

# National Model EMS Clinical Guidelines

January 2019

VERSION 2.2

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.

# Contents

<b>INTRODUCTION</b> .....	<b>5</b>
<b>PURPOSE AND NOTES</b> .....	<b>6</b>
TARGET AUDIENCE.....	7
NEW IN THE 2017 EDITION .....	7
ACKNOWLEDGEMENTS .....	7
<b>UNIVERSAL CARE</b> .....	<b>8</b>
UNIVERSAL CARE GUIDELINE .....	8
FUNCTIONAL NEEDS.....	16
PATIENT REFUSALS .....	20
<b>CARDIOVASCULAR</b> .....	<b>23</b>
ADULT AND PEDIATRIC SYNCOPE AND PRESYNCOPE.....	23
CHEST PAIN/ACUTE CORONARY SYNDROME (ACS)/ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) .....	27
BRADYCARDIA .....	30
IMPLANTABLE VENTRICULAR ASSIST DEVICES .....	34
TACHYCARDIA WITH A PULSE .....	37
SUSPECTED STROKE/TRANSIENT ISCHEMIC ATTACK .....	43
<b>GENERAL MEDICAL</b> .....	<b>46</b>
ABDOMINAL PAIN.....	46
ABUSE AND MALTREATMENT.....	49
AGITATED OR VIOLENT PATIENT/BEHAVIORAL EMERGENCY .....	53
ANAPHYLAXIS AND ALLERGIC REACTION .....	59
ALTERED MENTAL STATUS .....	64
BACK PAIN .....	67
END-OF-LIFE CARE/PALLIATIVE CARE.....	70
HYPERGLYCEMIA .....	73
HYPOGLYCEMIA.....	76
NAUSEA-VOMITING .....	80
PAIN MANAGEMENT.....	83
SEIZURES.....	91
SHOCK .....	96
SICKLE CELL PAIN CRISIS .....	102
<b>RESUSCITATION</b> .....	<b>105</b>
CARDIAC ARREST (VF/VT/ASYSTOLE/PEA) .....	105
ADULT POST-ROSC (RETURN OF SPONTANEOUS CIRCULATION) CARE .....	114
DETERMINATION OF DEATH/WITHHOLDING RESUSCITATIVE EFFORTS .....	117
DO NOT RESUSCITATE STATUS/ADVANCE DIRECTIVES/HEALTHCARE POWER OF ATTORNEY (POA) STATUS .....	120
TERMINATION OF RESUSCITATIVE EFFORTS .....	123
<b>PEDIATRIC-SPECIFIC GUIDELINES</b> .....	<b>128</b>
BRIEF RESOLVED UNEXPLAINED EVENT (BRUE).....	128
PEDIATRIC RESPIRATORY DISTRESS (BRONCHIOLITIS) .....	133
PEDIATRIC RESPIRATORY DISTRESS (CROUP) .....	138
NEONATAL RESUSCITATION .....	142

<b>OB/GYN .....</b>	<b>146</b>
CHILD BIRTH .....	146
ECLAMPSIA/PRE-ECLAMPSIA .....	150
OBSTETRICAL AND GYNECOLOGICAL CONDITIONS .....	154
<b>RESPIRATORY.....</b>	<b>157</b>
AIRWAY MANAGEMENT .....	157
BRONCHOSPASM (DUE TO ASTHMA AND OBSTRUCTIVE LUNG DISEASE).....	167
PULMONARY EDEMA.....	174
<b>TRAUMA.....</b>	<b>178</b>
GENERAL TRAUMA MANAGEMENT .....	178
BLAST INJURIES .....	184
BURNS.....	188
CRUSH INJURY.....	192
EXTREMITY TRAUMA/EXTERNAL HEMORRHAGE MANAGEMENT .....	195
FACIAL/DENTAL TRAUMA .....	200
HEAD INJURY .....	203
HIGH THREAT CONSIDERATIONS/ACTIVE SHOOTER SCENARIO.....	208
SPINAL CARE.....	211
<b>TOXINS AND ENVIRONMENTAL.....</b>	<b>218</b>
POISONING/OVERDOSE UNIVERSAL CARE.....	218
ACETYLCHOLINESTERASE INHIBITORS (CARBAMATES, NERVE AGENTS, ORGANOPHOSPHATES) EXPOSURE.....	226
RADIATION EXPOSURE.....	237
TOPICAL CHEMICAL BURN .....	240
STIMULANT POISONING/OVERDOSE .....	244
CYANIDE EXPOSURE .....	248
BETA BLOCKER POISONING/OVERDOSE.....	252
BITES AND ENVENOMATION .....	256
CALCIUM CHANNEL BLOCKER POISONING/OVERDOSE .....	260
CARBON MONOXIDE/SMOKE INHALATION.....	264
OPIOID POISONING/OVERDOSE .....	267
AIRWAY RESPIRATORY IRRITANTS .....	272
RIOT CONTROL AGENTS.....	281
HYPERTHERMIA/HEAT EXPOSURE.....	284
HYPOTHERMIA/COLD EXPOSURE.....	289
DROWNING .....	296
DIVE (SCUBA) INJURY/ACCIDENTS .....	300
ALTITUDE ILLNESS .....	303
CONDUCTED ELECTRICAL WEAPON INJURY (E.G. TASER®).....	307
ELECTRICAL INJURIES .....	310
LIGHTNING/LIGHTNING STRIKE INJURY .....	314
<b>APPENDICES.....</b>	<b>319</b>
I. AUTHOR, REVIEWER AND STAFF INFORMATION .....	319
II. PUBLIC REVIEW COMMENT CONTRIBUTORS .....	326
III. UNIVERSAL DOCUMENTATION GUIDELINE.....	327
IV. MEDICATIONS.....	341
V. APPROVED ABBREVIATIONS.....	358

VI. BURN AND BURN FLUID CHARTS ..... 362  
VII. NEUROLOGIC STATUS ASSESSMENT ..... 368  
VIII. ABNORMAL VITAL SIGNS..... 369  
IX. EVIDENCE-BASED GUIDELINES: GRADE METHODOLOGY ..... 370  
X. 2011 GUIDELINES FOR FIELD TRIAGE OF INJURED PATIENTS ..... 371

## Introduction

The inaugural edition of the National Association of State EMS Officials (NASEMSO) National Model EMS Clinical Guidelines was released in September 2014 and has been warmly welcomed by EMS practitioners, agencies, medical directors, and healthcare organizations in our nation as well as abroad. The creation of this document was a pinnacle event in the profession and medical practice of EMS as it fulfilled a recommendation in *The Future of Emergency Care: Emergency Medical Services at the Crossroads* published by the Institute of Medicine (now the National Academies of Sciences) in 2007. Specifically, this report 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 Traffic Safety Administration’s Office of EMS (NHTSA OEMS) has embraced this recommendation with the development of the Evidence-Based Guideline Project and continued support of the NASEMSO National EMS Model Clinical Guidelines.

The National Association of State EMS Officials recognizes the need for national EMS clinical guidelines to help state EMS systems ensure a more standardized approach to the current practice of patient care and, as experience dictates, adoption of future practices. Model EMS clinical guidelines promote uniformity in prehospital care which, in turn, promotes more consistent practice as EMS providers move across healthcare systems. They also provide a standard to EMS medical directors upon which to base practice. Supported by initial and subsequent grant funding from NHTSA OEMS and the Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau’s EMS for Children Program, NASEMSO authorized its Medical Directors Council to partner with national stakeholder organizations with expertise in EMS direct medical oversight 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 National 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 and to 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. NASEMSO’s ongoing support of this project underlines the critical evolution of the practice of EMS medicine as new EMS research and evidence-based patient care measures emerge in the future. We are grateful to be able to continue the work on this initiative considering the group of talented, committed individuals we have been fortunate to call our partners in the endeavor.

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Co-Principal Investigator

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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 Directors 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 IV – Medications](#).

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.

Quality assurance (QA) and/or continued performance improvement (CPI) programs are indispensable elements of direct medical oversight as they facilitate the identification of gaps and potential avenues of their resolution within an EMS system. Since the release of the inaugural document, the EMS Compass® project, which was led by NASEMSO, was tasked with the mission of improving systems of care through meaningful measures. This edition of the NASEMSO National Model EMS Clinical Guidelines has incorporated the existing EMS Compass® performance measures into the key performance measures associated with each clinical guideline.

## 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.

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.

## New in the 2017 Edition

All of the 2014 guidelines have been reviewed and updated, and additional guidelines and new evidence-based guidelines have been added to this edition. While some of the new material has been added as guidelines in the appropriate chapter, other topics have been incorporated into a previously existing guideline. New content has been added to the 2017 edition for the following clinical conditions or scenarios (as stand-alone guidelines or content in related guidelines):

Abdominal Pain	Human Trafficking
Active Shooter Incidents	Hypertension
Airway/Respiratory Irritants	Impaled Objects
Amputation	Riot Control Agents
Back Pain	Sickle Cell Pain Crisis
Cardiac Devices	Termination of Resuscitative Efforts
Crush Syndrome	Tracheostomy/Laryngectomy
End-of-Life Palliative Care	

## Acknowledgements

The authors of this document are NASEMSO Medical Directors 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).

In honor and gratitude, the authors of the inaugural NASEMSO National Model EMS Clinical Guidelines are also included. Their invaluable contributions and expertise to build the foundation of this evolutionary document will always be deeply respected and appreciated.

# Universal Care

## Universal Care Guideline

### Aliases

Patient assessment, patient history, physical assessment, primary survey, secondary survey

### 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
  - a. Evaluate for hazards to EMS personnel, patient, bystanders
  - b. Determine number of patients
  - c. Determine mechanism of injury
  - d. Request additional resources if needed and weigh the benefits of waiting for additional resources against rapid transport to definitive care
  - e. Consider declaration of mass casualty incident if needed
2. Use appropriate personal protective equipment (PPE)
3. Wear high-visibility, retro-reflective apparel when deemed appropriate (e.g. operations at night or in darkness, on or near roadways)
4. Consider cervical spine stabilization and/or spinal care if trauma
5. Primary survey  
(**A**irway, **B**reathing, **C**irculation is cited below; although there are specific circumstances where **C**irculation, **A**irway, **B**reathing may be indicated such as cardiac arrest or major arterial bleeding)
  - 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
      5. For patients with laryngectomies or tracheostomies, remove all objects or clothing that may obstruct the opening of these devices, maintain the flow of prescribed oxygen, and reposition the head and/or neck



- ii. Obstructed airway, laryngectomy, or tracheostomy – go to [Airway Management guideline](#)
  - b. Breathing
    - i. Evaluate rate, breath sounds, accessory muscle use, retractions, patient positioning
    - ii. Administer oxygen as appropriate with a target of achieving 94-98% saturation for most acutely ill patients
    - iii. Apnea (not breathing) – go to [Airway Management guideline](#)
  - c. Circulation
    - i. Control any major external bleeding [see [Extremity Trauma/External Hemorrhage Management guideline](#)]
    - ii. Assess pulse
      - 1. If none – go to [Cardiac Arrest guideline](#)
      - 2. Assess rate and quality of carotid and radial pulses
    - iii. Evaluate perfusion by assessing skin color and temperature
      - 1. Evaluate capillary refill
  - d. Disability
    - i. Evaluate patient responsiveness: AVPU scale (Alert, Verbal, Pain, Unresponsive)
    - ii. Evaluate gross motor and sensory function in all extremities
    - iii. Check 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
- 6. 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
    - iii. Spinal tenderness
  - 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
  - e. Neurologic
    - i. Mental status/orientation
    - ii. Motor/sensory
- 7. Obtain Baseline Vital Signs (An initial full set of vital signs is required: pulse, blood pressure, respiratory rate, neurologic status assessment)
  - a. Neurologic status assessment [see [Appendix VII](#)] involves establishing a baseline and then trending any change in patient neurologic status
    - i. Glasgow Coma Score (GCS) is frequently used, but there are often errors in applying and calculating this score. With this in consideration, a simpler field approach may be as valid as GCS. Either AVPU (**A**lert, **V**erbal, **P**ainful, **U**nresponsive) 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 or suspected cardiac complaints
    - iii. Continuous cardiac monitoring, if available
    - iv. Consider waveform capnography (essential for patients who require invasive airway management) or digital capnometry
  - c. Patient with altered mental status
    - i. Check blood glucose
    - ii. Consider waveform capnography (essential for patients who require invasive airway management) or digital capnometry
  - 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
- 8. Obtain OPQRST history:
  - a. **O**nset of symptoms
  - b. **P**rovocation – location; any exacerbating or alleviating factors
  - c. **Q**uality of pain
  - d. **R**adiation of pain
  - e. **S**everity of symptoms – pain scale
  - f. **T**ime of onset and circumstances around onset
- 9. Obtain SAMPLE history:
  - a. **S**ymptoms
  - b. **A**llergies – medication, environmental, and foods
  - c. **M**edications – prescription and over-the-counter; bring containers to ED if possible
  - d. **P**ast 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**ast oral intake
  - f. **E**vents leading up to the 911 call
    - In patients with syncope, seizure, altered mental status, or acute stroke, consider bringing the witness to the hospital or obtain their contact phone number to provide to ED care team

### **Treatment and Interventions**

1. Administer oxygen as appropriate with a target of achieving 94-98% saturation
2. Place appropriate monitoring equipment as dictated by assessment – these may include:
  - a. Continuous pulse oximetry
  - b. Cardiac rhythm monitoring
  - c. Waveform capnography or digital capnometry
  - d. Carbon monoxide assessment
3. Establish vascular access if indicated or in patients who are at risk for clinical deterioration.
  - a. If IO is to be used for a conscious patient, consider the use of .5 mg/kg of lidocaine 0.1mg/mL with slow push through IO needle to a maximum of 40 mg to mitigate pain from IO medication administration
4. Monitor pain scale if appropriate
5. Reassess patient

### **Patient Safety Considerations**

1. Routine use of lights and sirens is not warranted
2. Even when lights and sirens are in use, always limit speeds to level that is safe for the emergency vehicle being driven and road conditions on which it is being operated
3. 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)
4. Be aware of potential need to adjust management based on patient age and comorbidities, including medication dosages
5. 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
6. Direct medical oversight should be contacted when mandated or as needed
7. Consider air medical transport, if available, for patients with time-critical conditions where ground transport time exceeds 45 minutes

### **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
  - a. 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
  - b. Consider using the pediatric assessment triangle (appearance, work of breathing, circulation) when first approaching a child to help with assessment.
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
  - a. 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
    - i. Administer oxygen as appropriate with a target of achieving 94-98% saturation
    - ii. 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 below)
    - 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
  - c. Hypertension. Although abnormal, may be an expected finding in many patients
    - i. Unless an intervention is specifically suggested based on the patient's complaint or presentation, the hypertension should be documented, but otherwise, no intervention should be taken
    - ii. The occurrence of symptoms (e.g. chest pain, dyspnea, vision change, headache, focal weakness or change in sensation, altered mental status) in patients with hypertension should be considered concerning, and care should be provided appropriate with the patient's complaint or presentation
5. Secondary Survey: may not be completed if patient has critical primary survey problems
6. Critical Patients: proactive patient management should occur simultaneously with assessment
  - a. Ideally, one provider should be assigned to exclusively monitor and facilitate patient-focused care
  - b. Treatment and Interventions should be initiated as soon as practical, but should not impede extrication or delay transport to definitive care
7. Air Medical Transport: air 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) anatomic, physiologic, and situational high-acuity triage criteria

#### **Pertinent Assessment Findings**

This guideline is too broad to list all possible findings

#### **Quality Improvement**

##### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914075 – General-Universal Patient Care/Initial Patient Contact

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

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

## Performance Measures

- Abnormal vital signs should be addressed and reassessed
- Response to therapy provided should be documented including pain scale reassessment if appropriate
- Limit scene time for patients with time-critical illness or injury unless clinically indicated
- Appropriate utilization of air medical services
- Blood glucose level obtained when indicated
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *PEDS-01: Respiratory assessment.* Documented evidence that a respiratory assessment was performed on pediatric patients
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia
  - *Stroke-01: Suspected stroke receiving prehospital stroke assessment.* To measure the percentage of suspected stroke patients who had a stroke assessment performed by EMS
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain

## Normal Vital Signs

Age	Pulse	Respiratory Rate	Systolic BP
Preterm less than 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	120-160	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 or older	60-90	14-20	90-130

**Glasgow Coma Scale**

ADULT GLASGOW COMA SCALE		PEDIATRIC GLASGOW COMA SCALE	
<b>Eye Opening (4)</b>		<b>Eye Opening (4)</b>	
Spontaneous	4	Spontaneous	4
To Speech	3	To Speech	3
To Pain	2	To Pain	2
None	1	None	1
<b>Best Motor Response (6)</b>		<b>Best Motor Response (6)</b>	
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
<b>Verbal Response (5)</b>		<b>Verbal Response (5)</b>	
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
<b>Total</b>		<b>Total</b>	

## References

1. Bass, R. R., Lawner, B., Lee, D. and Nable, J. V. (2015) Medical oversight of EMS systems, in *Emergency Medical Services: Clinical Practice and Systems Oversight, Second Edition* (eds D. C. Cone, J. H. Brice, T. R. Delbridge and J. B. Myers), John Wiley & Sons, Ltd, Chichester, UK.
2. Bledsoe BE, Porter RS, Cherry RA. *Paramedic Care: Principles & Practice, Volume 3, 4<sup>th</sup> Ed.* Brady, 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. *Acad Emerg Med.* 2006;13(9):968-73.
4. National Association of State Emergency Medical Services Officials. *State model rules for the regulation of air medical services.* Published September 2016.
5. O'Driscoll BR, Howard LS, Davison AG. BTS guideline for emergency oxygen use in adult patients. *Thorax* 2008;63:vi1-vi68.
6. Thomas SH, Brown KM, Oliver ZJ, Spaite DW, Sahni R, Weik TS, et al. An evidence-based guideline for the air medical transportation of trauma patients. *Prehosp Emerg Care* 2014;18 Suppl 1:35-44.
7. U.S. Fire Administration. *Traffic incident management systems, FA-330.* Published March 2012.

## Revision Date

September 8, 2017

## Functional Needs

### **Aliases**

Developmental delay, disabled, handicapped, impaired, mental illness, mental retardation, special needs

### **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 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**

1. 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
2. The physical examination should not be intentionally abbreviated, 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
  5. Electronic applications for translation
- 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 daily living 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."

