucoma, severe respiratory depression, sleep apnea

### **Magnesium sulfate**

**Name** - MgSO<sub>4</sub>

**Class** – Class V antidysrhythmic, electrolyte

**Pharmacologic Action** - Depresses CNS, blocks peripheral neuromuscular transmission, produces anticonvulsant effects; decreases amount of acetylcholine released at end-plate by motor nerve impulse. Slows rate of sino-atrial (SA) node impulse formation in myocardium and prolongs conduction time. Promotes movement of calcium, potassium, and sodium in and out of cells and stabilizes excitable membranes

**Indications** – For the management of torsades de pointes or for severe bronchoconstriction with impending respiratory failure, seizure during the third trimester of pregnancy or in the postpartum patient

**Contraindications** – Hypersensitivity, myocardial damage, diabetic coma, heart block, hypermagnesemia, hypercalcemia

### **Methylprednisolone**

**Name** – Medrol®, Medrol Dosepak®, DepoMedrol®, SoluMedrol®

**Class** – Corticosteroid, anti-inflammatory agent

**Pharmacologic Action** - Potent glucocorticoid with minimal to no mineralocorticoid activity. Modulates carbohydrate, protein, and lipid metabolism and maintenance of fluid and electrolyte homeostasis. Controls or prevents inflammation by controlling rate of protein synthesis, suppressing

migration of polymorphonuclear leukocytes (PMNs) and fibroblasts, reversing capillary permeability, and stabilizing lysosomes at cellular level

**Indications** – For the management of acute bronchospastic disease as well as for adrenal insufficiency

**Contraindications** - Untreated serious infections, documented hypersensitivity, IM route is contraindicated in idiopathic thrombocytopenic purpura, traumatic brain injury (high doses)

### Metoclopramide

**Name** – Reglan®, Metozolv ODT®

**Class** – Antiemetic agent, prokinetic agent

**Pharmacologic Action** - Blocks dopamine receptors (at high dose) and serotonin receptors in chemoreceptor trigger zone of CNS; and sensitizes tissues to acetylcholine; increases upper GI motility but not secretions; increases lower esophageal sphincter tone

**Indications** – For the management of nausea and vomiting

**Contraindications** - Hypersensitivity to metoclopramide or procainamide, GI hemorrhage, mechanical obstruction, perforation, history of seizures, pheochromocytoma. Other drugs causing extrapyramidal symptoms (e.g. phenothiazines, butyrophenones)

### Metoprolol

**Name** – Lopressor®, Toprol XL®

**Class** – Beta blocker, beta-1 selective

**Pharmacologic Action** - Blocks response to beta-adrenergic stimulation; cardio selective for beta-1 receptors at low doses, with little or no effect on beta-2 receptors

**Indications** - For management of narrow complex tachycardias

**Contraindications** – Hypersensitivity. *When administered for hypertension or angina:* Sinus bradycardia, second or third degree AV block, cardiogenic shock, sick sinus syndrome (unless permanent pacemaker in place), severe peripheral vascular disease, pheochromocytoma. *When administered for myocardial infarction:* Severe sinus bradycardia with heart rate < 45 beats/minute, systolic BP < 100 mmHg, significant first-degree heart block (PR interval at least 0.24 seconds), moderate-to-severe cardiac failure

**WARNING:** May cause 1<sup>st</sup>, 2<sup>nd</sup>, or 3<sup>rd</sup> degree AV block

### Midazolam

**Name** – Versed®

**Class** - Anticonvulsants, other; antianxiety agent; anxiolytics; benzodiazepines

**Pharmacologic Action** - Binds receptors at several sites within the CNS, including the limbic system and reticular formation; effects may be mediated through gamma-aminobutyric acid (GABA) receptor system; increase in neuronal membrane permeability to chloride ions enhances the inhibitory effects of GABA; the shift in chloride ions causes hyperpolarization (less excitability) and stabilization of the neuronal membrane

**Indications** – For the management of seizures, uncontrolled shivering in hypothermia, and for the management of agitated or violent patients suffering behavioral emergencies

**Contraindications** - Documented hypersensitivity, severe respiratory depression, sleep apnea

**WARNING:** May cause respiratory depression, arrest, or apnea

### **Morphine Sulfate**

**Name** – MS Contin®, Avinza®, Depodur®, Duramorph®, Infumorph®, Astramorph®, Kadian®, MSO<sub>4</sub>

**Class** – Opioid analgesic

**Pharmacologic Action** - Narcotic agonist-analgesic of opiate receptors; inhibits ascending pain pathways, thus altering response to pain; produces analgesia, respiratory depression, and sedation; suppresses cough by acting centrally in medulla

**Indications** – Management of acute pain

**Contraindications** – Hypersensitivity, paralytic ileus, toxin-mediated diarrhea, respiratory depression, acute or severe bronchial asthma, upper airway obstruction, GI obstruction (extended release), hypercarbia (immediate release tablets/solution), upper airway obstruction (epidural/intrathecal), heart failure due to chronic lung disease, head injuries, brain tumors, deliriums tremens, seizure disorders, during labor when premature birth anticipated (injectable formulation), cardiac arrhythmia, increased intracranial or cerebrospinal pressure, acute alcoholism, use after biliary tract surgery, surgical anastomosis (suppository formulation)