  - a. Services animals are not classified as a pet and should, by law, always be permitted to accompany the patient with the following exceptions:
    - i. A public entity may ask an individual with a disability to remove a service animal from the premises if:
      1. The animal is out of control and the animal's handler does not take effective action to control it; or

2. The animal is not housebroken
- b. 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.
- c. EMS providers are not responsible for the care of the 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.
- d. Animals that solely provide emotional support, comfort, or companionship do not qualify as service animals

### **Quality Improvement**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914165 – Other (*no specific NEMESIS protocol matching this guideline*)
- 9914063 – General-Individualized Patient Protocol

#### **Key Documentation Elements**

- Document all barriers in the NEMESIS element “eHistory.01 – Barriers to Patient Care” (NEMESIS Required National Element)
- Document specific physical barriers in the appropriate exam elements (e.g. “blind” under Eye Assessment; or paralysis, weakness, or speech problems under Neurological Assessment)
- Document any of the following, as appropriate in the narrative:
  - Language barriers:
    - The patient’s primary language of fluency
    - The identification of the person assisting with the communication
    - The methods through which the patient augments his/her communication skills
  - Sensory barriers:
    - The methods through which the patient augments his/her communication skills
    - 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
  - Assistance adjuncts (devices that facilitate the activities of life for the patient)

#### **Performance Measure**

- Accuracy of key data elements (chief complaint, past medical history, medication, allergies)
- Utilization of the appropriate adjuncts to overcome communication barriers
- Documentation of the patient’s functional need and avenue exercised to support the patient
- Documentation of complete and accurate transfer of information regarding the functional need to the receiving facility
- Barriers documented under “eHistory.01 - Barriers to Patient Care”

## **References**

1. International classification of functioning, disability and health. Presented at: 54<sup>th</sup> World Health Assembly, WHA 54.21, Agenda Item 13.9; May 21, 2001.
2. 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>. Accessed August 18, 2017.
3. US Department of Labor. Americans with Disabilities Act; 28 Code of Federal Regulations Part 35. July 23, 2010.
4. US Department of Labor. Americans with Disabilities Act; 42 U.S. Code, Chapter 126. 1990.
5. US Department of Labor. Americans with Disabilities Act; Amendments Act; 42 U.S. Code. 2008.

## **Revision Date**

September 8, 2017

## Patient Refusals

### **Aliases**

Against medical advice, refusal of treatment, refusal of transport

### **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**

1. Decision-Making Capacity
  - a. An individual who is alert, oriented, and has the ability 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
  - b. 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, paying 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 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. The determination of decision-making capacity may be challenged by communication barriers or cultural differences
4. EMS providers should not put themselves in danger by attempting to treat and/or transport an individual who refuses care
5. 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
6. ***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
  - a. All states allow healthcare 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:
    - i. The child is suffering from an emergent condition that places his or her life or health in danger
    - ii. The child's legal guardian is unavailable or unable to provide consent for treatment or transport
    - iii. Treatment or transport cannot be safely delayed until consent can be obtained
    - iv. The prehospital professional administers only treatment for emergency conditions that pose an immediate threat to the child
    - v. As a general rule, when the prehospital 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
    - vi. If a minor is injured or ill and no parent contact is possible, the provider may contact direct medical oversight for additional instructions

## **Quality Improvement**

### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914189 – General-Refusal of Care

### **Key Documentation Elements**

- Document patient capacity with:
  - Any and all barriers to patient care in the NEMSIS element "eHistory.01 - Barriers to Patient Care" (a Required National Element of NEMSIS)
  - Exam fields for "eExam.19 - Mental Status" and "eExam.20 - Neurological Assessment"
  - Vitals for level of responsiveness and Glasgow Coma Scale
  - Alcohol and drug use indicators
  - Blood glucose level (as appropriate to situation and patient history)
- Patient Age

- Minors who are not emancipated and adults with a legal guardian: guardian name, contact, and relationship
- Any efforts made to contact guardians if contact could not be made
- What the patient's plan is after refusal of care and/or transport
- Who will be with the patient after EMS departs
- Patient was advised that they can change their mind and EMS can be contacted again at any time
- Patient was advised of possible risks to their health resulting from refusing care and/or transport
- Patient voices understanding of risks. A quotation of the patient's actual words, stating they understand, is best
- Reason for patient refusing care. A quotation of the patient's actual words, stating they understand, is best
- Direct medical oversight contact
- Any assessments and treatments performed

#### **Performance Measures**

- Patient decision-making capacity was determined and documented
- Direct medical oversight was contacted as indicated by EMS agency protocol
- Guardians contacted or efforts to contact the guardians for minor patients who are not or cannot be confirmed to be emancipated

#### **References**

1. Refusal of Medical Aid (RMA). Acep.org. [https://www.acep.org/Clinical---Practice-Management/Refusal-of-Medical-Aid-\(RMA\)/](https://www.acep.org/Clinical---Practice-Management/Refusal-of-Medical-Aid-(RMA)/). Revised October 2015. Accessed August 21, 2017.

#### **Revision Date**

September 8, 2017

# Cardiovascular

## Adult and Pediatric Syncope and Presyncope

### **Aliases**

Loss of consciousness, passed out, fainted

### **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 and resolves spontaneously without medical interventions. 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 (e.g. trauma – go to [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 (e.g. cardiac disease/stroke)
    - 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. Syncope that occurs during exercise often indicates an ominous cardiac cause. Patients should be evaluated in the emergency department

- iv. 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. Cardiac monitoring
    - ii. Ongoing vital signs
    - iii. 12-lead EKG

**Treatment and Interventions:**

1. Should be directed at abnormalities discovered in the physical exam or on additional examination and may include management of cardiac dysrhythmias, cardiac ischemia/infarct, hemorrhage, shock, and the like
  - a. Manage airway as indicated
  - b. Oxygen as appropriate
  - c. Evaluate for hemorrhage and treat for shock if indicated
  - d. Establish IV access
  - e. Fluid bolus if appropriate
  - f. Cardiac monitor
  - g. 12-lead EKG
  - h. Monitor for and treat arrhythmias (if present refer to appropriate guideline)

**Patient Safety Considerations:**

1. Patients suffering syncope due to arrhythmia may suffer recurrent arrhythmia and should therefore be placed on a cardiac monitor
2. Geriatric patients suffering falls from standing may sustain significant injury and should be diligently screened for trauma – go to [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
3. High risk causes of syncope include the following:
  - a. Cardiovascular
    - i. Myocardial infarction
    - ii. Aortic stenosis



- iii. Hypertrophic cardiomyopathy
    - iv. Pulmonary embolus
    - v. Thoracic aortic dissection
    - vi. Lethal dysrhythmia
  - b. Neurovascular
    - i. Intracranial hemorrhage
    - ii. Transient ischemic attack or stroke
- 4. Consider high risk 12-lead EKG features including, but not limited to:
  - a. Evidence of QT prolongation (generally over 500ms)
  - b. Delta waves
  - c. Brugada syndrome (incomplete RBBB pattern in V1/V2 with ST segment elevation)
  - d. Hypertrophic obstructive cardiomyopathy

#### **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**

##### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914149 – Medical-Syncope

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

- Presenting cardiac rhythm
- Cardiac rhythm present when patient is symptomatic
- Any cardiac rhythm changes

##### **Performance Measures**

- Acquisition of 12-lead EKG
- Application of cardiac monitor
- **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Stroke-01: Suspected stroke receiving prehospital stroke assessment.* To measure the percentage of suspected stroke patients who had a stroke assessment performed by EMS

#### **References**

1. Anderson JB, Willis M, Lancaster H, Leonard K, Thomas C. The evaluation and management of pediatric syncope. *Pediatr Neurol.* 2016;55:6-13.
2. Benditt DG, Adkisson WO. Approach to the patient with syncope. *Cardiol Clin.* 2013;31(1):9-25.
3. Dovgalyuk J, Holstege C, Mattu A, Brady WJ. The electrocardiogram in the patient with syncope. *Am J Emerg Med.* 2007;25:688-701.

4. Fischer J, Choo CS. Pediatric syncope: cases from the emergency department. *Emerg Med Clin North Am.* 2010;28(3):501-16.
5. Herbert M, Spangler M, Swadron S, Mason J. Emergency Medicine Reviews and Perspectives (EM:RAP). C3 Continuous Core Content Podcast. *Syncope – Introduction.* November 2016. <https://www.emrap.org/episode/c3syncope/syncope>. Accessed August 28, 2017.
6. Huff JS, Decker WW, Quinn JV, Perron AD, Napoli AM, Peeters S, et al; American College of Emergency Physicians. Clinical policy: critical issues in the evaluation and management of adult patients presenting to the emergency department with syncope. *Ann Emerg Med.* 2007;49(4):431-44.
7. Kessler C, Tristan JM, De Lorenzo R. The emergency department approach to syncope: evidence-based guidelines and prediction rules. *Emerg Med Clin North Am.* 2010;28(3):248-500.
8. Khoo C, Chakrabarti S, Arbour L, Krahn AD. Recognizing life-threatening causes of syncope. *Cardiol Clin.* 2013;31(1):51-66.
9. Orman R, Mattu A; Emergency Medicine Reviews and Perspectives (EMRAP). Spring Forward into PE. *Cardiology Corner – Syncope.* March 2016. <https://www.emrap.org/episode/springforward/cardiology>. Accessed August 28, 2017.
10. Ouyang H, Quinn J. Diagnosis and management of syncope in the emergency department. *Emerg Med Clin North Am.* 2010;28(3):471-485.

**Revision Date**

September 8, 2017

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

### **Aliases**

Heart attack, myocardial infarction (MI)

### **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 Criteria**

1. 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.
2. Some patients will present with likely non-cardiac 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 per the [Pain Management guideline](#).

#### **Exclusion Criteria**

None recommended

### **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 MI
2. Assess the patient's cardiac rhythm - treat pulseless rhythms, tachycardia, or symptomatic bradycardia [see [Cardiovascular](#) and [Resuscitation](#) guidelines]
3. If the patient is dyspneic, hypoxemic, or has obvious signs of heart failure, EMS providers should administer oxygen as appropriate with a target of achieving 94-98% saturation [see [Universal Care guideline](#)]
4. 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 within 10 minutes 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
5. Administer aspirin; chewable, non-enteric-coated aspirin preferred (162 to 325 mg)
6. Establish IV access
7. Nitroglycerin 0.4 mg SL, can repeat q 3-5 minutes as long as SBP greater than 100 mmHg (if range not desired use q 3 minutes)
  - a. The use of nitrates should be avoided in any patient who has used a phosphodiesterase inhibitor within the past 48 hours
  - b. Examples are: sildenafil (Viagra<sup>®</sup>, Revatio<sup>®</sup>), vardenafil (Levitra<sup>®</sup>, Staxyn<sup>®</sup>), tadalafil (Cialis<sup>®</sup>, Adcirca<sup>®</sup>) which are used for erectile dysfunction and pulmonary hypertension. Also avoid use in patients receiving intravenous epoprostenol (Flolan<sup>®</sup>) or treprostenil (Remodulin<sup>®</sup>) which is used for pulmonary hypertension
  - c. Administer nitrates with extreme caution, if at all, to patients with inferior-wall STEMI or suspected right ventricular (RV) involvement because these patients require adequate RV preload
8. Analgesia is indicated in STEMI when chest discomfort is unresponsive to nitrates; Morphine should be used with caution in unstable angina (UA)/non-STEMI due to an association with increased mortality
9. 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, blood thinners (anticoagulants), and medications for the treatment of erectile dysfunction or pulmonary hypertension.

#### **Quality Improvement**

##### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914117 – Medical-Cardiac Chest Pain
- 9914143 – Medical-ST-Elevation Myocardial Infarction (STEMI)

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

- The time of symptom onset
- The time of patient contact by EMS to the time of 12-lead EKG acquisition
- The time ASA administered, or reason why not given
- The time of STEMI notification

### **Performance Measures**

- The time of patient contact by to the time of 12-lead EKG acquisition within 10 minutes
- The time from first diagnostic 12-lead EKG to STEMI notification.
- Confirmation patient received Aspirin (taken Prior To EMS Arrival, given by EMS, or substantiated by other pertinent negatives)
- The time of a STEMI patient's ultimate arrival to a receiving hospital
- \*The time of EMS notification to the time of activation of a cardiac catheterization laboratory
- \*The time of arrival at the PCI center to the time of cardiac catheterization (door-to-balloon time) OR if patient not transported directly to PCI center, the time of arrival at receiving hospital to thrombolytics
- \*The time of prehospital 12-lead EKG acquisition to the time of cardiac catheterization (EKG-to-balloon time)

*\*NOTE: These measures can only be evaluated if EMS documentation can be combined with information provided by the receiving hospital*

### **References**

1. Bosson KN, Kaji AH, Niemann JT, et al. The utility of prehospital EKG transmission in a large EMS system. *Prehosp Emerg Care*. 2015;19(4):496-503.
2. De Champlain F, Boothroyd LJ, Vadeboncoeur A, et al. Computerized interpretation of the prehospital electrocardiogram: predictive value for ST segment elevation myocardial infarction and impact on on-scene time. *CJEM*. 2014;16(2):94-105.
3. Meine TJ, Roe MT, Chen AY, et al. Association of intravenous morphine use and outcomes in acute coronary syndromes: results from the CRUSADE quality improvement initiative. *Am Heart J*. 2005;149(6):1043-9.
4. Mission: Lifeline EMS Recognition. American Heart Association. Heart.org. [http://www.heart.org/HEARTORG/Professional/MissionLifelineHomePage/Mission-Lifeline-Home-Page\\_UCM\\_305495\\_SubHomePage.jsp](http://www.heart.org/HEARTORG/Professional/MissionLifelineHomePage/Mission-Lifeline-Home-Page_UCM_305495_SubHomePage.jsp). Accessed January 23, 2017.
5. Nam J, Caners K, Bowen JM, O'Reilly D. Systematic review and meta-analysis of the benefits of out-of-hospital 12-lead EKG and advance notification in ST-segment elevation myocardial infarction patients. *Ann Emerg Med*. 2014;64(2):176-86.
6. O'Connor RE, Abudulaziz AAS, Brady WJ, et al. Part 9: acute coronary syndromes. *Circulation*. 2015;132(18 Suppl 2):S483-500.
7. Squire BT, Tamaryo-Sarver JH, Rashi P, Koenig W, Niemann JT. Effect of prehospital cardiac catheterization lab activation on door-to-balloon time, mortality, and false-positive activation. *Prehosp Emerg Care*. 2014;18(1):1-8.
8. Verbeek PR, Ryan D, Turner L, Craig AM. Serial prehospital 12-lead electrocardiograms increase identification of ST-segment elevation myocardial infarction. *Prehosp Emerg Care*. 2012;16(1):109-14.

### **Revision Date**

September 8, 2017

## Bradycardia

### Aliases

Heart block, junctional rhythm

### 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. Hypoglycemia
  - g. Increased intracranial pressure (ICP)
  - h. Other

### Patient Presentation

#### Inclusion Criteria

1. Heart rate less than 60 beats per minute 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
    - i. Type I —Wenckenbach/Mobitz I
    - ii. Type II —Mobitz II
  - c. Third-degree AV block complete block
  - d. Ventricular escape rhythms
3. See additional inclusion criteria, below, for pediatric patients

#### Exclusion Criteria

No recommendations

### Patient Management

#### Assessment, Treatment, and Interventions

1. Adult Management
  - a. Manage airway as necessary
  - b. Administer oxygen as appropriate with a target of achieving 94-98% saturation
  - c. Initiate monitoring and perform 12-lead EKG
  - d. Establish IV access
  - e. Check blood glucose and treat hypoglycemia per the [Hypoglycemia](#) and [Hyperglycemia](#) guidelines
  - f. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
    - i. Atropine 0.5 mg IV q 3-5 minute (maximum total dose of 3 mg)
    - ii. Vasopressor medications (in order of preference)

1. Epinephrine IV drip 0.02-0.2 mcg/kg/min titrated to a MAP greater than 65 mmHg
    - OR**
    - 2. Epinephrine by push dose (dilute boluses)
      - a. Prepare 10 mcg/mL by adding 1 mL 0.1mg/mL Epinephrine to 9 mL normal saline, then administer 10-20 mcg boluses (1-2mL) every 2 minutes titrated MAP greater than 65mmHg
    - OR**
    - 3. Norepinephrine 0.02-0.4 mcg/kg/minute IV titrated to a MAP greater than 65 mmHg
  - 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 for heart less than 60 and signs of poor perfusion (altered mental status, hypoxia, hypotension, weak pulse, delayed capillary refill, cyanosis)
  - 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. Administer oxygen as appropriate with a target of achieving 94-98% saturation
  - d. Initiate monitoring and perform 12-lead EKG
  - e. Establish IV access
  - f. Check blood glucose and treat hypoglycemia per the [Hypoglycemia guideline](#)
  - g. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
    - i. Epinephrine by push dose (dilute boluses). Prepare 10 mcg/mL by adding 1 mL 0.1mg/mL Epinephrine to 9 mL Normal Saline, then administer 0.01mg/kg (0.1ml/kg) maximum single dose 10mcg (1ml) every 3-5 minutes titrated to MAP greater than 65mmHg
    - 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 to maximum initial dose of 0.5mg (maximum total dose of 3 mg)
    - iii. Transcutaneous pacing – If pacing is performed, consider sedation or pain control
    - iv. Epinephrine may be used for bradycardia and poor perfusion unresponsive to ventilation and oxygenation
      1. 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, digoxin, and clonidine
  - a. 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, cholinergic nerve agents
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. Dopamine is not indicated for pediatric patients
  - c. 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. When dosing medications for pediatric patients, dose should be weight-based for non-obese patients and based on ideal body weight for obese patients
9. Although dopamine is often recommended for the treatment of symptomatic bradycardia, recent research suggests that patients in cardiogenic or septic shock treated with norepinephrine have a lower mortality rate compared to those treated with dopamine
10. **Caution:** Norepinephrine can theoretically cause reflex bradycardia

### Pertinent Assessment Findings

No recommendations

## Quality Improvement

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914115 – Medical-Bradycardia

### Key Documentation Elements

- Cardiac rhythm/rate
- Time, dose and response of medications given
- Pacing: Time started or stopped, rate, joules, capture and response, rate,
- Patient weight
- Pediatric length-based tape color (for pediatrics who fit on tape)
- History of event supporting treatment of underlying causes



### Performance Measures

- Blood sugar obtained.
- Correct medication(s) and dose given for patient condition, age and weight
- Correct application and use of cardiac pacing
- Use of sedation or pain management with cardiac pacing
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia

### References

1. Brady W, Swart G, Mao R, Aufderheide TP. 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, Biston P, Devriendt J, et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010;362:779-89.
3. Gottlieb M. Bolus dose of epinephrine for refractory post-arrest hypotension. *CJEM*. 2017;10:1-5.
4. Kleinman ME, Chameides L, Schexnayder SM, et al. Part 14: pediatric advanced life support. *Circulation*. 2010;122(18 Suppl.3):S876-S908.
5. Link MS, Berkow PJ, Kudenchuk HR, et. al. Part 7: adult advanced cardiovascular life support. *Circulation*. 2015;132(18 Suppl 2):S444-64.
6. 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.
7. Weingart S. *EMCrit Podcast 6 – Push-Dose Pressors*. July 10, 2009. <http://emcrit.org/podcasts/bolus-dose-pressors/>. Accessed February 1, 2017.
8. Weingart S. Push-dose pressors for immediate blood pressure control. *Clin Exp Emerg Med*. 2015;2(2):131-132.

### Revision Date

September 8, 2017

## Implantable Ventricular Assist Devices

### **Aliases**

Ventricular assist device (VAD), left ventricular assist device (LVAD), right ventricular assist device (RVAD), biventricular assist device (BiVAD)

### **Patient Care Goals**

1. Rapid identification of, and interventions for, cardiovascular compromise in patients with VADs
2. Rapid identification of, and interventions for VAD-related malfunctions or complications

### **Patient Presentation**

#### **Inclusion Criteria**

1. Adult patients that have had an implantable ventricular assist device (VAD), including a left ventricular assist device (LVAD), right ventricular assist device (RVAD), or biventricular-assist device (BiVAD), and have symptoms of cardiovascular compromise
2. Patients with VADs that are in cardiac arrest
3. Patients with VADs that are experiencing a medical or injury-related event not involving the cardiovascular system or VAD malfunction

#### **Exclusion Criteria**

Adult patients who do not have a VAD in place

### **Patient Management**

#### **Assessment**

1. Assess for possible pump malfunction
  - a. Assess for alarms
  - b. Auscultate for pump sound “hum”
  - c. Signs of hypoperfusion including pallor, diaphoresis, altered mental status
2. If the VAD pump has malfunctioned:
  - a. Utilize available resources to troubleshoot potential VAD malfunctions and to determine appropriate corrective actions to restore normal VAD function:
    - i. Contact the patient’s VAD-trained companion, if available
    - ii. Contact the patient’s VAD coordinator, using the phone number on the device
    - iii. Check all the connections to system controller
    - iv. Change VAD batteries, and/or change system controller if indicated
    - v. Have patient stop all activity and assess for patient tolerance
    - vi. Follow appropriate cardiovascular condition-specific protocol(s) as indicated

#### **Treatment and Interventions**

1. Manage airway as indicated
2. Cardiac monitoring
3. IV access
4. Acquire 12-lead EKG
5. If patient is experiencing VAD-related complications or cardiovascular problems, expedite transport to the medical facility where VAD was placed if patient’s clinical condition and time allows

6. If patient has a functioning VAD and is experiencing a non-cardiovascular-related problem, transport to a facility that is appropriate for the patient's main presenting problem without manipulating the device
7. If patient has a functioning VAD and is hypoperfusing:
  - a. Administer IV fluids (30 mL/kg isotonic fluid; maximum of 1 liter) over less than 15 minutes, using a push-pull method of drawing up the fluid in a syringe and pushing it through the IV
  - b. May repeat up to 3 times based on patient's condition and clinical impression for a total cumulative dose not exceed 3 L
8. If patient is in full cardiac arrest:
  - a. CPR should not be performed if there is any evidence the pump is still functioning, the decision whether to perform CPR should be made based upon best clinical judgment in consultation with the patient's VAD-trained companion and the VAD coordinator (or direct medical oversight if VAD coordinator unavailable)
  - b. CPR may be initiated only where:
    - i. You have confirmed the pump has stopped and troubleshooting efforts to restart it have failed, and
    - ii. The patient is unresponsive and has no detectable signs of life

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

1. You do not need to disconnect the controller or batteries in order to:
  - a. Defibrillate or cardiovert
  - b. Acquire a 12-lead EKG
2. Automatic non-invasive cuff blood pressures may be difficult to obtain due to the narrow pulse pressure created by the continuous flow pump
3. Flow though many VAD devices is not pulsatile and patients may not have a palpable pulse or accurate pulse oximetry
4. The blood pressure, if measurable, may not be an accurate measure of perfusion.
5. Ventricular fibrillation, ventricular tachycardia, or asystole/PEA may be the patient's "normal" underlying rhythm. Evaluate clinical condition and provide care in consultation with VAD coordinator
6. The patient's travel bag should accompany them at all times with back-up controller and spare batteries
7. If feasible, bring the patient's power module, cable, and display module to the hospital
8. All patients should carry a spare pump controller with them
9. The most common cause for VAD alarms are low batteries or battery failures
10. Although automatic non-invasive blood pressure cuffs are often ineffective in measuring systolic and diastolic pressure, if they do obtain a measurement, the MAP is usually accurate
11. Other VAD complications:
  - a. Infection
  - b. Stroke/TIA
  - c. Bleeding
  - d. Arrhythmias
  - e. Cardiac tamponade
  - f. CHF
  - g. Aortic insufficiency

## **Quality Improvement**

### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914069 – General-Medical Device Malfunction
- 9914065 – General-Indwelling Medical Devices/Equipment

### **Key Documentation Elements**

- Information gained from the VAD control box indicating any specific device malfunctions
- Interventions performed to restore a malfunctioning VAD to normal function
- Time of notification to and instructions from VAD-trained companion and/or VAD coordinator

### **Performance Measures**

- Identify and mitigate any correctable VAD malfunctions
- Perform CPR for patients in cardiac arrest when indicated

## **References**

1. Garg S, Ayers CR, Fitzsimmons C, et al. In-hospital cardiopulmonary arrests in patients with left ventricular assist devices. *J Card Fail.* 2014;20(12):899-904.
2. Mabvuure NT, Rodrigues JN. External cardiac compression during cardiopulmonary resuscitation with left ventricular assist devices. *Interact Cardiovasc Thorac Surg.* 2014;19(2):286-9.
3. Mechem M. Prehospital assessment and management of patients with ventricular-assist devices. *Prehosp Emerg Care.* 2013;17(2):223-9.
4. Shinar Z, Bellezzo J, Stahovich M, Cheskes S, Chillcott S, Dembitsky W. Chest compressions may be safe in arresting patients with left ventricular assist devices (LVADs). *Resuscitation.* 2014;85(5):702-4.

## **Revision Date**

September 8, 2017

## Tachycardia with a Pulse

### **Aliases**

Supraventricular tachycardia (SVT), ventricular tachycardia (VT), multifocal atrial tachycardia (MAT), torsades, atrial fibrillation (A-FIB), atrial flutter

### **Patient Care Goals**

1. Maintain adequate oxygenation, ventilation, and perfusion
2. Control ventricular rate
3. Restore regular sinus rhythm in unstable patient
4. 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 greater than 100 bpm 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. Administer oxygen as appropriate with a target of achieving 94-98% saturation.
  - c. Initiate monitoring and perform 12-lead EKG
  - d. Establish IV access
  - e. Check blood glucose and treat hypoglycemia per the [Hypoglycemia 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 (proximal site) followed by 10 mL fluid bolus
        - a. If tachycardia continues, give adenosine 12 mg IV
        - b. A third dose of adenosine, 12 mg IV, can be given
      3. Diltiazem 0.25 mg/kg slowly IV over 2 minutes
        - a. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed
        - b. For patients older than 65, recommend maximum initial dose of diltiazem 10 mg IV and a maximum second dose of 20mg

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 and analgesia
- iii. **Irregular Narrow Complex Tachycardia – Stable** (atrial fibrillation, atrial flutter, multifocal atrial tachycardia)
  1. Diltiazem 0.25 mg/kg slowly IV over 2 minutes
    - a. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed
    - b. For patients older than 65, recommend maximum initial dose of diltiazem 10 mg IV and a maximum 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, supraventricular tachycardia, atrial fibrillation/flutter with aberrancy, accelerated idioventricular rhythms, pre-excited tachycardias with accessory pathways,)
  1. Amiodarone 150 mg IV over 10 minutes
    - a. May repeat
  2. Procainamide 20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases greater than 50%, or maximum dose 17 mg/kg given
    - a. Maintenance infusion: 1-4 mg/min
    - b. Avoid if prolonged QT or CHF
  3. Lidocaine 1-1.5 mg/kg IV
    - a. May be repeated at 5-minute intervals for a maximum dose of 3 mg/kg IV
  4. Adenosine 6 mg IV (proximal site) followed by 10 mL fluid bolus
    - a. If monomorphic tachycardia continues, give adenosine 12 mg IV
- vi. **Regular Wide Complex Tachycardia – Unstable**
  1. Deliver a synchronized shock based on manufacturer’s recommendation
  2. For responsive patients, consider sedation
- vii. **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. Procainamide 20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases *greater than* 50%, or maximum dose 17 mg/kg given
    - a. Maintenance infusion: 1-4 mg/min
    - b. Avoid if prolonged QT or CHF
  2. If torsades, give magnesium 1-2 g IV over 10 minutes
  3. Amiodarone 150 mg IV over 10 minutes
    - a. May repeat if needed



3. A wide-complex irregular rhythm should be considered pre-excited atrial fibrillation; extreme care must be taken in these patients
  - a. Characteristic EKG findings include a short PR interval and, in some cases, a delta wave
  - b. Avoid AV nodal blocking agents such as adenosine, calcium channel blockers, digoxin, and possibly beta-blockers in patients with pre-excitation atrial fibrillation (e.g. Wolff-Parkinson-White Syndrome, Lown-Ganong-Levine Syndrome) because these drugs may cause a paradoxical increase in the ventricular response
  - c. 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
  - d. Amiodarone or procainamide may be used as an alternative
4. Amiodarone or procainamide 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
  - a. 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 mmHg
  - a. Worsening CHF, COPD, asthma, as well as hypotension and bradycardia can occur with use of metoprolol
6. Biphasic waveforms have been proven to convert atrial fibrillation at lower energies and higher rates of success than monophasic waveforms
  - a. Strategies include dose escalation (70, 120, 150, 170 J for biphasic or 100, 200, 300, 360 J for monophasic) versus beginning with single high energy/highest success rate for single shock delivered
7. Studies in infants and children have demonstrated the effectiveness of adenosine for the treatment of hemodynamically stable or unstable SVT
8. Adenosine should be considered the preferred medication for stable SVT
  - a. Verapamil may be considered as alternative therapy in older children but should not be routinely used in infants
  - b. Procainamide or amiodarone given by a slow IV infusion with careful hemodynamic monitoring may be considered for refractory SVT

#### **Pertinent Assessment Findings**

No recommendations

#### **Patient Safety Considerations**

1. Only use one antidysrhythmic at a time
2. Patients who receive metoprolol and diltiazem are at significant risk for hypotension and bradycardia
3. If using cardioversion, consider sedation and pain control
4. With irregular wide complex tachycardia (atrial fibrillation with aberrancy such as Wolff-Parkinson-White and Lown-Ganong Levine), avoid use of AV nodal blocking agents (e.g. adenosine, calcium channel blockers, beta blockers)
5. Patients with Wolff-Parkinson-White should be given procainamide prior to amiodarone



## Quality Improvement

### Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914199 – Medical-Tachycardia
- 9914151 – Medical-Ventricular Tachycardia (With Pulse)
- 9914147 – Medical-Supraventricular Tachycardia (Including Atrial Fibrillation)

### Key Documentation Elements

- Initial rhythm and all rhythm changes
- Time, dose and response to medications given
- Cardioversion times, synchronization, attempts, joules and response
- Obtain monitor strips after each intervention
- Patient weight
- Pediatric length-based tape color (for pediatrics who fit on tape)
- History of event supporting treatment of underlying causes

### Performance Measures

- Time to clinical improvement from patient contact
- Blood sugar obtained
- Correct medication(s) and dose given for patient condition, age and weight
- Correct cardioversion joules delivered given patient weight and/or condition
- Use of sedation for responsive patient
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia

## References

1. DeSouza IS, Martindale JL, Sinert R. Antidysrhythmic drug therapy for the termination of stable, monomorphic ventricular tachycardia: a systematic review. *Emerg Med J.* 2015;32(2):161-7.
2. Fengler BT, Brady WJ, Plautz CU. Atrial fibrillation in the Wolff-Parkinson-White Syndrome: EKG recognition and treatment in the ED. *Am J Emerg Med.* 2007;25(5):576-83.
3. Fuster V, Rydén LE, Cannom DS, et al. [ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation – executive summary]. *Rev Port Cardiol.* Apr;26(4):383-446.
4. Link MS, Berkow LC, Kudenchuk HR, et al. Part 7: adult advanced cardiovascular life support. *Circulation.* 2015;132(18 Suppl 2):S444-64.
5. Long B, Koyfman A. Best clinical practice: emergency medicine management of stable monomorphic ventricular tachycardia. *J Emerg Med.* Epub 2016 Oct 15.
6. 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.* 2003;139(12):1018-33.
7. Ortiz M, Martin A, Arribas F, et al. Randomized comparison of intravenous procainamide vs. intravenous amiodarone for the acute treatment of tolerated wide QRS tachycardia: the PROCAMIO study. *Eur Hear J.* 2017;38(17):1329-35.

8. Somberg JC, Bailin SJ, Haffajee CI, et al. Intravenous lidocaine versus intravenous amiodarone (in a new aqueous formulation) for incessant ventricular tachycardia. *Am J Cardiol.* 2002;90(8):853-9.
9. Wann LS, Curtis AB, January CT, et al. 2011 ACCF/AHA/HRS focused update on the management of patients with atrial fibrillation (updating the 2006 guideline): a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines. *Circulation.* 2011;123:104-23.
10. Zimetbaum P, Reynolds MR, Ho KK, et al. Impact of a practice guideline for patients with atrial fibrillation on medical resource utilization and costs. *Am J Cardiol,* 2003;92(6):677-81.

**Revision Date**

September 8, 2017

## Suspected Stroke/Transient Ischemic Attack

### **Aliases**

Cerebrovascular accident (CVA), 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 is unresponsive)
4. Severe headache, neck pain/stiffness, difficulty seeing

### **Inclusion Criteria**

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

### **Exclusion Criteria**

1. If glucose less than 60 mg/dL, treat per the [Hypoglycemia guideline](#)
2. If trauma and GCS less than or equal to 13, treat per the [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 known well” and source of that information
  - b. Neurologic status assessment [see [Appendix VII](#)]
  - c. Patient is taking warfarin or any anticoagulant medication
3. Evaluate for the presence of stroke mimics including:
  - a. Hypoglycemia
  - b. Seizure
  - c. Sepsis
  - d. Migraine
  - e. Intoxication

#### **Treatment and Interventions**

1. Determine “last known well” time
2. Administer oxygen as appropriate with a target of achieving 94-98% saturation
3. If seizure activity present, treat per [Seizures guideline](#)

4. Check blood glucose level
  - a. Treat only if glucose less than 60 mg/dL
5. Acquire 12-lead EKG, if possible
6. Hospital notification per local stroke plan

#### **Patient Safety Considerations**

1. Prevent aspiration – elevate head of stretcher 15-30 degrees if systolic BP greater than 100 mm Hg
  - a. 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. Transport and destination decisions should be based on local resources and stroke system of care
  - a. Destinations hospitals may include:
    - i. Stroke Ready
    - ii. Primary Stroke Center
    - iii. Comprehensive Stroke Center
2. Do not treat hypertension
3. Place on cardiac monitor
4. Pediatrics:
  - a. Treatment principles remain the same
  - b. Although rare, pediatric patients can have strokes
  - c. Stroke scales are not validated for pediatric patients
  - d. The EMS crew should call ahead to make sure that the hospital can manage the patient

#### **Quality Improvement**

##### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914145 – Medical-Stroke/TIA

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

- “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)
- Blood glucose results
- Specific validated stroke scale used and findings
- Time of notification to receiving hospital

##### **Performance Measures**

- Documentation of time “last seen normal”
- Use of validated stroke scale
- Blood glucose level obtained
- EMS scene time minimized (goal: less than 20 minutes)
- Hospital stroke team pre-arrival alert or activation occurred as early as possible after positive stroke assessment finding

- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Stroke-01: Suspected stroke receiving prehospital stroke assessment.* To measure the percentage of suspected stroke patients who had a stroke assessment performed by EMS
  - *Stroke-08: Emergency Department Diagnosed Stroke Identified by Prehospital Stroke Assessment.* Measures the percentage of emergency department diagnosed stroke patients who had a positive stroke assessment by EMS

**NOTE:** This measure can only be evaluated if EMS documentation can be combined with information provided by the receiving hospital

### **References**

1. Jauch EC, Saver JL, Adams HP Jr, et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2013;44(3):870-947.
2. [www.strokeassociation.org](http://www.strokeassociation.org). Accessed August 28, 2017.

### **Revision Date**

September 8, 2017

# General Medical

## Abdominal Pain

### **Aliases**

None

### **Patient Care Goals**

1. Improve patient comfort
2. Identify life-threatening causes of abdominal pain

### **Patient Presentation**

#### **Inclusion Criteria**

Abdominal pain or discomfort related to a non-traumatic cause

#### **Exclusion Criteria**

1. Abdominal pain due to trauma [see [General Trauma Management guideline](#)]
2. Abdominal pain due to or related to pregnancy [see [OB/GYN guidelines](#)]

### **Patient Management**

#### **Assessment**

1. Perform airway assessment and management per the [Airway Management guideline](#)
2. Obtain vital signs including pulse, respiratory rate, pulse oximetry, and blood pressure
3. Provide evaluation and management of pain per the [Pain Management guideline](#)
4. Obtain vascular access as necessary to provide analgesia and/or fluid resuscitation
5. Assess for life-threatening causes of abdominal pain, which may include:
  - a. Ischemic, necrotic, or perforated bowel
    - i. Severe tenderness
    - ii. Abdominal pain with motion or “jiggling” of the abdomen
    - iii. Fever
    - iv. Bloody stool
    - v. Nausea and vomiting
    - vi. Possible absence of passage of stool or gas
    - vii. Abdominal distention, with possible tympany to percussion
  - b. Dissecting or ruptured abdominal aortic aneurysm (AAA)
    - i. Unequal femoral or distal lower extremity pulses
    - ii. “Pulsatile” abdominal mass
    - iii. Associated back pain and/or chest pain
    - iv. Known history of abdominal aortic aneurysm
  - c. Ruptured ectopic pregnancy
    - i. Vaginal bleeding
    - ii. Recently diagnosed pregnancy
  - d. Recent missed period/menstrual cycle in women of childbearing age

- e. Appendicitis
  - i. Focal right lower quadrant tenderness, possibly with rebound and guarding
  - ii. Right lower quadrant tenderness noted during palpation of the left lower quadrant (positive Rovsing's sign)
  - iii. Peri-umbilical or diffuse abdominal tenderness with palpation or "jiggling" of the abdomen/pelvis
  - iv. Fever
  - v. Nausea, vomiting
  - vi. Lack of appetite
- f. Acute Cholecystitis
  - i. Right upper quadrant or epigastric tenderness
  - ii. Fever
  - iii. Nausea and vomiting
  - iv. Possible history of gallstones
- g. Pyelonephritis
  - i. Fever
  - ii. Nausea, vomiting
  - iii. Urinary frequency/urgency
  - iv. Dysuria
  - v. Hematuria
  - vi. Back/flank pain
  - vii. Costovertebral angle tenderness to percussion
- 6. Assess for signs of shock
  - a. If shock is present, provide treatment per appropriate [Shock guideline](#)
- 7. Assess for other non-life-threatening causes of abdominal pain
  - a. Kidney stone
    - i. Unilateral flank pain
    - ii. Nausea, vomiting
    - iii. Possible Hematuria

### **Treatment and Interventions**

1. Medication Administration:
  - a. Provide analgesia per the [Pain Management guideline](#)
  - b. Administer antiemetics per the [Nausea-Vomiting guideline](#)
  - c. Provide transport to an appropriate receiving facility. Consider specialty destination centers for conditions such as suspected abdominal aortic aneurysm
  - d. Reassess vital signs and response to therapeutic interventions throughout transport

### **Patient Safety Considerations**

None recommended

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Assess for life-threatening causes of abdominal pain
2. Provide appropriate treatment for pain, vomiting, and shock
3. Consider transport to a trauma center if aortic aneurysm is suspected

### **Pertinent Assessment Findings**

1. Rebound tenderness
2. Guarding
3. Abdominal distension
4. Abdominal tympany to percussion
5. Tenderness focal to a specific abdominal quadrant
6. Presence of “pulsatile” abdominal mass
7. Absence of or significant inequality of femoral or distal arterial pulses in lower extremities
8. Hyper or hypothermia
9. Rectal bleeding, hematemesis (character), vaginal bleeding

### **Quality Improvement**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914109 – Medical-Abdominal Pain

#### **Key Documentation Elements**

- Assessment of abdomen to include findings on palpation/percussion including presence or absence of masses and presence and nature of tenderness/pain
- Treatment and response to treatment

#### **Performance Measures**

- Assessment for life-threatening etiology
- Mitigation of pain per the [Pain Management guideline](#)

### **References**

1. Attard AR, Corlett MJ, Kidner NJ, Leslie AP, Fraser IA. Safety of early pain relief for acute abdominal pain. *BMJ*. 1992;305(6853):554-6.
2. Brewster GS, Herbert ME, Hoffman JR. Medical myth: analgesia should not be given to patients with acute abdominal pain because it obscures the diagnosis. *West J Med*. 2000;172(3):209-10.
3. LoVecchio F, Oster N, Sturmman K, Nelson LS, Flashner S, Finger R. The use of analgesics in patients with acute abdominal pain. *J Emerg Med* 1997;15:775-9.
4. Manterola C, Astudillo P, Losada H, Pineda V, Sanhueza A, Vial M. Analgesia in patients with acute abdominal pain. *Cochrane Database of Syst Rev*. 2011;1:CD005660.
5. Pace S, Burke TF. Intravenous morphine for early pain relief in patients with acute abdominal pain. *Acad Emerg Med*. 1996;3:1086-92.
6. Ranji SR, Goldman LE, Simel DL, Shojania KG. Do opiates affect the clinical evaluation of patients with acute abdominal pain? *JAMA*. 2006;296(14):1764-74.
7. Vermuelen B, Morabia A, Unger PF, et al. Acute appendicitis: influence of early pain relief on the accuracy of clinical and US findings in the decision to operate – a randomized trial. *Radiology*. 1999;210:639-43.