### **Naloxone**

**Name** – Narcan®, Evzio®

**Class** – Opioid reversal agent

**Pharmacologic Action** - Competitive opioid antagonist; synthetic congener of oxymorphone

**Indications** – Reversal of acute opioid toxicity

**Contraindications** - Hypersensitivity

**WARNING:** Administration of naloxone can result in the sudden onset of opiate withdrawal (agitation, tachycardia, pulmonary edema, nausea, vomiting, and, in neonates, seizures)

### **Nifedipine**

**Name** – Procardia®, Adalat CC®, Nifedical®

**Class** - Calcium channel blocker

**Pharmacologic Action** - Calcium-channel blocker; inhibits transmembrane influx of extracellular calcium ions across myocardial and vascular smooth muscle cell membranes without changing serum calcium concentrations; this results in inhibition of cardiac and vascular smooth muscle contraction, thereby dilating main coronary and systemic arteries. Vasodilation with decreased peripheral resistance and increased heart rate

**Indications** – For the management of high altitude pulmonary edema (HAPE)

**Contraindications** - Hypersensitivity to nifedipine or other calcium-channel blockers, cardiogenic shock, concomitant administration with strong CYP3A4 inducers (e.g. rifampin, rifabutin,

phenobarbital, phenytoin, carbamazepine, St. John's wort) significantly reduces nifedipine efficacy, Immediate release preparation (sublingually or orally) for urgent or emergent hypertension

### **Nitrous Oxide**

**Name** – N<sub>2</sub>O

**Class** – Weak inhalational anesthetic

**Pharmacologic Action** - Its analgesic mechanism of action is described as opioid in nature and may involve a number of spinal neuromodulators. The anxiolytic effect is similar to that of benzodiazepine and may involve gamma aminobutyric (GABA) receptors. The anesthesia mechanism may involve GABA and possibly N-methyl-D-aspartate receptors as well.<sup>[6]</sup> In general, the effect of nitrous oxide ceases as soon as the inhalation stops, with no residual effect

**Indications** – Analgesia in the patient who is capable of self-administration of this medication

**Contraindications** – Significant respiratory compromise, suspected abnormal air-filled cavities (e.g. pneumothorax, bowel obstruction, air embolism)

**RELATIVE CONTRAINDICATIONS:** History of stroke, hypotension, pregnancy, known cardiac conditions, known vitamin B12 deficiency

### **Nitroglycerin**

**Name** – Nitrostat®, Nitrolingual Pumpspray®, NitroQuick®

**Class** – Nitrates, anti-anginal

**Pharmacologic Action** - Organic nitrate which causes systemic venodilation, decreasing preload. Cellular mechanism: nitrate enters vascular smooth muscle and converted to nitric oxide (NO) leading to activation of cyclic guanosine monophosphate (cGMP) and vasodilation. Relaxes smooth muscle via dose-dependent dilation of arterial and venous beds to reduce both preload and afterload, and myocardial O<sub>2</sub> demand. Also improves coronary collateral circulation. Lower BP, increases heart rate, occasional paradoxical bradycardia

**Indications** – As an anti-anginal medication for the management of chest pain as well as a reducer of preload for patients suffering from acute pulmonary edema

**Contraindications** - Hypersensitivity, acute myocardial infarction, severe anemia, recent use of erectile dysfunction medications (sildenafil (Viagra® – within last 24 hours), tadalafil (Cialis® – within last 48 hours), vardenafil (Levitra® – within last 48 hours), or other phosphodiesterase-5 inhibitors). There is potential for dangerous hypotension, narrow angle glaucoma (controversial: may not be clinically significant). Nitrates are contraindicated in the presence of hypotension (SBP < 90 mm Hg or ≥30 mm Hg below baseline), extreme bradycardia (< 50 bpm), tachycardia in the absence of heart failure (> 100 bpm), and right ventricular infarction

### **Norepinephrine**

**Name** – Levophed®, Levarterenol®

**Class** – Alpha/beta adrenergic agonist

**Pharmacologic Action** - Strong beta-1 and alpha-adrenergic effects and moderate beta-2 effects, which increase cardiac output and heart rate, decrease renal perfusion and peripheral vascular resistance, and cause variable BP effects

**Indications** – As a pressor agent used in the management of shock

**Contraindications** – Hypersensitivity, hypotension due to blood volume deficit, peripheral vascular thrombosis (except for lifesaving procedures)

*RELATIVE CONTRAINDICATIONS:* concomitant use with some general anesthetics: chloroform, trichloroethylene, cyclopropane, halothane

*WARNING:* Norepinephrine is a vesicant and can cause severe tissue damage if extravasation occurs. Do not use in the same IV line as alkaline solutions as these may deactivate it