### **Revision Date**

September 8, 2017



## Abuse and Maltreatment

### Aliases

Maltreatment of vulnerable populations

### Definitions

1. 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
2. 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, but is not limited to, failure to provide for the child's needs (e.g. physical, emotional, medical/dental, and educational neglect) and failure to supervise (e.g. inadequate supervision or safety precautions, lack of appropriate car seat use, and exposure to violent or dangerous environments)
3. Human Trafficking: when people are abducted or coerced into service and often transported across international borders. Signs may include, but are not limited to: patient with branding/tattoos and environmental clues such as padlocks and/or doorknobs removed on interior doors, and intact windows that are boarded up

### 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. 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 adult patient to speak for themselves, or who appears controlling – pay special attention to patients who cannot communicate due to young age or language and/or cultural barriers
  - g. Inadequate safety precautions or facilities where the patient lives and/or evidence of security measures that appear to confine the patient inappropriately
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. Unexplained trauma to genitourinary systems or frequent infections to this system
  - f. Evidence of malnourishment and/or serious dental problems
3. Have a high index of suspicion for abuse in children presenting with a Brief Resolved Unexplained Event (BRUE) [see [BRUE guideline](#)]

### **Patient Management**

#### **Assessment**

1. Start with a primary survey and identify any potentially life-threatening issues
2. Document thorough secondary survey to identify clues of for potential abuse/maltreatment:
  - a. Inability to communicate due to developmental age, 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. Unexplained 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
  - a. Avoid asking directed questions of a child

### **Treatment and Interventions**

1. Address life-threatening issues
2. Remove the 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, the 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. 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.
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, interview, 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 a Brief Resolved Unexplained Event (BRUE). Of the very serious causes of BRUE, child abuse has been found in as many as 11% of cases. One retrospective review noted that a call to 911 for BRUE was associated with an almost 5 times greater odds of abusive head trauma being diagnosed as the cause of the BRUE, 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").
7. Providers should be knowledgeable about mandatory reporting statutes in their area, especially regarding adults (domestic violence, elder abuse).

#### **Pertinent Assessment Findings**

As noted above

## **Quality Improvement**

### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914187 – General-Neglect or Abuse Suspected

### **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 recommendations

## **References**

1. Blue Campaign. DHS.gov. <https://www.dhs.gov/blue-campaign>. Updated April 5, 2016. Accessed August 21, 2017.
2. Child Abuse and Neglect: Definitions. CDC.gov. <http://www.cdc.gov/violenceprevention/childmaltreatment/definitions.html>. Accessed August 13, 2017

## **Revision Date**

September 8, 2017

## Agitated or Violent Patient/Behavioral Emergency

### **Aliases**

Acute psychosis, 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**

1. Patients exhibiting agitated or violent behavior due to medical conditions including, but not limited to:
  - a. Head trauma
  - b. Metabolic disorders (e.g. hypoglycemia, hypoxia)

### **Patient Management**

#### **Assessment**

1. Note medications/substances on scene that may contribute to the agitation, or may be relevant to the treatment of a contributing medical condition
2. Maintain and support airway
3. Note respiratory rate and effort – If possible, monitor pulse oximetry and/or capnography
4. Assess circulatory status:
  - a. Blood pressure (if possible)
  - b. Pulse rate
  - c. Capillary refill
5. Assess mental status
  - a. Check blood glucose (if possible)
6. Obtain temperature (if possible)
7. Assess for evidence of traumatic injuries
8. Use a validated risk assessment tool such as RASS (Richmond Agitation Sedation Score), AMSS (Altered Mental Status Score), or BARS (Behavioral Activity Rating Scale) to risk stratify violent patients to help guide interventions

#### **Treatment and Interventions**

1. Establish patient rapport
  - a. Attempt verbal reassurance and calm patient prior to use of pharmacologic and/or physical management devices
  - 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 use of chemical/physical management devices

2. Pharmacologic management
  - a. Notes:
    - i. Selection of medications for pharmacologic management should be based upon the patient's clinical condition, current medications, and allergies in addition to EMS resources and medical oversight
    - ii. The medications are annotated to indicate when they are preferred for patients that are particularly high risk for violence as assessed by a validated scale – note that the dosing can be adjusted to achieve different levels of sedation
    - iii. The numbering of medications below is not intended to indicate a hierarchy/preference of administration
  - b. 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 (maximum dose is 5 mg)  
**OR**
        - b. 0.1-0.2 mg/kg IM(maximum dose is 10 mg)
    - 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 (maximum dose is 2 mg)  
**OR**
        - b. 0.05 mg/kg IM (maximum dose is 4 mg)
    - 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 (maximum dose 5 mg)  
**OR**
        - b. 0.1-0.15 mg/kg IM (maximum dose is 5 mg)  
**OR**
        - c. 0.3 mg/kg IN(maximum dose is 5 mg)
  - c. Antipsychotics
    - i. Droperidol (option for high violence risk)
      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 (Limited data available, optimal dose not established)
      - 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: Age 6-12 yo: 1-3 mg IM (maximum dose 0.15 mg/kg)
    - iii. Olanzapine
 

*(Note: Concurrent use of IM/IV benzodiazepines and olanzapine IM is not recommended as fatalities have been reported)*

      - 1. Adults: 10 mg IM; 15-30 minute onset of action
      - 2. Pediatrics:
        - a. Age 6-11 yo: 5 mg IM *(limited data available for pediatric use)*
        - b. Age 12-18 yo: 10 mg IM
    - iv. Ziprasidone
      - 1. Adults: 10 mg IM; 10 minute onset of action
      - 2. Pediatrics:
        - a. Age 6-11 yo: 5 mg IM *(limited data available for pediatric use)*
        - b. Age 12-18 yo: 10 mg IM
  - d. Dissociative Agents (Provide Sedation and Anesthesia)
    - i. Ketamine (option for high violence risk)
      - 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: 1 mg/kg IM/IV/PO (maximum dose of 25 mg)
2. Physical Management Devices
  - a. Body
    - i. Stretcher straps should be applied as the standard procedure for all patients during transport
    - ii. Physical management devices, including stretcher straps, should never restrict the patient's chest wall motion
    - iii. If necessary, sheets may be used as improvised supplemental stretcher straps. Other forms of improvised physical management devices should be discouraged
    - iv. Supplemental straps or sheets may be necessary to prevent flexion/extension of torso, hips, legs by being placed around the lower lumbar region, below the buttocks, and over the thighs, knees, and legs
  - b. Extremities
    - i. Soft or leather devices should not require a key to release them
    - ii. Secure all four extremities to maximize safety for patient, staff, and others
    - iii. Secure all extremities to the stationary frame of the stretcher
    - iv. Multiple knots should not be used to secure a device

### **Patient Safety Considerations**

The management of violent patients requires a constant reevaluation of the risk/benefit balance for the patient and bystanders in order to provide the safest care for all involved. These are complex and high-risk encounters. There is no one size fits all solution for addressing these patients.

1. Don 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 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 pharmacologic management medications have been administered
7. All patients who have received pharmacologic management medications must be monitored closely for the development of hypoventilation and oversedation
  - a. Utilize capnography if available
8. Patients who have received antipsychotic medication for pharmacologic management 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 secured with one arm above the head and the other arm below the waist, and both lower extremities individually secured
11. The following techniques should be expressly prohibited by EMS providers:
  - a. Secure or transport in a prone position with or without hands and feet behind the back (hobbling or "hog-tying")
  - b. "Sandwiching" patients between backboards
  - c. Techniques that constrict the neck or compromise the airway
  - d. EMS provider use of weapons as adjuncts in managing a patient
12. Concurrent use of IM/IV benzodiazepines and olanzapine IM is not recommended as fatalities have been reported



## **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. Stretchers with adequate foam padding, particularly around the head, facilitates patient's ability to self-position the head and neck to maintain airway patency
4. For patients with key-locking devices, applied by another agency, consider the following options:
  - a. Remove device and replace it with a device that does not require a key
  - b. Administer pharmacologic management medication then remove and replace device with another non-key-locking device after patient has become more cooperative
  - c. Transport patient, accompanied in patient compartment by person who has device key
  - 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**

1. Continuous monitoring of:
  - a. Airway patency
  - b. Respiratory status with pulse oximetry and/or capnography
  - c. Circulatory status with frequent blood pressure measurements
  - d. Mental status and trends in level of patient cooperation
  - e. Cardiac status, especially if the patient has received pharmacologic management medication
  - f. Extremity perfusion with capillary refill in patients in physical management device

## **Quality Improvement**

### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914053 – General-Behavioral/Patient Restraint

### **Key Documentation Elements**

- Etiology of agitated or violent behavior if known
- Patient's medications, other medications or substances found on scene
- Patient's medical history or other historic factors reported by patient, family or bystanders
- Physical evidence or history of trauma
- Adequate oxygenation by pulse oximetry
- Blood glucose measurement
- Measures taken to establish patient rapport
- Dose, route, and number of doses of pharmacologic management medications administered
- Clinical response to pharmacologic management medications
- Number and physical sites of placement of physical management devices
- Duration of placement of physical management devices
- Repeated assessment of airway patency
- Repeated assessment of respiratory rate, effort, pulse oximetry/capnography
- Repeated assessment of circulatory status with blood pressure, capillary refill, cardiac monitoring

- Repeated assessment of mental status and trends in the level of patient cooperation
- Repeated assessment of capillary refill in patient with extremity securing devices
- Communications with EMS direct medical oversight
- Initiation and duration of engagement with law enforcement

### **Performance Measures**

- Incidence of injuries to patient, EMS personnel, or others on scene
- Incidence of injuries to patient, EMS personnel, or others during transport
- Medical or physical complications (including sudden death) in patients
- Advance informational communication of EMS protocols for the management of agitated and violent patients to others within the emergency care system and law enforcement
- Initiation and engagement with EMS direct medical oversight
- Initiation and duration of engagement with law enforcement
- **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms

### **References**

1. Adimando AJ, Poncin YB, Baum CR. Pharmacological management of the agitated pediatric patient. *Pediatr Emerg Care.* 2010;26(11):856-60.
2. Drayna PC, Estrada C, Wang W, Saville BR, Arnold DH. Ketamine sedation is not associated with clinically meaningful elevation of intraocular pressure. *Am J Emerg Med.* 2012;30(7):1215-8.
3. Ely EW, Truman B, Shintani A, et al. Monitoring sedation status over time in ICU patients: reliability and validity of the Richmond Agitation-Sedation Scale (RASS). *JAMA.* 2003;289(22):2983-91.
4. Halstead SM, Deakyne SJ, Bajaj L, Enzenauer R, Roosevelt GE. The effect of ketamine on intraocular pressure in pediatric patients during procedural sedation. *Acad Emerg Med.* 2012;19(10):1145-50.
5. Ho JD, Smith SW, Nystrom PC, et al. Successful management of excited delirium syndrome with prehospital ketamine: two case examples. *Prehosp Emerg Care.* 2013;17(2): 274-9.
6. Kupas DF, Wydro GC. Patient restraint in emergency medical services systems. *Prehosp Emerg Care.* 2002;6(3):340-5.
7. Sonnier L, Barzman D. Pharmacologic management of acutely agitated pediatric patients. *Paediatr Drugs.* 2011 1;13(1):1-10.
8. Swift RH, Harrigan EP, Cappelleri JC, Kramer D, Chandler LP. Validation of the behavioural activity rating scale (BARS): a novel measure of activity in agitated patients. *J Psychiatr Res.* 2002;36(2):87-95.
9. Tsz DS, Steele DW, Machan JT, Akhlaghi F, Linakis JG. Intranasal ketamine for procedural sedation in pediatric laceration repair: a preliminary report. *Pediatr Emerg Care.* 2012;28(8):767-70
10. *White Paper Report on Excited Delirium Syndrome.* ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009.

### **Revision Date**

September 8, 2017

## Anaphylaxis and Allergic Reaction

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

### Aliases

Anaphylactic Shock

### 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 and/or anaphylaxis

#### Exclusion Criteria

No 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
  - a. 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 after exposure to a known allergen
    1. Adults: Systolic BP *less than* 90
    2. Pediatrics: see [Appendix VIII – Abnormal Vital Signs](#)

**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)
      - a. Skin involvement may be ABSENT in up to 40% of cases of anaphylaxis
    2. Respiratory compromise (dyspnea, wheeze, stridor, hypoxemia)
    3. Persistent gastrointestinal symptoms (vomiting, abdominal pain, diarrhea)
    4. Hypotension or associated symptoms (syncope, hypotonia, incontinence)
- b. Non-anaphylactic Allergic Reaction
  - i. Signs involving only **one** organ system (e.g. localized angioedema that does not compromise the airway, or not associated with vomiting; hives alone)

### **Treatment and Interventions**

1. If signs of allergic reaction without signs of anaphylaxis, go to **Step 4**
2. If signs of anaphylaxis, administer epinephrine 1mg/mL at the following dose and route:
  - a. Adult (25kg or more) 0.3 mg IM in the anterolateral thigh
  - b. Pediatric (less than 25kg) 0.15 mg in the anterolateral thigh
  - c. Epinephrine 1mg/mL may be administered from a vial or via auto-injector, if available
3. For urticaria or pruritus, administer a diphenhydramine 1 mg/kg, up to maximum dose of 50 mg IM, IV, or PO)
  - a. The IV route is preferred for the patient in severe shock
  - b. As a supplement to diphenhydramine given for urticaria, any H2-blocking antihistamine (e.g. famotidine, cimetidine) can be given IV or PO in conjunction with diphenhydramine
4. If respiratory distress with wheezing is present, consider administering
  - a. Albuterol 2.5-5 mg nebulized
  - AND/OR**
  - b. Epinephrine 1mg/mL, 5mL nebulized
5. If stridor is present, consider administering epinephrine 1mg/mL, 5mL nebulized
6. If signs of anaphylaxis and hypoperfusion persist following the first dose of epinephrine, additional IM epinephrine can be repeated every 5-15 minutes at above noted doses
7. 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
8. 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
9. 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. 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 (e.g. food, medicine, pollen, insect sting or any ingested, inhaled, or injected substance). A localized allergic reaction (e.g. 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. 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.

3. 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
4. Gastrointestinal symptoms occur most commonly in food-induced anaphylaxis, but can occur with other causes
  - a. Oral pruritus is often the first symptom observed in patients experiencing food-induced anaphylaxis
  - b. Abdominal cramping is also common, but nausea, vomiting, and diarrhea are frequently observed as well
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**

##### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914111 – Medical-Allergic Reaction/Anaphylaxis

### Key Documentation Elements

- Medications given
- Dose and concentration of epinephrine given
- Route of epinephrine administration
- Time of epinephrine administration
- Signs and symptoms of the patient

### Performance Measures

- Percentage of patients with anaphylaxis that receive epinephrine for anaphylaxis:
  - Via the IM route (vs. other routes)
  - Via the IM route in the anterolateral thigh (vs. other locations)
- Percentage of patients with anaphylaxis who receive:
  - Epinephrine within 10 minutes of arrival
  - The appropriate weight-based dose of epinephrine
- Percentage of patients that require airway management in the prehospital setting (and/or the emergency department)
- **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - **PEDS-03: Documentation of estimated weight in kilograms.** Frequency that weight or length-based estimate are documented in kilograms

### References

1. Banerji, A, Rudders SA, Corel B, Garth AP, Clark S, Camargo, CA Jr. Predictors of hospital admission for food-related allergic reactions that present to the emergency department. *Ann Allergy Asthma Immunol.* 2011;106(1):42-8.
2. Breuer C, Wachall B, Gerbeth K, Abdel-Tawab M, Fuhr U. Pharmacokinetics and pharmacodynamics of moist inhalation epinephrine using a mobile inhaler. *Eur J Clin Pharmacol.* 2013;69(6):303-10.
3. Capps JA, Sharma V, Arkwright, PD. Prevalence, outcome and pre-hospital management of anaphylaxis by first aiders and paramedical ambulance staff in Manchester, UK. *Resuscitation.* 2010;81(6):653-7.
4. Dahlof C, Mellstrand T, Svedmyr N. Systemic absorption of adrenaline after aerosol, eye-drop and subcutaneous administration to healthy volunteers. *Allergy.* 1987;42(3):215-21.
5. Hauswald M. Can paramedics safely decide which patients do not need ambulance transport or emergency department care? *Prehosp Emerg Care.* 2002;6(4):383-6.
6. Heilborn H, Hjemdahl P, Daleskog M, Adamsson U. Comparison of subcutaneous injection and high-dose inhalation of epinephrine – implications for self-treatment to prevent anaphylaxis. *J Allergy Clin Immunol.* 1986;78(6):1174-9.
7. Hompes S, Köhli A, Nemat K, et al. Provoking allergens and treatment of anaphylaxis in children and adolescents – data from the anaphylaxis registry of German-speaking countries. *Pediatr Allergy Immunol.* 2011;22(6):568-74.
8. Huang F, Chawla K, Jarvinen KM, Nowak-Wegrzyn A. Anaphylaxis in a New York City pediatric emergency department: Triggers, treatments, and outcomes. *J Allergy Clin Immunol.* 2012;129(1):162-168.e1-3.
9. Iribarren C, Tolstykh IV, Miller MK, Eisner, MD. Asthma and the prospective risk of anaphylactic shock and other allergy diagnoses in a large integrated health care delivery system. *Ann Allergy Asthma Immunol.* 2010;104(5):371-7.
10. Kanwar M, Irvin CB, Frank JJ, Weber K, Rosman H. Confusion about epinephrine dosing

- leading to iatrogenic overdose: a life-threatening problem with a potential solution. *Ann Emerg Med.* 2010;55(4):341-4.
11. Lieberman P, Nicklas RA, Randolph C, et al. Anaphylaxis-a practice parameter update 2015. *Ann Allergy Asthma Immunol.* 2015;115(5):341-84.
  12. Pointer JE, Levitt MA, Young JC, Promes SB, Messana BJ, Ader ME. Can paramedics using guidelines accurately triage patients? *Ann Emerg Med.* 2011;38(3):268-77.
  13. Rea TD, Edwards C, Murray JA, Cloyd DJ, Eisenberg, MS. Epinephrine use by emergency medical technicians for presumed anaphylaxis. *Prehosp Emerg Care.* 2004;8(4):405-10.
  14. Runge JW, Martinez JC, Caravati EM, Williamson SG, Hartsell, SC. Histamine antagonists in the treatment of acute allergic reactions. *Ann Emerg Med.* 1992;21(3):237-42.
  15. Sampson HA. Anaphylaxis and emergency treatment. *Pediatrics.* 2003;111(6 Pt 3):1601-8.
  16. Sampson HA, Munoz-Furlong A, Campbell RL, et al. Second symposium on the definition and management of anaphylaxis: summary report – Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network Symposium. *J Allergy Clin Immunol.* 2004;117(2):391-7.
  17. Sheikh A, Shehata YA, Brown SG, Simons FE. Adrenaline (epinephrine) for the treatment of anaphylaxis with and without shock. *Cochrane Database Syst Rev.* (4) 2008 CD006312
  18. Sheikh A, Simons FE, Barbour V, Worth A. Adrenaline auto-injectors for the treatment of anaphylaxis with and without cardiovascular collapse in the community. *Cochrane Database Syst Rev.* 2012 Aug 15;(8):CD008935.
  19. Sheikh A, ten Broek V, Brown SG, Simons FE. H1-antihistamines for the treatment of anaphylaxis with and without shock. *Cochrane Database Syst Rev.* 2007 Jan 24;(1):CD006160.
  20. Silvestri S, Rothrock SG, Kennedy D, Ladde J, Bryant M, Pagane J. Can paramedics accurately identify patients who do not require emergency department care? *Prehosp Emerg Care.* 2002;6(4):387-90.
  21. Simons FE, Chan ES, Gu X, Simons KJ. Epinephrine for the out-of-hospital (first-aid) treatment of anaphylaxis in infants: is the ampule/syringe/needle method practical? *J Allergy Clin Immunol.* 2001;108(6):1040-4.
  22. Simons FE, Gu X, Johnston, LM, Simons KJ. Can epinephrine inhalations be substituted for epinephrine injection in children at risk for systemic anaphylaxis? *Pediatrics.* 2000;106(5):1040-4.
  23. Simons FE, Roberts JR, Gu X, Simons KJ. Epinephrine absorption in children with a history of anaphylaxis. *J Allergy Clin Immunol.* 1998;101(1 Pt 1):33-7.
  24. Taillac PP, Brown L, Lubogo N, Nichols J, Shah MI. An evidence-based guideline for pediatric prehospital allergic reaction management using GRADE methodology. Manuscript in preparation.
  25. Watson NT, Weiss EL, Harter PM. Famotidine in the treatment of acute urticaria. *Clin Exp Dermatol.* 2000;25(3):186-9.
  26. Yavuz ST, Sahiner UM, Buyuktiryaki B, et al. Clinical features of children with venom allergy and risk factors for severe systemic reactions. *Int Arch Allergy Immunol.* 2013;160(3):313-21.

### **Revision Date**

September 8, 2017

## Altered Mental Status

### **Aliases**

Confusion, altered level of consciousness

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



8. Vasopressors [see [Shock guideline](#)]

### **Patient Safety Considerations**

1. With depressed mental status, initial focus is on airway protection, oxygenation, ventilation, and perfusion
2. The violent patient may need pharmacologic and/or physical management to insure proper assessment and treatment
3. 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:
  - a. Anticoagulants
  - b. Anti-depressants
  - c. Narcotic pain relievers
  - d. Benzodiazepines
6. Medical alert tags and accessory medical devices
7. Evaluate for reduced PO intake and/or vomiting and/or diarrhea or dehydration as a cause of AMS in the pediatric and geriatric populations
8. Medications a child may have access to including but not limited to:
  - a. Antihypertensives
  - b. Oral hypoglycemic
  - c. Opioids
  - d. Benzodiazepines
  - e. Antiepileptics

#### **Pertinent Assessment Findings**

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

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914113 – Medical-Altered Mental Status

#### **Key Documentation Elements**

- GCS or AVPU description
- Temperature was taken when able
- Patient and medic safety were considered
- Pupil and neck exam were done

### **Performance Measure**

- Hypoglycemia considered and treated appropriately
  - Blood glucose level obtained.
  - **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
    - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia
- Sepsis considered as a possible cause of hypotension
- Hypotension appropriately treated
- Naloxone is used as therapeutic intervention, not a diagnostic tool
- CO detector is used when available

### **References**

1. Frisch A, Miller T, Haag A, Martin-Gill C, Guyette FX, Suffoletto BP. Diagnostic accuracy of a rapid checklist to identify delirium in older patients transported by EMS. *Prehosp Emerg Care*, 2013 Apr-Jun; 17(2): 230-4.
2. Kumar A, Roberts D et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med*, 2006 Jun; 34(6): 1,589–96.
3. Leong LB, Jian KH, Vasu A, Seow E. Prospective study of patients with altered mental status: clinical features and outcome. *Int J Emerg Med*, 2008 Sep; 1(3): 179–82.

### **Revision Date**

September 8, 2017

## Back Pain

### **Aliases**

None

### **Patient Care Goals**

1. Improve patient discomfort
2. Identify life-threatening causes of back pain

### **Patient Presentation**

#### **Inclusion Criteria**

Back pain or discomfort related to a non-traumatic cause or when pain was due to non-acute trauma (e.g. chronic pain conditions)

#### **Exclusion Criteria**

1. Back pain from spinal trauma [see [Trauma](#) guidelines]
2. Back pain due to sickle cell pain crisis [see [Sickle Cell Pain Crisis guideline](#)]
3. Back pain from suspected labor [see [OB/GYN](#) guidelines]

### **Patient Management**

#### **Assessment**

1. Perform airway assessment and management, per the [Airway Management guideline](#)
2. Obtain vital signs including pulse, respiratory rate, pulse oximetry, and blood pressure
3. Provide evaluation and management of pain, per the [Pain Management guideline](#)
4. Obtain vascular access as necessary to provide analgesia and/or fluid resuscitation
5. Assess for life-threatening causes of back pain, which may include:
  - a. Spinal cord compression (e.g. from spinal epidural abscess, malignancy, spinal epidural hematoma for patients on anticoagulants)
    - i. Urinary and/or bowel incontinence
    - ii. Inability to walk due to weakness
    - iii. New neurologic deficits in extremities
    - iv. Loss of sensation in saddle distribution
  - b. Aortic dissection or ruptured abdominal aortic aneurysm
    - i. Unequal femoral or distal lower extremity pulses
    - ii. "Pulsatile" abdominal mass
    - iii. Associated abdominal pain and/or chest pain
    - iv. Known history of abdominal aortic aneurysm or dissection
  - c. Pyelonephritis
    - i. Fever
    - ii. Nausea, vomiting
    - iii. Urinary frequency/urgency
    - iv. Dysuria
    - v. Hematuria
    - vi. Abdominal pain
    - vii. Costovertebral angle tenderness to percussion

6. Assess for signs of shock. If shock is present, provide treatment per appropriate [Shock guideline](#)
7. Assess for other non-life threatening causes of abdominal pain
  - a. Kidney stone
    - i. Unilateral flank pain
    - ii. Nausea, vomiting
    - iii. Possible hematuria
    - iv. History of kidney stones

### **Treatment and Interventions**

1. Medication Administration
  - a. Provide analgesia, per [Pain Management guideline](#)
  - b. Administer antiemetics, per [Nausea-Vomiting guideline](#)
  - c. Provide transport to an appropriate receiving facility – Consider specialty destination centers for conditions such as suspected aortic emergency
  - d. Reassess vital signs and response to therapeutic interventions throughout transport

### **Patient Safety Considerations**

No recommendations

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Assess for life-threatening causes of back pain
2. Provide appropriate treatment for pain, vomiting, and shock
3. Consider transport to appropriate specialty center if aortic emergency suspected
4. Back and abdominal pain can often coexist with similar disease processes
5. Identify patients on anticoagulants since they are higher risk for spinal epidural hematoma or retroperitoneal hemorrhage which can present as back pain
6. Identify patients with IVDA history and/or impaired immune system since they are higher risk for spinal epidural abscess
7. Identify patients with a history of cancer or with one suspicious for cancer – spinal metastases can cause spinal cord compression

#### **Pertinent Assessment Findings**

1. Midline back tenderness
2. Back erythema or swelling
3. Motor and/or sensory loss in arms or legs
4. Loss of perianal sensation
5. Absence of or significant inequality of femoral or distal arterial pulses in lower extremities
6. Hyper or hypothermia
7. Rectal bleeding or hematemesis

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914051 – General-Back Pain

**Key Documentation Elements**

- Assessment of back and abdomen to include findings on palpation/percussion including presence or absence of masses and presence and nature of tenderness/pain
- Assesses initial and changes in neurologic status
- Assesses initial and changes in perfusion/pulses

**Performance Measures**

- Assessment for life-threatening etiology
- Mitigation of pain, per the [Pain Management guideline](#)

**References**

None recommended

**Revision Date**

September 8, 2017

## End-of-Life Care/Palliative Care

### Aliases

None noted

### Patient Care Goals

1. When providing care for a patient near end-of-life:
  - a. Provide relief from pain and other distressing symptoms
  - b. Affirm dying as a normal process
  - c. Integrate psychological and spiritual aspects of patient care
  - d. Offer a support system to help the family cope during the patient's illness and in their own bereavement

### Patient Presentation

#### Inclusion Criteria

Patient enrolled in hospice or palliative care, or who have advance care directives, experiencing complaints related to the illness for which the patient is receiving those services.

#### Exclusion Criteria

Complaints unrelated to the illness for which the patient is receiving those services.

### Patient Management

#### Assessment, Treatment, and Interventions

1. Perform general patient management
2. If the patient is able to communicate and has the capacity to make decisions regarding treatment and transport, consult directly with the patient before treatment and/or transport
3. If the patient lacks the capacity to make decisions regarding treatment and/or transport, identify any advanced care planning in place for information relating to advanced care planning and consent for treatment
  - a. Advanced care directives
  - b. MOLST/POLST or similar forms
  - c. Guardian, power of attorney, or other accepted healthcare proxy
4. If the patient requires pain relief [see [Pain Management guideline](#)]
5. If the adult patient is experiencing severe respiratory distress, consider:
  - a. Midazolam 2 to 5 mg IV

**OR**

  - b. Fentanyl 25 mcg mixed in 2 mL saline nebulized or other analgesics
6. If the patient has nausea [see [Nausea and Vomiting guideline](#)]
7. If the patient has excessive secretions, provide suctioning
8. If the adult patient is anxious, consider:
  - a. Benzodiazepines

**OR**

  - b. Haldol 5 mg IV

**OR**

  - c. Geodon 20 mg IM

9. If the patient appears dehydrated
  - a. Encourage PO fluid intake if patient is able to swallow
  - b. If available, offer ice chips and swabs soaked in ice water
  - c. Consider administration of normal saline at 10 to 20 mL/kg IV
10. In collaboration with hospice or palliative care provider, coordinate with guardian, power of attorney, or other accepted healthcare proxy if non-transport is considered

#### **Patient Safety Considerations**

1. Careful and thorough assessments should be performed to identify complaints not related to the illness for which the patient is receiving hospice or palliative care
2. Care should be delivered with the utmost patience and compassion

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

##### **Key Considerations**

1. Social interactions with family may affect end-of-life care
2. Scene safety should be considered when deciding on management

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

1. Vital signs
2. Pain score
3. Neurologic exam
4. Lung sounds

#### **Quality Improvement**

##### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914169 – Cardiac Arrest-Do Not Resuscitate
- 9914171 – Cardiac Arrest-Special Resuscitation Orders
- 9914177 – General-Exception Protocol

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

- Interaction with hospice or palliative care provider
- Confirmation of advanced directive or other advanced care documentation
- Pain score if applicable

##### **Performance Measures**

- If in patient in pain, pain score change
- If patient is nauseated, symptom relief
- If patient is dehydrated, symptom relief or vital sign change

## **References**

1. Canadian Prehospital Evidence Based Practice. <https://emssep.cdha.nshealth.ca/TOC.aspx>. Accessed April 28, 2017.
2. Coyne PJ, Viswanathan R, Smith TJ. Nebulized fentanyl citrate improves patients' perception of breathing, respiratory rate, and oxygen saturation in dyspnea. *J Pain Symptom Manage*. 2002;23(2):157-60.
3. Farahmand S, Shiralizadeh S, Talebian MT, et al. Nebulized fentanyl vs intravenous morphine for ED patients with acute limb pain: a randomized clinical trial. *Am J Emerg Med*. 2014;32(9):1011-5.
4. Shirk MB, Donahue KR, Shirvai J. Unlabeled uses of nebulized medications. *Am J Health Syst Pharm*. 2006;63(18):1704-16.

## **Revision Date**

September 8, 2017



## Hyperglycemia

### **Aliases**

Diabetic ketoacidosis (DKA), hyperosmolar hyperglycemic state, hyperosmolar non-ketotic coma, diabetes

### **Patient Care Goals**

1. Limit morbidity from hyperglycemia by:
  - a. Appropriate use of glucose monitoring
  - b. Appropriate hydration for hyperglycemia

### **Patient Presentation**

#### **Inclusion Criteria**

1. Adult or pediatric patient with altered level of consciousness [see [Altered Mental Status guideline](#)]
2. Adult or pediatric patient with stroke symptoms (e.g. hemiparesis, dysarthria) [see [Suspected Stroke/Transient Ischemic Attack guideline](#)]
3. Adult or pediatric patient with seizure [see [Seizures guideline](#)]
4. Adult or pediatric patient with symptoms of hyperglycemia (e.g. polyuria, polydipsia, weakness, dizziness, abdominal pain, tachypnea)
5. Adult or pediatric patient with history of diabetes and other medical symptoms

#### **Exclusion Criteria**

Patient in cardiac arrest.

### **Patient Management**

#### **Assessment**

1. Monitoring:
  - a. Check blood glucose level
2. Secondary survey pertinent to altered blood glucose level:
  - a. Constitutional: assess for tachycardia, hypotension, and tachypnea
  - 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
3. Evaluate for possible concomitant sepsis and septic shock [see [Shock guideline](#)]
4. Obtain 12-lead EKG to assess for peaked T waves or other findings consistent with hyperkalemia

#### **Treatment and Interventions**

1. If altered level of consciousness, stroke, or sepsis/septic shock, treat per [Altered Mental Status](#), [Suspected Stroke/Transient Ischemic Attack](#), or [Shock](#) guidelines accordingly
2. If findings of hyperkalemia are present, administer IV fluids and consider administration of:
  - a. Calcium chloride – 1 gm IV/IO over 5 minutes, ensure IV patency and do not exceed 1 mL per minute

**OR**

  - b. Calcium gluconate – 2 gm IV/IO over 5 minutes, with constant cardiac monitoring

3. If findings of hyperkalemia, administer sodium bicarbonate 1 mEq /kg (max dose of 50 mEq) IV bolus over 5 minutes and consider albuterol 5.0 mg via small volume nebulizer
4. If glucose greater than 250 mg/dL with symptoms of dehydration, vomiting, abdominal pain, or altered level of consciousness:
  - a. Provide volume expansion with normal saline bolus
    - i. Adult: Normal saline 1 L bolus IV; reassess and rebolus 1L if indicated
    - ii. Pediatric: Normal saline 10 mL/kg bolus IV, reassess, and repeat up to 40 mL/kg total
5. Reassess patient
  - a. Reassess vital signs, mental status, and signs of dehydration
  - b. If mental status changes, reassess blood glucose level and provide appropriate treatment if hypoglycemia has developed
6. Disposition
  - a. Transport to closest appropriate receiving facility

### **Patient Safety Considerations**

1. Overly aggressive administration of fluid in hyperglycemic patients may cause cerebral edema or dangerous hyponatremia
  - a. Closely monitor for signs of altered mental status, increased intracranial pressure, and immediately discontinue IV fluids and elevate head of bed if signs of increased ICP develop
  - b. Reassess and manage airway as needed
2. Asymptomatic hyperglycemia poses no risk to the patient while inappropriately aggressive interventions to manage blood sugar can harm patients

### **Notes/Educational Pearls**

#### **Key Considerations**

1. New onset diabetic ketoacidosis in pediatric patients commonly presents with nausea, vomiting, abdominal pain, and/or urinary frequency
2. Consider causes for hyperglycemia by thinking about the 3 I's:
  - a. Insulin – this refers to any medication changes for insulin or oral medications including poor compliance or malfunctioning insulin pump
  - b. Ischemia – this refers to hyperglycemia sometimes being an indication of physiologic stress in a patient and can be a clue to myocardial ischemia in particular
  - c. Infection – underlying infection can cause derangements in glucose control

#### **Pertinent Assessment Findings**

1. Concomitant trauma
2. Abdominal pain, “fruity breath,” and rapid-deep respirations (Kussmaul’s respiration) may be associated with diabetic ketoacidosis

### **Quality Improvement**

#### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914121 – Medical-Hyperglycemia

### Key Documentation Elements

- Document reassessment of vital signs and mental status after administration of IV fluids
- Document glucose level (if in scope of practice) when indicated

### Performance Measures

- 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
- When hyperglycemia documented, appropriate volume replacement given while avoiding overzealous repletion before insulin therapy at receiving center
- 12-lead EKG obtained
- **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms

### References

1. Corwell B, Knight B, Olivieri L, Willis GC. Current diagnosis and treatment of hyperglycemic emergencies. *Emerg Med Clin North Am.* 2014;32(2):437-52.
2. Kitabchi AE, Umpierrez GE, Miles JM, et al. Hyperglycemic crises in adult patients with diabetes. *Diabetes Care.* 2009;32(7):1335–43.
3. Funk DL, Chan L, Lutz N, Verdile VP. Comparison of capillary and venous glucose measurements in healthy volunteers. *Prehosp Emerg Care.* 2001;5(3):275-7.
4. Desachy A, Vuagnat AC, Ghazali AD, et al. Accuracy of bedside glucometry in critically ill patients: influence of clinical characteristics and perfusion index. *Mayo Clin Proc.* 2008;83(4):400-5.
5. Holstein A, Kuhne D, Elsing HG, et al. Practicality and accuracy of prehospital rapid venous blood glucose determination. *Am J Emerg Med.* 2000;18(6):690-4.
6. Holstein A, Plaschke A, Vogel MY, Egberts EH. Prehospital management of diabetic emergencies – a population-based intervention study. *Acta Anaesthesiol Scand.* 2003;47(5):610-5.
7. Jones JL, Ray VG, Gough JE, Garrison HG, Whitley TW. Determination of prehospital blood glucose: a prospective, controlled study. *J Emerg Med.* 1992;10(6):679-82.
8. Kulkarni A, Saxena M, Price G., et al. Analysis of blood glucose measurements using capillary and arterial blood samples in intensive care patients. *Intensive Care Med.* 2005;31:142.
9. Kumar G, Sng BL, Kumar S. Correlation of capillary and venous glucometry with laboratory determination. *Prehosp Emerg Care.* 2004;8(4):378-83.
10. Roberts K, Smith A. Outcome of diabetic patients treated in the prehospital arena after a hypoglycemic episode, and an exploration of treat and release protocols: a review of the literature. *Emerg J Med.* 2003;20(3):274-6.