### **Olanzapine**

**Name** – Zyprexa®

**Class** – Antipsychotic, second generation, antimanic agents

**Pharmacologic Action** - May act through combination of dopamine and serotonin type 2 receptor site antagonism

**Indications** – For the management of agitated or violent patients suffering a behavioral emergency

**Contraindications** - Documented hypersensitivity

*WARNING:* Patients are at risk for severe sedation (including coma) or delirium after each injection and must be observed for at least 3 hours in registered facility with ready access to emergency response services. Patients are at significant risk of severe sedation when olanzapine is administered with benzodiazepines or to patients who have are taking benzodiazepines

### **Ondansetron**

**Name** – Zofran®, Zofran ODT®, Zuplenz®

**Class** – Antiemetic, selective 5-HT3 antagonist

**Pharmacologic Action** - Mechanism not fully characterized; selective 5-HT3 receptor antagonist; binds to 5-HT3 receptors both in periphery and in CNS, with primary effects in GI tract. Has no effect on dopamine receptors and therefore does not cause extrapyramidal symptoms

**Indications** – For the management of nausea or vomiting

*NOTE:* EKG monitoring is recommended in patients who have electrolyte abnormalities, CHF, or bradyarrhythmias or who are also receiving other medications that cause QT prolongation

**Contraindications** – Hypersensitivity, coadministration with apomorphine; combination reported to cause profound hypotension and loss of consciousness

*WARNING:* May cause dose-dependent QT prolongation, avoid in patients with congenital long QT syndrome

### **Oxymetazoline**

**Name** – Afrin®, Duramist Plus®, Dristan 12 Hr®, Sinarest 12 Hour®, Vicks Sinus 12 Hour®

**Class** – Decongestants, intranasal

**Pharmacologic Action** - Alpha-adrenergic agonist; stimulates alpha-adrenergic receptors and produces vasoconstriction in the arterioles of the nasal mucosa

**Indications** – For the management of epistaxis in the patient suffering facial trauma

**Contraindications** - Hypersensitivity

### **Potassium iodide**

**Name** – Pima Syrup®, SSKI®, ThyroSafe®, ThyroShield®

**Class** – Antidotes, other; antithyroid agents

**Pharmacologic Action** – As a thyroid protective agent: Systemically circulating potassium iodide is readily taken up by thyroid gland by sodium/iodide transporter in basal membrane; blocking the thyroid uptake of radioactive isotopes of iodine; concentration gradient of thyroid gland to plasma is 20-50:1

**Indications** – Indicated during environmental radiation emergency to block uptake of radioactive iodine isotopes in thyroid and reduce risk of thyroid cancer

**Contraindications** - Iodine sensitivity (although allergy to radiocontrast media, contact dermatitis from iodine-containing antibacterials, allergy to seafood should not be considered evidence of potassium iodide allergy), hyperthyroidism, respiratory failure

### **Pralidoxime chloride (2-PAM)**

**Name** – Protopam®, 2PAM Antidote®, Pralidoxime Auto Injector®, a component of Mark I® kits and DuoDote®

**Class** – Cholinergic, toxicity antidote

**Pharmacologic Action** - Binds to organophosphates and breaks alkyl phosphate-cholinesterase bond to restore activity of acetylcholinesterase

**Indications** – For the management of toxicity caused by organophosphate insecticides and related nerve gases (e.g. tabun, sarin, soman)

**Contraindications** – Documented hypersensitivity

### **Procainamide**

**Name** – Pronestyl®, Procanbid®

**Class** – Class Ia antidysrhythmic

**Pharmacologic Action** - Class Ia (membrane stabilizing) antidysrhythmic agent; inhibits recovery after repolarization resulting in decreasing myocardial excitability and conduction velocity. Direct membrane depressant that decreases conduction velocity, prolongs refractoriness, decreases automaticity and reduces repolarization abnormalities

**Indications** – For the management of stable patients with regular, wide complex tachycardia

**Contraindications** - Hypersensitivity to procainamide or other ingredients, complete heart block, second or third degree AV block, systemic lupus erythematosus (SLE), torsades de pointes

*RELATIVE CONTRAINDICATION:* Patients with QT prolongation



### **Prochlorperazine**

**Name** – Compazine®

**Class** – Antiemetic agent; antipsychotics, phenothiazine

**Pharmacologic Action** - Antiemetic: antidopaminergic effect, blocking dopamine receptors in the brain, blocking vagus nerve in GI tract. Antipsychotic: Blocking mesolimbic dopamine receptors, and blocking alpha-adrenergic receptors (D1 and D2) in brain

**Indications** – For the management of nausea and vomiting

**Contraindications** - Documented hypersensitivity to phenothiazines, coma, severe CNS depression, concurrent use of large amounts of CNS depressants, poorly controlled seizure disorder, subcortical brain damage, pediatric surgery, children < 2 years or weighing < 9 kg

### **Sildenafil**

**Name** – Revatio®, Viagra®

**Class** – Pulmonary artery hypertension therapy, PDE-5 inhibitors; phosphodiesterase-5 enzyme inhibitor

**Pharmacologic Action** - Inhibits PDE-5, increasing cyclic guanosine monophosphate (cGMP) to allow smooth-muscle relaxation

**Indications** – As an adjunct to descent in the management of high altitude pulmonary edema (HAPE)

**Contraindications** - Concomitant use of organic nitrates in any form (e.g. nitroglycerin, isosorbide, illicit “poppers”) either regularly or intermittently, increases risk of severe or potentially fatal hypotension, hypersensitivity