### Revision date

September 8, 2017

## Hypoglycemia

### **Aliases**

Diabetic coma, insulin shock

### **Patient Care Goals**

1. Limit morbidity from hypoglycemia by:
  - a. Describing appropriate use of glucose monitoring
  - b. Treating symptomatic hypoglycemia

### **Patient Presentation**

#### **Inclusion Criteria**

1. Adult or pediatric patient with blood glucose less than 60 mg/dL with symptoms of hypoglycemia
2. Adult or pediatric patient with altered level of consciousness [see [Altered Mental Status guideline](#)]
3. Adult or pediatric patient with stroke symptoms (e.g. hemiparesis, dysarthria) [see [Suspected Stroke/Transient Ischemic Attack guideline](#)]
4. Adult or pediatric patient with seizure [see [Seizures guideline](#)]
5. Adult or pediatric patient with history of diabetes and other medical symptoms
6. Pediatric patient with suspected alcohol ingestion
7. Adult patient who appears to be intoxicated

#### **Exclusion Criteria**

Patient in cardiac arrest

### **Patient Management**

#### **Assessment**

1. Monitoring:
  - a. Check blood glucose level
2. Secondary survey pertinent to altered blood glucose level:
  - a. Evaluate for presence of an automated external insulin delivery device (insulin pump)
  - b. Constitutional: assess for tachycardia and hypotension
  - c. Eyes: assess for sunken eyes from dehydration
  - d. Nose /mouth/ears: assess for dry mucus membranes or tongue bite from seizure
  - e. 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, treat per [Altered Mental Status](#) or [Suspected Stroke/Transient Ischemic Attack](#) guidelines accordingly
2. If blood glucose is 60 mg/dL or less administer one of the following:
  - a. Conscious patient with a patent airway:
    - i. Glucose, oral (in form of glucose tablets, glucose gel, tube of cake icing, etc.)
      1. Adult Dosing: 25 g
      2. Pediatric Dosing: 0.5-1 g/kg

- b. Unconscious patient, or patients who are unable to protect their own airway:
    - i. Dextrose IV – administer in incremental doses until mental status improves or maximum field dosing is reached
      - 1. Maximum field adult dosing: 25 g of 10-50% dextrose IV
        - a. 50 mL of 50% dextrose
        - b. 100 mL of 25% dextrose
        - c. 250 mL of 10% dextrose
      - 2. Maximum field pediatric dosing: 0.5-1 g/kg of 10-25% dextrose IV
        - a. 2 – 4 mL/kg of 25% dextrose
        - b. 4 – 8 mL/kg of 12.5% dextrose
        - c. 5 – 10 mL/kg of 10% dextrose
    - ii. Glucagon IM/IN
      - 1. Adult dosing: 1 mg IM/IN
      - 2. Pediatric dosing:
        - a. 1 mg IM/IN if  $\geq 20$  kg (or  $\geq 5$  yo)
        - b. 0.5 mg IM/IN if less than 20 kg (or less than 5 yo)
    - iii. Remove or disable insulin pump if above treatments cannot be completed
  - c. For patients with an insulin pump who are hypoglycemic with associated altered mental status (GCS <15):
    - i. Stop the pump, disconnect or remove at insertion site if patient cannot ingest oral glucose or ALS is not available
    - ii. Leave the pump connected and running if able to ingest oral glucose or receive ALS interventions
3. Reassess patient
  - a. Reassess vital signs and mental status
  - b. Repeat check of blood glucose level 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
  - c. If maximal field dosage of dextrose solution does not achieve euglycemia and normalization of mental status:
    - i. Initiate transport to closest appropriate receiving facility for further treatment of refractory hypoglycemia
    - ii. Evaluate for alternative causes of altered mental status
    - iii. Continue treatment of hypoglycemia using dextrose solutions as noted above
4. Disposition
  - a. If hypoglycemia with continued symptoms, transport to closest appropriate receiving facility
  - b. Hypoglycemic patients who have had a seizure should be transported to the hospital regardless of their mental status and response to therapy
  - c. If symptoms of hypoglycemia resolve after treatment, release without transport should only be considered if **all** of the following are true:
    - i. Repeat glucose is greater than 80 mg/dL
    - ii. Patient takes insulin or metformin to control diabetes
    - iii. Patient returns to normal mental status, with no focal neurologic signs/symptoms after receiving glucose/dextrose
    - iv. Patient can promptly obtain and will eat a carbohydrate meal
    - v. Patient or legal guardian refuses transport and EMS providers agree transport not indicated

- vi. A reliable adult will be staying with patient
- vii. No major co-morbid symptoms exist, like chest pain, shortness of breath, seizures, intoxication
- viii. A clear cause of the hypoglycemia is identified (e.g. missed meal)

**Patient Safety Considerations**

- 1. Dextrose 10% can be safely used in all ages of patient
- 2. Dextrose 50% can cause local tissue damage if it extravasates from vein, and may cause hyperglycemia. Dextrose 50% carries risk for little clinical gain. EMS systems may consider carrying no more than 25% concentration of dextrose for treating hypoglycemia in adults
- 3. For children *less than* 8 yo, dextrose concentration of no more than 25% should be used
- 4. For neonates and infants *less than* 1 month of age, dextrose concentration of no more than 10-12.5% should be used
- 5. Sulfonylureas (e.g. glyburide, glipizide) have long half-lives ranging from 12-60 hours. Patients with corrected hypoglycemia who are taking these agents are at particular risk for recurrent symptoms and frequently require hospital admission

**Notes/Educational Pearls**

A formula for calculating a 0.5 g/kg dose of IV dextrose:  
 [50] [ \_\_\_ % concentration of glucose ] = \_\_\_ 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
- 4. Avoid overshoot hyperglycemia when correcting hypoglycemia. Administer dextrose-containing IV fluids in small doses until either mental status improves or a maximum field dose is achieved

**Pertinent Assessment Findings**

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

**Quality Improvement**

**Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914125 – Medical-Hypoglycemia/Diabetic Emergency

### Key Documentation Elements

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

### Performance Measures

- When in scope of practice, blood glucose is checked for all patients with symptoms of altered level of consciousness, seizure, stroke, or hypoglycemia
- If patient released at scene, criteria documented for safe release
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia

### References

1. A review of the efficiency of 10% dextrose as an alternative to high concentration glucose in the treatment of out-of-hospital hypoglycemia. *J Emerg Prim Health Care.* 2009;7(3):990341.
2. Desachy A, Vuagnat AC, Ghazali AD, et al. Accuracy of bedside glucometry in critically ill patients: influence of clinical characteristics and perfusion index. *Mayo Clin Proc.* 2008;83(4):400-5.
3. Funk DL, Chan L, Lutz N, Verdile VP. Comparison of capillary and venous glucose measurements in healthy volunteers. *Prehosp Emerg Care.* 2001;5(3):275-7.
4. Hern HG, Kiefer M, Louie D, Barger J, Alter HJ. D10 in the treatment of prehospital hypoglycemia: a 24 month observational cohort study. *Prehosp Emerg Care.* 2017;21(1):63-7.
5. Holstein A, Kuhne D, Elsing HG, et al. Practicality and accuracy of prehospital rapid venous blood glucose determination. *Am J Emerg Med.* 2000;18(6):690-4.
6. Holstein A, Plaschke A, Vogel MY, Egberts EH. Prehospital management of diabetic emergencies – a population-based intervention study. *Acta Anaesthesiol Scand.* 2003;47(5):610-5.
7. Jones JL, Ray VG, Gough JE, Garrison HG, Whitley TW. Determination of prehospital blood glucose: a prospective, controlled study. *J Emerg Med.* 1992;10(6):679-82.
8. Kulkarni A, Saxena M, Price G, O'Leary MJ, Jacques T, Myburgh JA. Analysis of blood glucose measurements using capillary and arterial blood samples in intensive care patients. *Intensive Care Med.* 2005;31(1):142-5.
9. Kumar G, Sng BL, Kumar S. Correlation of capillary and venous glucometry with laboratory determination. *Prehosp Emerg Care.* 2004;8(4):378-83.
10. Moore C, Woollard M. Dextrose 10% or 50% in the treatment of hypoglycaemia out of hospital? a randomized controlled trial. *Emerg Med J.* 2005;22:512–5.
11. Roberts K, Smith A. Outcome of diabetic patients treated in the prehospital arena after a hypoglycemic episode, and an exploration of treat and release protocols: a review of the literature. *Emerg J Med.* 2003;20(3):274-6.
12. Vilke GM, Castillo EM, Ray LU, Murrin PA, Chan TC. Evaluation of pediatric glucose monitoring and hypoglycemic therapy in the field. *Pediatr Emerg Care.* 2005;21(1):1-5.

### Revision Date

September 8, 2017

Updated January 5, 2019

## Nausea-Vomiting

### Aliases

Gastroenteritis, emesis

### Patient Care Goals

Decrease discomfort secondary to nausea and vomiting

### Patient Presentation

#### Inclusion Criteria

Currently nauseated and/or vomiting

#### Exclusion Criteria

No 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, hypoglycemia, hyperglycemia)

#### Treatment and Interventions

1. Anti-emetic medication administration (optional, if available; any that can be given IV can be given IO):
  - a. Ondansetron (contraindicated for suspected or known diagnosis of prolonged QT syndrome)
    1. Adult:
      1. 4mg IV/PO/SL
      - OR**
      2. 4 mg SL of the ODT formulation
    - ii. Pediatric (6 months old –14 yo): 0.15 mg/kg IV/PO (maximum dose of 4 mg)
  - b. Metoclopramide
    - i. Adult: 10 mg IV/IM
    - ii. Pediatric (over 2 yo only and greater than 12kg):
      1. 0.1 mg/kg IM
      - OR**
      2. IV (maximum 10 mg)
        - a. May repeat x 1 in 20 -30 minutes if no relief
  - c. Prochlorperazine
    - i. Adult: 5 mg IV/IM
    - ii. Pediatric (over 2 yo only and greater than 12kg):
      1. 0.1 mg/kg slow IV
      - OR**
      2. Deep IM (maximum 10 mg)
  - d. Diphenhydramine
    - i. Adult: 12.5-25mg IV/IM/PO
    - ii. Pediatric (over 2 yo only and greater than 12kg): 0.1 mg/kg IV (maximum 25 mg)



- e. Isopropyl alcohol – Allow patient to inhale vapor from isopropyl alcohol wipe 3 times every 15 minutes as tolerated
2. If signs of hypovolemia, administer Normal Saline
  - a. Adult: 500 mL IV/IO unless contraindicated (e.g. h/o CHF, renal failure)
  - b. Pediatric: Consider 10-20 mL/kg IV fluid unless contraindicated (e.g. by potential fluid overload)
  - c. May repeat as indicated

### **Patient Safety Considerations**

1. For very young pediatric patients, Ondansetron can be sedating
2. Dystonic and extrapyramidal symptoms are possible side effects of antiemetics – If encountered, consider diphenhydramine:
  - a. Adult: 25-50mg IV/IM/PO
  - b. Pediatric: 1 mg/kg IV/IM/PO (maximum dose 50mg)

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Ondansetron is preferred in children for the treatment of nausea and vomiting;
2. Metoclopramide has fewer adverse effects than prochlorperazine in children
3. Prochlorperazine and metoclopramide (phenothiazines) have an increased risk of dystonic reactions
  - a. 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
  - b. Prochlorperazine carries a black box warning for children under 2 yo
4. IV form of ondansetron may be given PO in same dose
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)
6. While ondansetron has not been adequately studied in pregnancy to determine safety, it remains a treatment option for hyperemesis gravidum in pregnant patient

#### **Pertinent Assessment Findings**

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

### **Quality Improvement**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914131 – Medical-Nausea/Vomiting

#### **Key Documentation Elements**

- Patient age
- Patient weight and/or length-based weight measure for pediatric patients
- Medications given, including time, provider level, dose, dose units, route, response and complications

- Vital signs before and after medication administration
- History and physical with regard to etiology of nausea/vomiting
- EKG performed and interpretation documented if cardiac risk factors are present

### **Performance Measures**

- In patients with nausea and vomiting, appropriate medication(s) was/were administered (including proper dosage) and the patient's response to treatment is documented
- Any event where complications occurred, such as a dystonic reaction, should have event and appropriate responsive interventions performed and documented
- **EMS Compass® Measure** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - **PEDS-03: Documentation of estimated weight in kilograms.** Frequency that weight or length-based estimate are documented in kilograms

### **References**

1. Beadle KL, Helbling AR, Love SL, April MD, Hunter CJ. Isopropyl alcohol nasal inhalation for nausea in the emergency department: a randomized controlled trial. *Ann Emerg Med.* 2016;68(1):1-9.
2. Colletti J, Brown KM, Sharieff GQ, Barata IA, Ishimine P; ACEP Pediatric Emergency Medicine Committee. The management of children with gastroenteritis and dehydration in the emergency department. *J Emerg Med.* 2010;38(5):686-98.
3. Kenneday D. Ondansetron and pregnancy: understanding the data. *Obstet Med.* 2016;9(1):28-33.
4. *Nausea and Vomiting of Pregnancy.* The American College of Obstetricians and Gynecologists; September 2015. Practice Bulletin Number 153.
5. Patanwala A, Amini R, Hays DP, Rosen P. Antiemetic therapy for nausea and vomiting in the emergency department. *J Emerg Med.* 2010;39(3):330-6.
6. Salvucci AA, Squire B, Burdick M, Luoto M, Brazzel D, Vaezazizi R. Ondansetron is safe and effective for prehospital treatment of nausea and vomiting by paramedics. *Prehosp Emerg Care.* 2011;15(1):34-8.
7. Warden CR, Moreno R, Daya M. Prospective evaluation of ondansetron for undifferentiated nausea and vomiting in the prehospital setting. *Prehosp Emerg Care.* 2008;12(1):87-91.

### **Revision Date**

September 8, 2017

## Pain Management

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

### **Aliases**

Analgesia, pain control, acute pain, acute traumatic pain, acute atraumatic pain

### **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. Approaches to pain relief must be designed to be safe and effective in the dynamic prehospital environment. The degree of pain and the hemodynamic status of the patient will determine the urgency and extent of analgesic interventions.

### **Patient Presentation**

#### **Inclusion Criteria**

Patients who are experiencing pain

#### **Exclusion Criteria**

1. Pregnancy with active labor
2. Dental pain
3. Patients with care-plans that prohibit use of parenteral analgesics by EMS
4. Patients with chronic pain who aren't part of a hospice/palliative care plan

### **Patient Management**

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

1. Determine patient's pain score assessment using standard pain scale.
  - a. Less than 4 yo: Observational scale (e.g. Faces, Legs, Arms, Cry, Consolability [FLACC] or Children's Hospital of Eastern Ontario Pain Scale [CHEOPS])
  - b. 4-12 yo: Self-report scale (e.g. Wong Baker Faces, Faces Pain Scale [FPS], Faces Pain Scale Revised [FPS-R])
  - c. Greater than 12 yo: Self-report scale (Numeric Rating Scale [NRS])
2. Place patient on cardiac monitor per patient assessment
3. 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
4. If not improved and patient is experiencing moderate discomfort consider use of analgesics as available and as permitted by direct medical oversight
  - a. Acetaminophen 15 mg/kg PO (maximum dose 1 g)
  - 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 (maximum initial dose of 100 mcg)
  - d. Ketorolac (one-time dose only):
    - i. Adult: 30 mg IM in adults who are not pregnant

- ii. Pediatric: (2-16 yo) 1mg/kg IM (maximum dose 30 mg)
    - iii. Geriatric: 1mg/kg IM (maximum dose 30 mg)
  - e. Morphine sulfate: 0.1 mg/kg IM (maximum initial dose 15 mg)
  - f. Ketamine: 0.5mg/kg IN (maximum initial dose 25mg; maximum cumulative dose of 100mg)
  - g. Nitrous Oxide
- 5. Establish IV of normal saline per patient assessment
- 6. If the patient is experiencing severe to excruciating pain, administer analgesics
  - a. Ketorolac (one-time dose only):
    - i. Adult: 15 mg IV in adults who are not pregnant
    - ii. Pediatric: (2-16 yo) 0.5mg/kg (maximum dose 15 mg)
  - b. Morphine sulfate: 0.1 mg/kg IV or IO (maximum initial dose 10 mg)
  - c. Fentanyl: 1 mcg/kg IV or IO (maximum initial dose 100 mcg)
  - d. Hydromorphone: 0.015mg/kg IM, IV, or IO (maximum initial dose 2 mg; maximum cumulative dose of 4 mg)
  - e. Ketamine: 0.25mg/kg IM, IV, IO (maximum initial dose 25mg; maximum cumulative dose 100mg)
- 7. Consider administration of oral, sublingual, or IV antiemetics to prevent nausea in high risk patients [see [Nausea/Vomiting guideline](#)]
- 8. If indicated based on pain assessment, and vital signs allow, repeat pain medication administration (excluding ketorolac) after 5 minutes of the previous dose
- 9. Transport in position of comfort and reassess as indicated

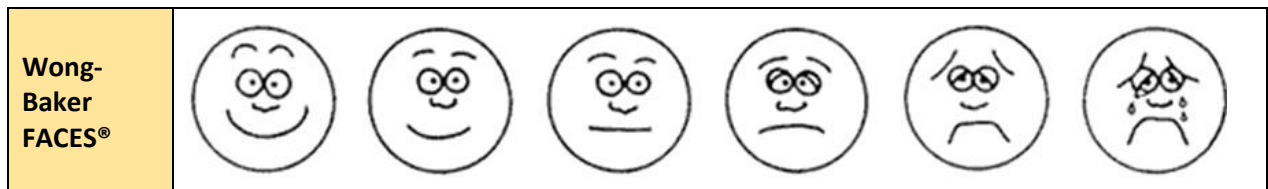
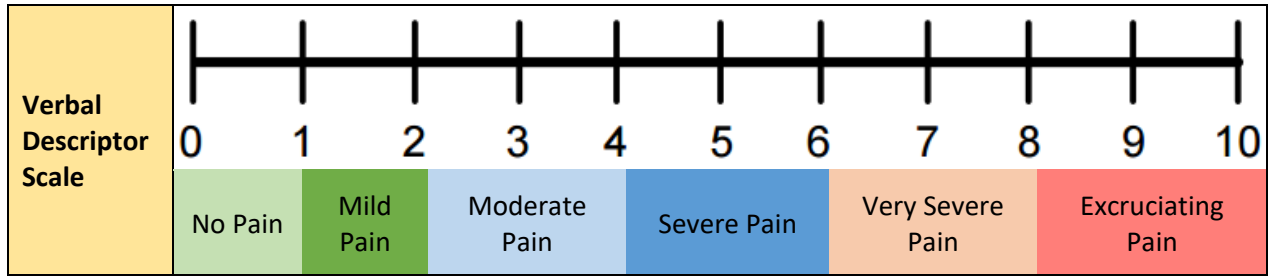
Adult nonverbal pain scale University of Rochester Medical Center			
Categories	0	1	2
Face	No particular expression or smile.	Occasional grimace, tearing, frowning, wrinkled forehead.	Frequent grimace, tearing, frowning, wrinkled forehead.
Activity (movement)	Lying quietly, normal position.	Seeking attention through movement or slow, cautious movement.	Restless, excessive activity and/or withdrawal reflexes.
Guarding	Lying quietly, no positioning of hands over areas of body.	Splinting areas of the body, tense.	Rigid, stiff.
Physiology (vital signs)	Stable vital signs	Change in any of the following: * SBP > 20 mm Hg. * HR > 20/minute.	Change in any of the following: * SBP > 30 mm Hg. * HR > 25/minute.
Respiratory	Baseline RR/SpO <sub>2</sub> Compliant with ventilator	RR > 10 above baseline, or 5% ↓SpO <sub>2</sub> mild asynchrony with ventilator	RR > 20 above baseline, or 10% ↓SpO <sub>2</sub> severe asynchrony with ventilator

Abbreviations: HR, heart rate; RR, respiratory rate; SBP, systolic blood pressure; SpO<sub>2</sub>, pulse oximetry. Instructions: Each of the 5 categories is scored from 0-2, which results in a total score between 0 and 10. Document total score by adding numbers from each of the 5 categories. Scores of 0-2 indicate no pain, 3-6 moderate pain, and 7-10 severe pain. Document assessment every 4 hours on nursing flow-sheet and complete assessment before and after intervention to maximize patient comfort. Sepsis, hypovolemia, hypoxia need to be excluded before interventions.