**WARNING:** Hypotension may occur due to vasodilation

### **Sodium Bicarbonate**

**Name** - Bicarb

**Class** – Antidote, other

**Pharmacologic Action** - Increases blood and urinary pH by releasing a bicarbonate ion, which in turn neutralizes hydrogen ion concentrations

**Indications** – For the management of cardiac arrest in cases in which either hyperkalemia or tricyclic antidepressant (TCA) overdose are suspected as contributory, QRS prolongation in known or suspected TCA overdose

**Contraindications** – Documented hypersensitivity, severe pulmonary edema, known alkalosis, hypernatremia, or hypocalcemia

### **Sodium Nitrite**

**Name** - Nithiodote®

**Class** – Cyanide antidote

**Pharmacologic Action** - Nitrites create methemoglobins to bind to cyanide

**Indications** – For the management of cyanide toxicity

**Contraindications** – Documented hypersensitivity, suspected or confirmed smoke inhalation and/or carbon monoxide poisoning

**WARNING:** There is a risk of worsening hypoxia due to methemoglobin formation. In addition, sodium nitrite can cause serious adverse reactions and death from hypotension and methemoglobin formation. Monitor to ensure adequate perfusion and oxygenation during treatment with sodium nitrite

### **Sodium Thiosulfate**

**Name-** Nithiodote®

**Class** – Cyanide antidote

**Pharmacologic Action** - Thiosulfate is sulfur donor utilized by rhodenase to convert cyanide to less toxic thiocyanate

**Indications** – For the management of cyanide toxicity

**Contraindications** – Documented hypersensitivity

### **Sorbitol**

**Name** - Sorbitol

**Class** – Laxatives, osmotic

**Pharmacologic Action** - Polyalcoholic sugar with hyperosmotic effects

**Indications** – Administered for the management of patients suffering from toxic ingestions

**Contraindications** - Acute abdominal pain, nausea, vomiting, or other symptoms of appendicitis or undiagnosed abdominal pain, documented hypersensitivity

**WARNING:** Sorbitol is no longer recommended to be given with activated charcoal

### **Tadalafil**

**Name** – Cialis®, Adcirca®

**Class** – Pulmonary artery hypertension therapy, PDE-5 inhibitors; phosphodiesterase-5 enzyme inhibitor

**Pharmacologic Action** - Pulmonary arterial hypertension (PAH): inhibits PDE-5, increasing cyclic guanosine monophosphate (cGMP) to allow relaxation of pulmonary vascular smooth-muscle cells and vasodilation of pulmonary vasculature

**Indications** – As an adjunct to descent in the management of high altitude pulmonary edema (HAPE)

**Contraindications** - Concomitant use of any form of organic nitrates (e.g. nitroglycerin, isosorbide dinitrate, isosorbide mononitrate, illicit "poppers"), either regularly or intermittently; may potentiate hypotensive effect of nitrates. Hypersensitivity, including Stevens-Johnson syndrome and exfoliative dermatitis

**WARNING:** Hypotension may occur due to vasodilation

### **Ziprasidone**

**Name** - Geodon®

**Class** – Second generation antipsychotic

**Pharmacologic Action** - Acts as antagonist at dopamine-2 and serotonin type 1 and 2 (5HT1D, 5HT2A) receptors; acts as agonist at serotonin 5HT1A receptor; moderately inhibits reuptake of norepinephrine and serotonin; has alpha-blocking and antihistaminic activity

**Indications** – For the management of agitated or violent patients suffering a behavioral emergency

**Contraindications** - Documented hypersensitivity, any drugs or conditions that prolong QT interval, recent acute myocardial infarction, uncompensated heart failure

## IV. Approved Abbreviations

The following is the Project's list of approved medical abbreviations used in this document:

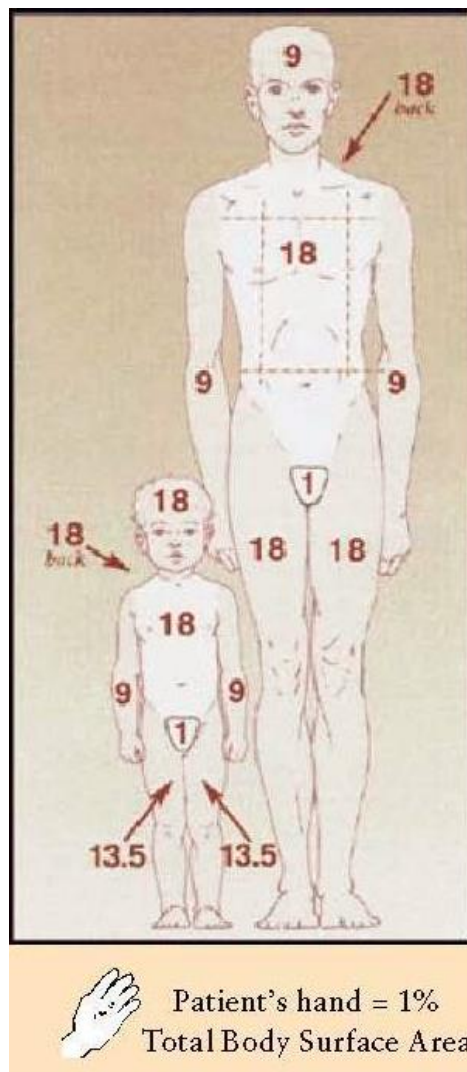
< ( $\leq$ )	less than (less than or equal to)
> ( $\geq$ )	more/greater than (more/greater than or equal to)
ACS	acute coronary syndrome
AED	automatic external defibrillator
A-FIB	atrial fibrillation
ALS	advanced life support
AMS	altered mental status
ASA	aspirin
AV	atrioventricular
BLS	basic life support
BP	blood pressure
BPM	beats per minute
BSA	body surface area
BVM	bag-valve-mask
CABG	coronary artery bypass graft
CAD	coronary artery disease
CC	chief complaint
CDC	Centers for Disease Control and Prevention
CHF	congestive heart failure
CNS	central nervous system
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
COPD	chronic obstructive pulmonary disease
CP	chest pain
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
C-SECTION	caesarean section
C-SPINE	cervical spine
CT	cat scan, Cardiac Technician
CVA	cerebrovascular accident (stroke)
D5W	5% dextrose in water
DKA	diabetic ketoacidosis
DNI	do not intubate
DNR	do not resuscitate
DT	delirium tremens
Dx	diagnosis
EKG	electrocardiogram

EEG	electroencephalogram
EENT	eye, ear, nose, and throat
EMS	emergency medical services
EMT	emergency medical technician
ET	endotracheal
ETA	estimated time of arrival
ETCO <sub>2</sub>	end-tidal CO <sub>2</sub>
ETOH	ethanol (alcohol)
ETT	endotracheal tube
FBAO	foreign body airway obstruction
FiO <sub>2</sub>	fraction of inspired oxygen
g	gram(s)
GI	gastrointestinal
gtts	drops
GU	gastrourinary
GYN	gynecology (gynecological)
HR	heart rate (hour)
ICU	intensive care unit
IM	intramuscular
IO	intraosseous
IV	Intravenous
IVP	intravenous push
J	joules
JVD	jugular vein distension
kg	kilogram
KVO	keep vein open
LPM	liters per minutes
LR	lactated ringers
mcg	microgram(s)
MED	medicine
mg	milligram(s)
MI	myocardial infarction (heart attack)
mmol	millimole
MOLST	medical orders for life-sustaining treatment
MS	mental status
msec	millisecond
MVC	motor vehicle crash
N/V	nausea/vomiting
NC	nasal cannula
NRB	non-rebreather
NS	normal saline
NSR	normal sinus rhythm

OB/GYN	obstetrics/gynecology
O <sub>2</sub>	oxygen
P	pulse
PAC	premature atrial contraction
PE	pulmonary embolus
PEA	pulseless electrical activity
PO	orally
POLST	physician orders for life-sustaining treatment
PPE	personal protection equipment
prn	as needed
PVC	premature ventricular contraction
q	every (e.g. q 3-5 minutes)
RR	respiratory rate
Rx	medicine
sat	saturation
SBP	systolic blood pressure
SC	subcutaneous
SL	sublingual
SOB	shortness of breath
ST	sinus tachycardia
SVT	supraventricular tachycardia
T	temperature
TBSA	total body surface area
TCA	tricyclic antidepressants
TIA	transient ischemic attack
TID	three times a day
TKO	to keep open
VF	ventricular fibrillation
VS	vital signs
VT	ventricular tachycardia
yo	years old (years of age)