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From: Odhner M, Wegman D, Freeland N, Ingersoll G. Evaluation of a newly developed non-verbal pain scale (NVPS) for assessment of pain in sedated critically ill patients. Available at: <http://www.aacn.org/AACN/NTIPoster.nsf/vwdoc/2004NTI> Posters. Accessed July 18, 2017.

## 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 Desmasiado Fuerte	Un Dolor Insoportable

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

Pediatric-Appropriate Pain Assessment Tools

**Faces, Legs, Activity, Cry, Consolability (FLACC) Behavioral Scale**

Appropriate age for use (per guideline): less than 4 years

Categories	Scoring		
	0	1	2
<b>Face</b>	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant frown, clenched jaw, quivering chin
<b>Legs</b>	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
<b>Activity</b>	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid, or jerking
<b>Cry</b>	No cry (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams or sobs, frequent complaints
<b>Consolability</b>	Content, relaxed	Reassured by occasional touching, hugging, or being talked to, distractible	Difficult to console or comfort

*Each of the five categories (F) Face; (L) Legs; (A) Activity; (C) Cry; (C) Consolability is scored from 0-2, which results in a total score between zero and ten.*

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**Instructions:**

- **Patients who are awake:** Observe for at least 1-2 minutes. Observe legs and body uncovered. Reposition patient or observe activity, assess body for tenseness and tone. Initiate consoling interventions if needed
- **Patients who are asleep:** Observe for at least 2 minutes or longer. Observe body and legs uncovered. If possible reposition the patient. Touch the body and assess for tenseness and tone.

**Face**

- Score 0 point if patient has a relaxed face, eye contact and interest in surroundings
- Score 1 point if patient has a worried look to face, with eyebrows lowered, eyes partially closed, cheeks raised, mouth pursed
- Score 2 points if patient has deep furrows in the forehead, with closed eyes, open mouth and deep lines around nose/lips

**Legs**

- Score 0 points if patient has usual tone and motion to limbs (legs and arms)
- Score 1 point if patient has increase tone, rigidity, tense, intermittent flexion/extension of limbs
- Score 2 points if patient has hyper tonicity, legs pulled tight, exaggerated flexion/extension of limbs, tremors

### Activity

- Score 0 points if patient moves easily and freely, normal activity/restrictions
- Score 1 point if patient shifts positions, hesitant to move, guarding, tense torso, pressure on body part
- Score 2 points if patient is in fixed position, rocking, side-to-side head movement, rubbing body part

### Cry

- Score 0 points if patient has no cry/moan awake or asleep
- Score 1 point if patient has occasional moans, cries, whimpers, sighs
- Score 2 points if patient has frequent/continuous moans, cries, grunts

### Consolability

- Score 0 points if patient is calm and does not require consoling
- Score 1 point if patient responds to comfort by touch or talk in ½ - 1 minute
- Score 2 points if patient require constant consoling or is unconsoled after an extended time

Whenever feasible, behavioral measurement of pain should be used in conjunction with self-report. When self-report is not possible, interpretation of pain behaviors and decision-making regarding treatment of pain requires careful consideration of the context in which the pain behaviors were observed.

Each category is scored on a 0-2 scale, which results in a total score of 0-10

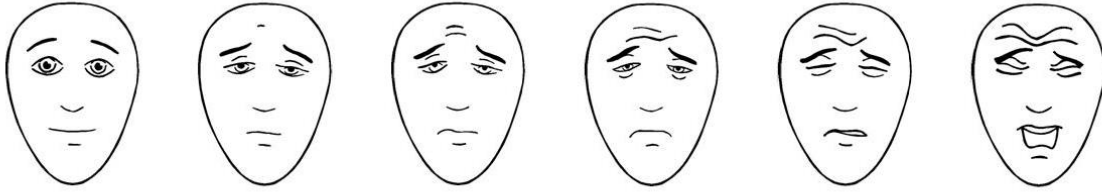
### Assessment of Behavioral Score:

- 0 = Relaxed and comfortable
- 1-3 = Mild discomfort
- 4-6 = Moderate pain
- 7-10 = Severe discomfort/pain

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**Source:** *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)**



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 face on far left] shows no pain. The faces show more and more pain [point to each from left to right] up to this one [point to face on far right] - 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" or "sad." This scale is intended to measure how children feel inside, not how their face looks.

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### **Patient Safety Considerations**

1. All patients should have drug allergies identified prior to administration of pain medication
2. Administer opioids with caution to patients with GCS less than 15, hypotension, identified medication allergy, hypoxia (oxygen saturation less than 90%) after maximal supplemental oxygen therapy, or signs of hypoventilation
3. Opioids are contraindicated for patients who have taken monoamine oxidase inhibitors (MAOIs – e.g. Nardil®, Parnate®, Azilect®, Marplan®, Eldepryl®) during the previous 14 days
4. Avoid non-steroidal anti-inflammatory medications such as ketorolac in patients with NSAID allergy, aspirin-sensitive asthma, renal insufficiency, pregnancy, or known peptic ulcer disease
5. Ketorolac should not be used in patients with hypotension (due to renal toxicity)
6. Use of splinting techniques and application of ice should be done to reduce the total amount of medication used to keep the patient comfortable

### **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. Patients with acute abdominal pain should receive analgesic interventions – Use of analgesics for acute abdominal pain does not mask clinical findings or delay diagnosis
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

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914071 – General-Pain Control

### Key Documentation Elements

- Documentation of patient vital signs with pulse oximetry
- Acquisition of patient’s allergies prior to administration of medication
- Documentation of initial patient pain scale assessment
- Documentation of medication administration with correct dose
- Documentation of patient reassessment with repeat vital signs and patient pain scale assessment

### Performance Measures

- The clinical efficacy of prehospital analgesia in terms of adequacy of dosing parameters
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain

## References

1. Attard AR, Corlett MJ, Kidner NJ, Leslie AP, Fraser IA. Safety of early pain relief for acute abdominal pain. *BMJ.* 1992;305(6853):554-6.
2. Bieri D, Reeve R, Champion GD, Addico at 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.
3. Brewster GS, Herbert ME, Hoffman JR. Medical myth: analgesia should not be given to patients with acute abdominal pain because it obscures the diagnosis. *West J Med.* 2000;172(3):209-10.
4. *Prehospital use of Ketamine in Battlefield Analgesia 2012-13.* Falls Church, VA: Defense Health Agency; March 8, 2012. Correspondence to Assistant Secretary of Defense (Health Affairs).
5. 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.* 2000;92:1-11.
6. Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale – Revised: Toward a common metric in pediatric pain measurement. *Pain.* 2001;93:173-83.
7. Jennings PA, Cameron P, Bernard S. Ketamine as an analgesic in the pre-hospital setting: a systematic review. *Acta Anaesthesiol Scand.* 2011;55(6):638-43.
8. LoVecchio F, Oster N, Sturmman K, Nelson LS, Flashner S, Finger R. The use of analgesics in patients with acute abdominal pain. *J Emerg Med.* 1997;15(6):775-9.
9. Manterola C, Astudillo P, Losada H, Pineda V, Sanhueza A, Vial M. Analgesia in patients with acute abdominal pain. *Cochrane Database Syst Rev.* 2007 Jul 18;(3)CD005660.
10. Merkel S, et al. The FLACC: A behavioral scale for scoring postoperative pain in young children., *Pediatr Nurse.* 1997;23(3):293–7.

11. Odhner M, Wegman D, Freeland N, Ingersoll G. Evaluation of a newly developed non-verbal pain scale (NVPS) for assessment of pain in sedated critically ill patients. Available at: [http://www.aacn.org/AACN/NTIPoster.nsf/vwdoc/2004NTI Posters](http://www.aacn.org/AACN/NTIPoster.nsf/vwdoc/2004NTI%20Posters). Accessed July 18, 2017.
12. Pace S, Burke TF. Intravenous morphine for early pain relief in patients with acute abdominal pain. *Acad Emerg Med*. 1996;3(12):1086-92.
13. Porter K. Ketamine in prehospital care. *Emerg Med J* 2004;21:351-4.
14. Ranji SR, Goldman LE, Simel DL, Shojania KG. Do opiates affect the clinical evaluation of patients with acute abdominal pain? *JAMA*. 2006;296(14):1764-74.
15. Svenson JE, Abernathy MK. Ketamine for prehospital use: new look at an old drug. *Am J Emerg Med*. 2007;25:977-80.
16. Vermuelen B, Morabia A, Unger PF, et al. Acute appendicitis: influence of early pain relief on the accuracy of clinical and US findings in the decision to operate – a randomized trial. *Radiology*. 1999;210(3):639-43.
17. Wiel E, Zitouni D, Assez N, et al. Continuous infusion of ketamine for out-of-hospital isolated orthopedic injuries secondary to trauma: a randomized controlled trial. *Prehosp Emerg Care*. 2015;19(1):10-16.
18. Wood PR. Ketamine: prehospital and in-hospital use. *Trauma*. 2003;5(2):137-40.

**Revision Date**

September 8, 2017

## Seizures

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

### **Aliases**

Status epilepticus, febrile seizure, convulsions, eclampsia

### **Patient Care Goals**

1. Prompt 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**

Seizures due to trauma, pregnancy, hyperthermia, or toxic exposure should be managed according to those condition-specific guidelines

#### **Inclusion Criteria**

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

#### **Exclusion Criteria**

None

### **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. Focality of onset, direction of eye deviation
  - f. Concurrent symptoms of apnea, cyanosis, vomiting, bowel/bladder incontinence, or fever
  - g. Bystander administration of medications to stop the seizure
  - h. Current medications, including anticonvulsants
  - i. Recent dose changes or non-compliance with anticonvulsants
  - j. History of trauma, pregnancy, heat exposure, or toxin exposure
2. Exam
  - a. Air entry/airway patency
  - b. Breath sounds, respiratory rate and effectiveness of ventilation
  - c. Signs of perfusion (pulses, capillary refill, color)
  - d. Neurologic status (GCS, nystagmus, pupil size, focal neurologic deficit or signs of stroke)

#### **Treatment and Interventions**

1. If signs of airway obstruction are present and a chin-lift, jaw thrust, positioning, and/or suctioning does not alleviate it, place oropharyngeal airway (if gag reflex is absent) or

- nasopharyngeal airway
2. Place pulse oximeter and/or waveform capnography to monitor oxygenation/ventilation
  3. Administer oxygen as appropriate with a target of achieving 94-98% saturation. Use bag-valve-mask ventilation if oxygenation/ventilation are compromised
  4. Assess perfusion
  5. Assess neurologic status
  6. Routes for treatment
    - a. IN/IM routes are preferred over rectal (PR), IV, or IO routes, if within the provider's scope of practice
      - i. If none of these routes (IN/IM/IV/IO) of medication administration are in provider's scope of practice, diazepam 0.2 mg/kg PR (maximum dose 10 mg) is an acceptable route of administration
    - b. IV placement is not necessary for treatment of seizures, but could be obtained if needed for other reasons
  7. Anticonvulsant Treatment
    - a. If vascular access is absent: midazolam 0.2 mg/kg (maximum dose 10 mg), IM preferred, or IN
    - b. If vascular access (IV or IO) is present:
      - i. Diazepam 0.1mg/kg IV or IO, maximum 4mg
      - ii. Lorazepam 0.1mg/kg IV or IO, maximum 4mg
      - iii. Midazolam 0.1mg/kg IV or IO, maximum 4mg
  7. Glucometry
    - a. If still actively seizing, check blood glucose level
    - b. If less than 60 mg/dL, treat per the [Hypoglycemia guideline](#)
  8. Consider magnesium sulfate in the presence of seizure in the third trimester of pregnancy or post-partum [see the [Eclampsia/Pre-eclampsia guideline](#)]
  9. For febrile seizures, consider the following interventions after stopping the seizure, since the following interventions provide symptomatic relief for fevers but do not stop the seizure:
    - a. Acetaminophen 15 mg/kg, maximum dose 650 mg, PR/IV/IO (if unable to swallow) or PO (if able to swallow)  
**AND/OR**
    - b. Ketorolac 1 mg/kg, maximum dose 15 mg, IV (if unable to swallow) OR Ibuprofen 10 mg/kg, maximum dose 600 mg, PO (if able to swallow)  
**AND/OR**
    - c. Removing excessive layers of clothing  
**AND/OR**
    - d. Applying cool compresses to the body
  10. Consider acquiring a 12-lead EKG following cessation of seizure in patients without a history of seizure to determine possible cardiac cause

#### **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
  - a. 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, but not limited to, trauma, stroke, electrolyte abnormality, toxic ingestion, pregnancy with eclampsia, hyperthermia
4. A variety of safe and efficacious doses for benzodiazepines have been noted in the literature for seizures
  - a. The doses for anticonvulsant treatment noted above are those that are common to the forms and routes of benzodiazepines noted in this guideline
  - b. 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
5. Recent evidence supports the use of midazolam IM as an intervention that is at least as safe and effective as intravenous lorazepam for prehospital seizure cessation

#### **Pertinent Assessment Findings**

The presence of fever with seizure in children less than 6 months old and greater than 6 yo is **not** consistent with a simple febrile seizure, and should prompt evaluation for meningitis, encephalitis or other cause

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914141 – Medical- Seizure

#### **Key Documentation Elements**

- Actively seizing during transport and time of seizure onset/cessation
- Focality of onset, direction of eye deviation
- Concurrent symptoms of apnea, cyanosis, vomiting, bowel/bladder incontinence, or fever
- Medication amounts/routes given by bystanders or prehospital providers
- Neurologic status (GCS, nystagmus, pupil size, focal neurologic deficit or signs of stroke)
- Blood glucose level

#### **Performance Measures**

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

## References

1. Alldredge BK, Gelb AM, Isaacs SM, et al. A comparison of lorazepam, diazepam, and placebo for the treatment of out-of-hospital status epilepticus. *N Engl J Med*. 2001;345(9):631-7.
2. Alldredge BK, Wall DB, Ferriero DM. Effect of prehospital treatment on the outcome of status epilepticus in children. *Pediatr Neurol*. 1995;12(3):213-6.
3. Appleton R, Sweeney A, Choonara I, Robson J, Molyneux E. Lorazepam versus diazepam in the acute treatment of epileptic seizures and status epilepticus. *Dev Med Child Neurol*. 1995;37(8):682-8.
4. Arya R, Gulati S, Kabra M, Sahu JK, Kalra V. Intranasal versus intravenous lorazepam for control of acute seizures in children: a randomized open-label study. *Epilepsia*. 2011;52(4):788-93.
5. Bhattacharyya M, Kalra V, Gulati S. Intranasal midazolam vs rectal diazepam in acute childhood seizures. *Pediatr Neurol*. 2006;34(5):355-9.
6. Cain E, Ackroyd-Stolarz S, Alexiadis P, Murray D. Prehospital hypoglycemia: the safety of not transporting treated patients. *Prehosp Emerg Care*. 2003;7(4):458-65.
7. Chamberlain JM, Altieri MA, Futterman C, Young GM, Ochsenschlager DW, Waisman Y. A prospective, randomized study comparing intramuscular midazolam with intravenous diazepam for the treatment of seizures in children. *Pediatr Emerg Care*. 1997;13(2):92-4.
8. Chin RF, Neville BG, Peckham C, Wade A, Bedford H, Scott RC. Treatment of community-onset, childhood convulsive status epilepticus: a prospective, population-based study. *Lancet Neurol*. 2008;7(8):696-703.
9. Fisgin T, Gurer Y, Tezic T, et al. Effects of intranasal midazolam and rectal diazepam on acute convulsions in children: prospective randomized study. *J Child Neurol*. 2002;17(2):123-6.
10. Frascone RJ, Jensen J, Wewerka SS, Salzman JG. Use of the pediatric EZ-IO needle by emergency medical services providers. *Pediatr Emerg Care*. 2009;25(5):329-32.
11. Galustyan SG, Walsh-Kelly CM, Szewczuga D, Bergholte J, Hennes H. The short-term outcome of seizure management by prehospital personnel: a comparison of two protocols. *Pediatr Emerg Care*. 2003;19(4):221-5.
12. Holliman CJ, Wuerz RC, Vazquez-de Miguel G, Meador SA. Comparison of interventions in prehospital care by standing orders versus interventions ordered by direct (on-line) medical command. *Prehosp Disaster Med*. 1994;9(4):202-9.
13. Holsti M, Dudley N, Schunk J, et al. Intranasal midazolam vs rectal diazepam for the home treatment of acute seizures in pediatric patients with epilepsy. *Arch Pediatr Adolesc Med*. 2010;164(8):747-53.
14. Lahat E, Goldman M, Barr J, Bistrizter T, Berkovitch M. Comparison of intranasal midazolam with intravenous diazepam for treating febrile seizures in children: prospective randomized study. *Br Med J*. 2000;321(7253):83-6.
15. Lamhaut L, Dagron C. Comparison of intravenous and intraosseous access by pre-hospital medical emergency personnel with and without CBRN protective equipment. *Resuscitation*. 2010;81(1):65-8.
16. Leppik IE, Derivan AT, Homan RW, Walker J, Ramsay RE, Patrick B. Double-blind study of lorazepam and diazepam in status epilepticus. *JAMA*. 1983;249(11):1452-4.
17. Mahmoudian T, Zadeh MM. Comparison of intranasal midazolam with intravenous diazepam for treating acute seizures in children. *Epilepsy Behav*. 2004;5(2):253-5.
18. McIntyre J, Robertson S, Norris E, et al. Safety and efficacy of buccal midazolam versus rectal diazepam for emergency treatment of seizures in children: a randomized controlled trial. *Lancet*. 2005;366(9481):205-10.