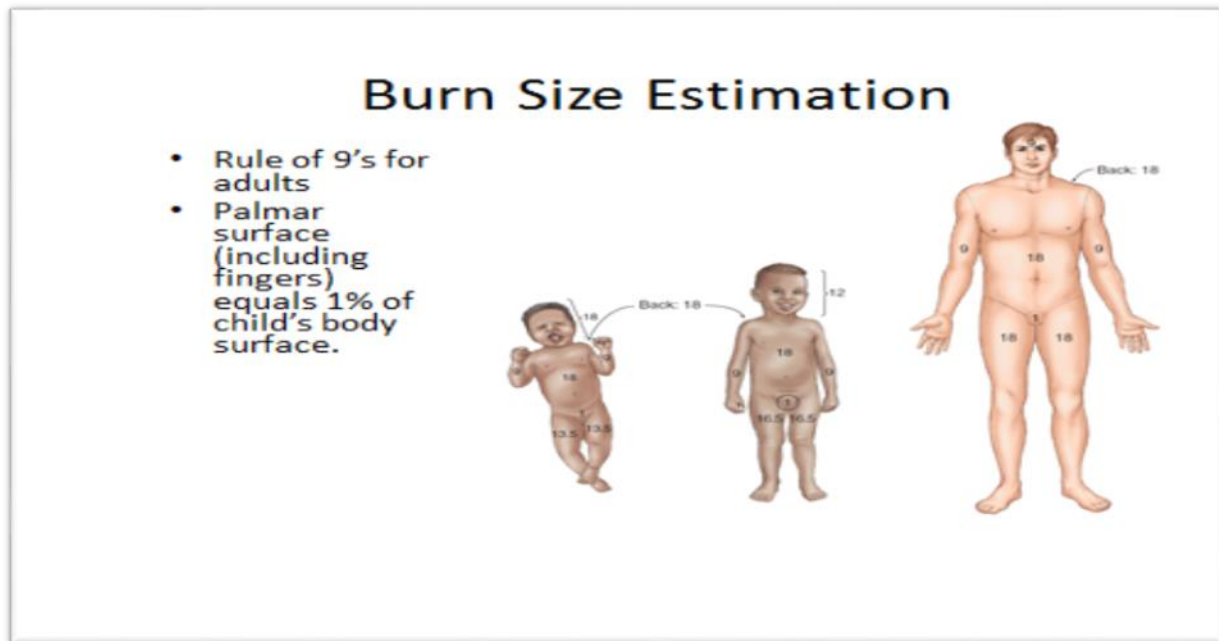
## V. Burn and Burn Fluid Charts

**Burn Size Chart 1**



Source: Used with permission, University of Utah Burn Center

## Burn Size Chart 2



Source: American Heart Association, *Pediatric Advanced Life Support Textbook*, 2013



**Percentage of Total Body Surface Area by Age, Anatomic Structure, and Body Habitus**

***Adult***

**Anatomic structure    Surface area**

Anterior head	4.5%
Posterior head	4.5%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	9%
Posterior leg, each	9%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia, perineum	1%

***Adult, obese > 80 kg***

**Anatomic structure    Surface area**

Head and neck	2%
Anterior torso	25%
Posterior torso	25%
Leg, each	20%
Arm, each	5%
Genitalia/perineum	0%

***Child***

**Anatomic structure    Surface area**

Anterior head	9%
Posterior head	9%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	6.75%
Posterior leg, each	6.75%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia/perineum	1%

***Infant < 10 kg***

**Anatomic structure    Surface area**

Head and neck	20%
Anterior torso	16%
Posterior torso	16%
Leg, each	16%
Arm, each	8%
Genitalia/perineum	1%

### **Parkland Formula**

For patients who require fluid resuscitation, consider use of the Parkland formula to calculate the volume of normal saline or Lactated Ringer's solution that should be administered intravenously to ensure hemodynamic stability.

Volume of Intravenous Fluid required in the first 24 hours (in ml) =  
(4 X patient weight in kg) X (Percentage of total body surface area burned)

The first half of the volume of fluid should be administered over the first 8 hours following the burn with the remaining fluid administered over the following 16 hours.

For pediatric patients, a weight-based assessment tool (length-based tape or other system) should be used to provide a more accurate estimate of the patient's weight. Likewise, the total body surface area (BSA) estimates are different for pediatric patients compared to adults due to larger head and trunk size. For children, the palmar surface of the hand (not including the fingers) is approximately equal to 1% BSA. The guidelines listed above will provide assistance during the estimation of the percentage of total body surface area burned for patients of various ages and body habitus.

## Burn Injury IV Fluid Rates Fluid Infusion Rate > 30 KG

\*Fluid of choice LR/NS, DO NOT use dextrose containing fluids

Wt (lbs)	Wt (kg)	% TBSA	/Hr for 1 <sup>st</sup> 8 Hrs of care	60 gtt set, gtt/min	20 gtt set, gtt/min	15 gtt set, gtt/min	10 gtt set, gtt/min
66	30	10	75	75	25.0	18.8	12.5
66	30	20	150	150	50.0	37.5	25.0
66	30	30	225	225	75.0	56.3	37.5
66	30	40	300	300	100.0	75.0	50.0
66	30	50	375	375	125.0	93.8	62.5
66	30	60	450	450	150.0	112.6	75.0
88	40	10	100	100	33.3	25.0	16.7
88	40	20	200	200	66.7	50.0	33.3
88	40	30	300	300	100.0	75.0	50.0
88	40	40	400	400	133.3	100.0	66.7
88	40	50	500	500	166.7	125.00	83.3
88	40	60	600	600	200.0	150.0	100.0
110	50	10	125	125	41.7	31.3	20.8
110	50	20	250	250	83.3	62.5	41.7
110	50	30	375	375	125.0	93.8	62.5
110	50	40	500	500	166.7	125.0	83.3
110	50	50	625	625	208.3	156.3	104.2
110	50	60	750	750	250.0	187.6	125.0
132	60	10	150	150	50.0	37.5	25.0
132	60	20	300	300	100.0	75.0	50.0
132	60	30	450	450	150.0	112.5	75.0
132	60	40	600	600	200.0	150.0	100.0
132	60	50	750	750	250.0	187.5	125.0
132	60	60	900	900	300.0	225.0	150.0
154	70	10	175	175	58.3	43.8	29.2
154	70	20	350	350	116.7	87.5	58.3
154	70	30	525	525	175.0	131.3	87.5
154	70	40	700	700	233.3	175.0	116.7
154	70	50	875	875	291.7	218.8	145.8
154	70	60	1050	1050	350.0	262.6	175.0
176	80	10	200	200	66.7	50.0	33.3
176	80	20	400	400	133.3	100.0	66.7
176	80	30	600	600	200.0	150.0	100.0
176	80	40	800	800	266.7	200.0	133.3
176	80	50	1000	1000	333.3	250.0	166.7
176	80	60	1200	1200	400.0	300.0	200.0
198	90	10	225	225	75.0	56.3	37.5
198	90	20	450	450	150.0	112.5	75.0
198	90	30	675	675	225.0	168.8	112.5
198	90	40	900	900	300.0	225.0	150.0
198	90	50	1125	1125	375.0	281.3	187.5
198	90	60	1350	1350	450.0	337.6	225.0
220	100	10	250	250	83.3	62.5	41.7
220	100	20	500	500	166.7	125.0	83.3
220	100	30	750	750	250.0	187.5	125.0
220	100	40	1000	1000	333.3	250.0	166.7
220	100	50	1250	1250	416.7	312.5	208.3
220	100	60	1500	1500	500.0	375.0	250.0
242	110	10	275	275	91.6	68.7	45.9
242	110	20	550	550	183.4	137.5	91.6
242	110	30	825	825	275	206.2	137.5
242	110	40	1100	1100	366.6	275.0	183.4
242	110	50	1375	1375	458.4	343.7	229.1
242	110	60	1650	1650	550.0	412.4	275
264	120	10	300	300	99.9	74.9	50.1
264	120	20	600	600	200.1	150.0	99.9
264	120	30	825	825	300.0	224.9	150.0
264	120	40	1200	1200	399.9	300.0	200.1
264	120	50	1500	1500	500.1	374.9	249.9
264	120	60	1650	1650	600.0	449.8	300

Patients with traumatic injuries may require additional fluids.

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## Burn Injury IV Fluid Rates Fluid Infusion Rate < 30 KG

\*Fluid of choice LR/NS, DO NOT use dextrose containing fluids

Wt (lbs)	Wt (kg)	% TBSA	/Hr for 1 <sup>st</sup> 8 Hrs of care	60 gtt set, gtt/min	20 gtt set, gtt/min	15 gtt set, gtt/min	10 gtt set, gtt/min
11	5	10	12.5	12.5	4.2	3.2	2.1
11	5	20	25	25	8.3	6.3	4.2
11	5	30	37.5	37.5	12.5	9.5	6.3
11	5	40	50	50	16.7	12.5	8.3
11	5	50	62.5	62.5	20.8	15.7	10.5
11	5	60	75	75	25	18.7	12.5
22	10	10	25	25	8.4	6.4	4.1
22	10	20	50	50	16.6	12.5	8.4
22	10	30	75	75	25	18.9	12.5
22	10	40	100	100	33.3	25	16.6
22	10	50	125	125	41.6	31.4	20.9
22	10	60	150	150	50	37.4	25
27.5	12.5	10	31.3	31.3	10.5	7.5	5.2
27.5	12.5	20	62.5	62.5	20.8	15.7	10.5
27.5	12.5	30	93.8	93.8	31.3	23.6	15.7
27.5	12.5	40	125	125	41.7	31.7	21
27.5	12.5	50	156.2	156.2	52.1	39.8	26.3
27.5	12.5	60	187.4	187.4	62.5	47.9	31.6
33	15	10	37.5	37.5	12.6	8.5	6.2
33	15	20	75	75	25	18.8	12.6
33	15	30	112.5	112.5	37.5	28.3	18.8
33	15	40	150	150	50	37.5	25
33	15	50	187.5	187.5	62.5	46.7	31.2
33	15	60	225	225	75	55.9	37.4
38.5	17.5	10	43.8	43.8	14.7	10.6	7.3
38.5	17.5	20	87.5	87.5	29.2	21.9	14.7
38.5	17.5	30	131.3	131.3	43.8	33	21.9
38.5	17.5	40	175	175	58.3	44.2	29.2
38.5	17.5	50	218.7	218.7	72.8	55.4	36.5
38.5	17.5	60	262.4	262.4	87.3	66.6	43.8
44	20	10	50	50	16.7	12.6	8.3
44	20	20	100	100	33.3	25	16.7
44	20	30	150	150	50	37.6	25
44	20	40	200	200	66.7	50	33.3
44	20	50	250	250	83.3	62.6	41.7
44	20	60	300	300	100	75	50
49.6	22.5	10	56.3	56.3	18.8	14.2	9.4
49.6	22.5	20	112.5	112.5	37.5	28.1	18.8
49.6	22.5	30	168.8	168.8	56.3	42.3	28.2
49.6	22.5	40	225	225	75	56.4	37.6
49.6	22.5	50	281.2	281.2	93.7	70.5	47
49.6	22.5	60	337.4	337.4	112.5	84.6	56.4
55.1	25	10	62.5	62.5	20.9	15.7	10.4
55.1	25	20	125	125	41.7	31.2	20.9
55.1	25	30	187.5	187.5	62.5	47	31.3
55.1	25	40	250	250	83.4	62.5	41.8
55.1	25	50	312.5	312.5	104.2	78	52.3
55.1	25	60	375	375	125	93.5	62.8
60.6	27.5	10	68.8	68.8	23	17.3	11.5
60.6	27.5	20	137.5	137.5	45.9	34.4	23
60.6	27.5	30	206.2	206.2	68.8	51.7	34.4
60.6	27.5	40	274.9	274.9	91.7	79.7	53.3
60.6	27.5	50	343.6	343.6	114.6	96.9	64.8
60.6	27.5	60	412.4	412.4	137.5	114.1	76.3
66	30	10	75	75	25.0	18.8	12.5
66	30	20	150	150	50.0	37.5	25.0
66	30	30	225	225	75.0	56.3	37.5
66	30	40	300	300	100.0	75.0	50.0
66	30	50	375	375	125.0	93.8	62.5
66	30	60	450	450	150.0	112.6	75.0

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## VI. Neurologic Status Assessment

Neurologic status assessment involves establishing a baseline and then trending any change in patient neurologic status. Glasgow Coma Score (GCS) is frequently used, but there are often errors in applying and calculating this score. With this in consideration, Glasgow Coma Score may not be more valid than a simpler field approach. Either AVPU (Alert, Verbal, Painful, Unresponsive – see below) or only the motor component of the GCS may more effectively serve in this capacity.

Glasgow Coma Score			
	Points	Pediatric	Adult
<b>Eyes</b>	1	No eye opening	
	2	Eye opening to pain	
	3	Eye opening to verbal	
	4	Eyes open spontaneously	
<b>Verbal</b>	1	No vocalization	No verbal response
	2	Inconsolable, agitated	Incomprehensible sounds
	3	Inconsistently consolable, moaning	Inappropriate words
	4	Cries but consolable, inappropriate interactions	Confused
	5	Smiles, oriented to sounds, follows objects, interacts	Oriented
<b>Motor</b>	1	No motor response	
	2	Extension to pain	
	3	Flexion to pain	
	4	Withdraws from pain	
	5	Localizes pain	
	6	Obeys commands	

### AVPU

**A:** The patient is alert

**V:** The patient responds to verbal stimulus

**P:** The patient responds to painful stimulus

**U:** The patient is completely unresponsive

## VII. Normal Vital Signs

Age	Heart Rate	Resp Rate	Systolic BP	Temp (°C)
0 d – 1 m	> 205	> 60	< 60	<36 or >38
≥ 1 m - 3 m	> 205	> 60	< 70	<36 or >38
≥ 3 m - 1 r	> 190	> 60	< 70	<36 or >38.5
≥ 1 y - 2 y	> 190	> 40	< 70 + (age in yr × 2)	<36 or >38.5
≥ 2 y - 4 y	> 140	> 40	< 70 + (age in yr × 2)	<36 or >38.5
≥ 4 y - 6 y	> 140	> 34	< 70 + (age in yr × 2)	<36 or >38.5
≥ 6 y - 10 y	> 140	> 30	< 70 + (age in yr × 2)	<36 or >38.5
≥ 10 y - 13 y	> 100	> 30	< 90	<36 or >38.5
> 13 y	> 100	>16	< 90	<36 or >38.5

## VIII. Evidence-based Guidelines - Grade Methodology

### An Overview of GRADE Methodology

Although engagement in quality EMS research has increased significantly, the demand for evidence-based quality prehospital research continues to exceed its availability. The need for evidence-based prehospital patient care protocols was clearly recognized by the Institute of Medicine of the National Academies and clearly stated in 2007 in *The Future of Emergency Care: Emergency Medical Services at the Crossroads*.

The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology is a transparent process where the available research is reviewed and assessed by a panel of subject matter experts. Following this thorough review process, the available research is reviewed and graded for its validity based upon the assessment of the workgroup, and an evidence-based guideline (EBG) is developed based upon the outcome of the workgroup.

The Federal Interagency Committee on Emergency Medical Services (FICEMS) and the National EMS Advisory Council (NEMSAC) approved a National Prehospital Evidence-based Guideline Model Process for the development, implementation, and evaluation of evidence-based guidelines. This Model Process recommends the use of the GRADE methodology for the guideline development tool. The six process steps of the GRADE EBG development tool are:

- Assemble the expert panel and provide GRADE training
- Define the EBG content area and establish the specific clinical questions to address in patient, intervention, comparison, and outcome (PICO) format
- Prioritize outcomes to facilitate systematic literature searches
- Create GRADE tables (or evidence profiles) for each PICO question
- Vet and endorse GRADE evidence tables and draft recommendations
- Synthesize recommendations into an EMS protocol and visual algorithm

The current evidence-based guidelines cited in this document were created for and released by NHTSA; however, the GRADE methodology is not proprietary to NHTSA or any other organization. Local, regional, and state EMS agencies and EMS systems are encouraged to support the ongoing need for quality prehospital care, improved patient outcome, and the growing demand for EBGs for EMS.

#### References:

Brown KM. The development of evidence-based prehospital guidelines using a GRADE-based methodology, *Prehospital Emergency Care*, 2014, Suppl 1:3-14, 2014