19. McMullan J, Sasson C, Pancioli A, Silbergleit R. Midazolam versus diazepam for the treatment of status epilepticus in children and young adults: a meta-analysis. *Acad Emerg Med.* 2010;17(6):575-82.
20. Mittal P, Manohar R, Rawat AK. Comparative study of intranasal midazolam and intravenous diazepam sedation for procedures and seizures. *Indian J Pediatr.* 2006;73(11):975-8.
21. Mpimbaza A, Ndeezi G, Staedke S, Rosenthal PJ, Byarugaba J. Comparison of buccal midazolam with rectal diazepam in the treatment of prolonged seizures in Ugandan children: a randomized clinical trial. *Pediatrics.* 2008;121(1):58-64.
22. Muchohi SN, Kokwaro GO, Ogutu BR, et al. Pharmacokinetics and clinical efficacy of midazolam in children with severe malaria and convulsions. *Br J Clin Pharmacol.* 2008;66(4):529-38.
23. Muchohi SN, Obiero K, Newton CR, et al. Pharmacokinetics and clinical efficacy of lorazepam in children with severe malaria and convulsions. *Br J Clin Pharmacol.* 2008;65(1):12-21.
24. Rainbow J, Browne GJ, Lam LT. Controlling seizures in the prehospital setting: diazepam or midazolam? *J Paediatr Child Health.* 2002;38(6):582-6.
25. Schwartz D, Amir L, Dichter R, et al. The use of a powered device for intraosseous drug and fluid administration in a national EMS: a 4-year experience. *J Trauma.* 2008;64(3):650-5.
26. Shah I, Deshmukh CT. Intramuscular midazolam vs. intravenous diazepam for acute seizures. *Indian J Pediatr.* 2005;72(8):667-70.
27. Shah MI, Macias CG, Dayan PS, et al. An evidence-based guideline for pediatric prehospital seizure management using GRADE methodology. *Prehosp Emerg Care.* 2014;18 Suppl 1:15-24.
28. Silbergleit R, Durkalski V, Lowenstein D, et al. Intramuscular versus intravenous therapy for prehospital status epilepticus. *N Engl J Med.* 2012;366(7):591-600.
29. Silbergleit R, Durkalski V, Lowenstein D, et al; NETT Investigators. Intramuscular versus intravenous therapy for prehospital status epilepticus. *N Engl J Med.* 2012;366(7):591-600.
30. Silbergleit R et al. RAMPART (rapid anticonvulsant medication prior to arrival trial): a double-blind randomized clinical trial of the efficacy of IM midazolam versus IV lorazepam in the pre-hospital treatment of status epilepticus by paramedics. *Epilepsia.* 2011;52 Suppl 8:45-7.
31. Sporer KA, Johnson NJ. Detailed analysis of prehospital interventions in medical priority dispatch system determinants. *West J Emerg Med.* 2011;12(1):19-29.
32. Sreenath TG, Gupta P, Sharma KK, Krishnamurthy S. Lorazepam versus diazepam-phenytoin combination in the treatment of convulsive status epilepticus in children: a randomized controlled trial. *Eur J Paediatr Neurol.* 2010;14(2):162-8.
33. Talukdar B, Chakrabarty B. Efficacy of buccal midazolam compared to intravenous diazepam in controlling convulsions in children: a randomized control trial. *Brain Dev.* 2009;31(10):744-9.
34. Vilke GM, Sharieff GQ, Marino A, Gerhart AE, Chan TC. Midazolam for the treatment of out-of-hospital pediatric seizures. *Prehosp Emerg Care.* 2002;6(2):215-7.
35. Wuerz RC, Swope GW, Holliman J, Vazquez-de Miguel G. On-line medical direction: a prospective study. *Prehosp Disaster Med.* 1995;10(3):51-4.
36. Zarate L, Mandleco B, Wilshaw R, Ravert P. Peripheral intravenous catheters started in prehospital and emergency department settings. *J Trauma Nurs.* 2008;15(2):47-52.

### **Revision Date**

September 8, 2017

## Shock

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

### **Aliases**

None noted

### **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 *less than* 94%)
  - d. Decreased urine output
  - e. Respiratory rate greater than 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. Less than 1 yo: 60
    - ii. 1-10 yo: (age in years) (2)+70
    - iii. Greater than 10 yo: 90
  - g. Tachycardia for age, out of proportion to temperature [see [Appendix VIII – Abnormal Vital Signs](#)]
  - h. Weak, decreased or bounding pulses
  - i. Cool/mottled or flushed/ruddy skin
2. Potential etiologies of shock:
  - a. Hypovolemia (poor fluid intake, excessive fluid loss (e.g. bleeding, SIADH, hyperglycemia excessive diuretics, vomiting, diarrhea)
  - b. Sepsis
    - i. Temperature instability:
      1. Less than 36°C or 96.8°F
      2. Greater than 38.5°C or 101.3°F**and/or**
      3. 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 or port
  - 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 vital signs
2. Administer oxygen as appropriate with a target of achieving 94-98% saturation
3. Cardiac monitor
4. Pulse oximetry and ETCO<sub>2</sub> (reading of less than 25 mmHg may be sign of poor perfusion)
5. Check blood sugar, and correct if less than 60 mg/dl
6. EKG
7. Check lactate, if available (greater than 2.0 mmol/L is abnormal)
8. Establish IV access - if unable to obtain within 2 attempts or less than 90 seconds, place an IO needle
9. IV fluids (30 mL/kg isotonic fluid; maximum of 1 liter) over less than 15 minutes, using a push-pull method of drawing up the fluid in a syringe and pushing it through the IV (preferred for pediatric patients) - may repeat up to 3 times based on patient's condition and clinical impression
10. If there is a history of adrenal insufficiency or long-term steroid dependence, give:
  - a. Hydrocortisone succinate, 2 mg/kg (maximum 100 mg) IV/IM (preferred)

**OR**

  - b. Methylprednisolone 2 mg/kg IV (maximum 125 mg)

11. Vasopressors (shock unresponsive to IV fluids)
  - a. Cardiogenic shock, hypovolemic shock, obstructive shock:
    - i. Norepinephrine - there is recent evidence that supports the use of norepinephrine as the preferred intervention. Although dopamine is often recommended for the treatment of symptomatic bradycardia, recent research indicates that patients in cardiogenic or septic shock treated with norepinephrine have a lower mortality rate compared to those treated with dopamine (initial norepinephrine dose: 0.05 – 0.5 mcg/kg/minute titrated to effect)
    - ii. Give epinephrine, 0.05-0.3 mcg/kg/minute
    - iii. Give dopamine, 2-20 mcg/kg/minute
  - b. Distributive shock (with the exception of anaphylactic shock):
12. Give norepinephrine, 0.05-0.5 mcg/kg/minute
13. Norepinephrine is the first-line drug of choice for neurogenic shock
14. For anaphylactic shock, treat per the [Anaphylaxis and Allergic Reaction guideline](#)
15. Provide advanced notification to the hospital
16. Consider empiric antibiotics for suspected septic shock if transport time is anticipated to be greater than 1 hour, if blood cultures can be obtained in advance, and/or EMS has coordinated with regional receiving hospitals about choice of antibiotic therapy
17. Antipyretics for fever
  - a. Acetaminophen (15 mg/kg; maximum dose of 1000 mg)
  - b. Ibuprofen (10 mg/kg; maximum dose of 800 mg)

#### **Patient Safety Considerations**

1. 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. In most adults, tachycardia is the first sign of compensated shock, and may persist for hours. Tachycardia can be a late sign of shock in children and a tachycardic child may be close to cardiovascular collapse
4. Hypotension indicates uncompensated shock, which may progress to cardiopulmonary failure within minutes
5. Hydrocortisone succinate, if available, is preferred over methylprednisolone and dexamethasone for the patient with adrenal insufficiency, because of its dual glucocorticoid and mineralocorticoid effects

- a. 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
- b. Patients with adrenal insufficiency may have an emergency dose of hydrocortisone available that can be administered IV or IM

### **Pertinent Assessment Findings**

1. Decreased perfusion manifested by altered mental status, or abnormalities in capillary refill or pulses, decreased urine output (*less than 1 mL/kg/hr*):
  - a. Cardiogenic, hypovolemic, obstructive shock: capillary refill greater than 2 seconds, diminished peripheral pulses, mottled cool extremities
  - b. Distributive shock: flash capillary refill, bounding peripheral pulses

### **Quality Improvement**

#### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914127 – Medical-Hypotension/Shock (Non-Trauma)

#### **Key Documentation Elements**

- Medications administered
- Full vital signs with reassessment every 15 minutes or as appropriate
- Lactate level (if available)
- Neurologic status assessment [see [Appendix VII](#)]
- Amount of fluids given

#### **Performance Measures**

- Percentage of patients who have full vital signs (HR, RR, BP, T, O<sub>2</sub>) documented
- Presence of a decision support tool (laminated card, a protocol, or electronic alert) to identify patients in shock
- Percentage of patients with suspected shock for whom advanced notification to the hospital was provided
- Mean time from abnormal vitals to initiation of a fluid bolus
- Percentage of patients who receive pressors for ongoing hypotension after receiving 30 mL/kg isotonic fluid in the setting of shock

### **References**

1. Annane D, Bellissant E, Bollaert P, Briegel J, Keh, D, Kupfer Y. Corticosteroids for treating severe sepsis and septic shock. 2004. *Cochrane Database Syst Rev.* 2004;(1):CD002243.
2. Band, RA, Gaieski DF, Hylton JH, Shofer FS, Goyal M, Meisel ZF. Arriving by emergency medical services improves time to treatment endpoints for patients with severe sepsis or septic shock. *Acad Emerg Med.* 2011;18(9):934-40.
3. Bernardin G, Pradier C, Tiger F, Deloffre P, Mattei M. Blood pressure and arterial lactate level are early indicators of short-term survival in human septic shock. *Intensive Care Med.* 1996;22(1):17-25.
4. Boluyt N, Bollen C, Bos A, Kok J, Offringa M. Fluid resuscitation in neonatal and pediatric hypovolemic shock: A Dutch Pediatric Society evidence-based clinical practice guideline. *Intensive Care Med.* 2006;32(7):995-1003.

5. Brierley J, Carcillo JA, Choong K, et al. Clinical practice parameters for hemodynamic support of pediatric and neonatal patients in septic shock. *Crit Care Med*. 2009;37(2):666-8.
6. Carcillo JA, Davis AL, Zaritsky A. Role of early fluid resuscitation in pediatric septic shock. *JAMA*. 1991;266(9):1242-5.
7. Choong K, Bohn D, Fraser DD, et al. Vasopressin in pediatric vasodilatory shock: a multicenter randomized controlled trial. *Am J Respir Crit Care Med*. 2009;180(7):632-9.
8. Chopra A, Kumar V, Dutta A. Hypertonic versus normal saline as initial fluid bolus in pediatric septic shock. *Indian J Pediatr*. 2011;78(7):833-7.
9. Cronin L, Cook DJ, Carlet J, et al. Corticosteroid treatment for sepsis: a critical appraisal and meta-analysis of the literature. *Crit Care Med*. 1995;23(8):1430-9.
10. Cruz AT, Perry AM, Williams EA, Graf JM, Wuestner ER, Patel B. Implementation of goal-directed therapy for children with suspected sepsis in the emergency department. *Pediatrics*. 2011;127(3):e758-66.
11. De Backer D, Aldecoa C, Njimi H, Vincent J. Dopamine versus norepinephrine in the treatment of septic shock: a meta-analysis. *Crit Care Med*. 2011;13(6):1-6.
12. De Backer D, Biston P, Devriendt J, et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010;362(9):779-89.
13. Guyette F, Suffoletto B, Castillo JL, Quintero J, Callaway C, Puyana, JC. Prehospital serum lactate as a predictor of outcomes in trauma patients: a retrospective observational study. *J Trauma*. 2011;70(4):782-6.
14. Guyette FX, Gomez H, Suffoletto B, et al. Prehospital dynamic tissue oxygen saturation response predicts in-hospital lifesaving interventions in trauma patients. *J Trauma Acute Care Surg*. 2012;72(4):930-5.
15. Han YY, Carcillo JA, Dragotta MA, et al. Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome. *Pediatrics*. 2013;112(4):793-9.
16. Hartholt KA, van Lieshout EM, Thies WC, Patka P, Schipper IB. Intraosseous devices: a randomized controlled trial comparing three intraosseous devices. *Prehosp Emerg Care*. 2010;14(1):6-13.
17. Howell MD, David AM. Management of sepsis and septic shock. *JAMA*. 2017;317(8):847-8.
18. Hunter CL, Silvestri S, Dean M, Falk JL, Papa L. End-tidal carbon dioxide is associated with mortality and lactate in patients with suspected sepsis. *Am J Emerg Med* (2013) 31, 64–71
19. Jansen TC, van Bommel J, Mulder PG, Rommes JH, Schieveld SJ, Bakker, J. The prognostic value of blood lactate levels relative to that of vital signs in the pre-hospital setting: a pilot study. *Crit Care*. 2008;12(6):R160.
20. Kumar A, Roberts D, Wood KE, et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med*. 2006;34(6):1589-96.
21. Lampard JG, Lang E. Vasopressors for hypotensive shock. *Ann Emerg Med*. 2013;31(3):351-2.
22. Larsen GY, Mecham N, Greenberg R. An emergency department septic shock protocol and care guideline for children initiated at triage. *Pediatrics*. 2011;127(6):e1585-92.
23. Levy B, Bastien O, Karim B, et al. Experts' recommendations for the management of adult patients with cardiogenic shock. *Ann Intensive Care*. 2015;5(1):17.
24. Lillis KA, Jaffe DM. Prehospital intravenous access in children. *Ann Emerg Med*. 1992;21(12):1430-4.
25. Martin C, Papazian L, Perrin G, Saux P, Gouin F. Norepinephrine or dopamine for the treatment of hyperdynamic septic shock? *Chest*. 1993;103(6):1826-31.
26. Martin C, Viviani X, Leone M, Thirion X. Effect of norepinephrine on the outcome of septic shock. *Crit Care Med*. 2000;28(8):2758-65.

27. Mikkelsen ME, Miltiades AN, Gaieski DF, et al. Serum lactate is associated with mortality in severe sepsis independent of organ failure and shock. *Crit Care Med*. 2009;37(5):1670-7.
28. Morimatsu H, Singh K, Uchino S, Bellomo R, Hart G. Early and exclusive use of norepinephrine in septic shock. *Resuscitation*. 2004;62(2):249-54.
29. Oliveira CF, Nogueira de Sá FR, Oliveira DS, et al. Time- and fluid-sensitive resuscitation for hemodynamic support of children in septic shock: barriers to the implementation of the American College of Critical Care Medicine/Pediatric Advanced Life Support Guidelines in a pediatric intensive care unit in a developing world. *Pediatr Emerg Care*. 2008;24(12):810-5.
30. Patel GP, Grahe JS, Sperry M, et al. Efficacy and safety of dopamine versus norepinephrine in the management of septic shock. *Shock*. 2010;33(4):375-80.
31. Rhodes A, Evans LE, Alhazzani W, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016. *Intensive Care Med*. Epub 2017 Jan 18.
32. Santhanam I, Sangareddi S, Venkataraman S, Kisson N, Thiruvengadamudayan V, Kasthuri RK. A prospective randomized controlled study of two fluid regimens in the initial management of septic shock in the emergency department. *Pediatr Emerg Care*. 2008;24(10):647-55.
33. Sebat F, Johnson D, Musthafa AA, et al. A multidisciplinary community hospital program for early and rapid resuscitation of shock in nontrauma patients. *Chest*. 2005;127(5):1729-43.
34. Seymour CW, Band RA, Cooke CR, et al. Out-of-hospital characteristics and care of patients with severe sepsis: a cohort study. *J Crit Care*. 2010;25(4):553-62.
35. Shapiro NI, Howell MD, Talmor D, et al. Implementation and outcomes of the multiple urgent sepsis therapies (MUST) protocol. *Crit Care Med*. 2006;34(4):1025-32.
36. Sholl JM, Chung S, Prentiss S, Smith JM, Shah MI. An evidence-based guideline for pediatric prehospital shock management using GRADE methodology. Manuscript in preparation.
37. Studnek JR, Artho MR, Garner CL Jr., Jones AE. The impact of emergency medical services on the ED care of severe sepsis. *Am J Emerg Med*. 2012;30(1):51-6.
38. Trzeciak S, Dellinger RP, Chansky ME, et al. Serum lactate as a predictor of mortality in patients with infection. *Intensive Care Med*. 2007;33(6):970-7.
39. Van Beest PA, Mulder PJ, Oetomo SB, van den Broek B, Kuiper MA, Spronk PE. Measurement of lactate in a prehospital setting is related to outcome. *Eur J Emerg Med*. 2009;16(6):318-22.

### **Revision Date**

September 8, 2017

## Sickle Cell Pain Crisis

### **Aliases**

None

### **Patient Care Goals**

1. Identify potentially life-threatening complications of a sickle cell disease
2. Improve patient comfort

### **Patient Presentation**

#### **Inclusion Criteria**

1. Patient with known sickle cell disease experiencing a pain crisis

#### **Exclusion Criteria**

1. Pain due to acute traumatic injury [see [Trauma](#) section guidelines]
2. Abdominal pain due to or related to pregnancy [see [OB/GYN](#) section guidelines]
3. Patients with sickle cell trait

### **Patient Management**

#### **Assessment**

1. Perform airway assessment and management per the [Airway Management guideline](#)
2. Obtain vital signs including pulse, respiratory rate, pulse oximetry, and blood pressure
3. Provide evaluation and management of altered mental status per the [Altered Mental Status guideline](#)
4. Provide evaluation and management of pain per the [Pain Management guideline](#)
5. Obtain vascular access as necessary to provide analgesia and/or fluid resuscitation
6. Assess for potentially serious complications other than pain crisis which may include:
  - a. Acute chest syndrome
    - i. Hypoxia
    - ii. Chest pain
    - iii. Fever
  - b. Stroke [see [Suspected Stroke/Transient Ischemic Attack guideline](#)]
    - i. Focal neurologic deficits
  - c. Meningitis
    - i. Headache
    - ii. Altered mental status
    - iii. Fever
  - d. Septic arthritis
    - i. Severe pain in a single joint
    - ii. Fever
  - e. Splenic sequestration crisis (usually young pediatric patients)
    - i. Abdominal pain, LUQ
    - ii. Splenic enlargement (examine with care)
    - iii. Hypotension, tachycardia
7. Assess for signs of shock – If shock is present, treat per [Shock guideline](#)

### **Treatment and Interventions**

1. Medication Administration:
  - a. Provide analgesia per the [Pain Management guideline](#)
  - b. Start oxygen by nasal cannula
  - c. Start an IV and provide saline 10ml/kg normal saline bolus (up to 1L)
  - d. Provide transport to an appropriate receiving facility.
  - e. Reassess vital signs and response to therapeutic interventions throughout transport
2. Comfort measures:
  - a. Keep patient warm and dry
  - b. Transport in a position of comfort unless clinical condition requires otherwise

### **Patient Safety Considerations**

None recommended

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Assess for life-threatening complications of sickle cell disease – these patients have significantly higher risk of numerous complications in addition to pain crises
2. Provide appropriate treatment for pain, respiratory distress, and shock
3. These patients may have a higher tolerance to narcotic pain medications if they are taking them on a regular basis
4. These patients will tolerate acute blood loss poorly due to baseline anemia
5. Patients with sickle cell trait can have acute pain crises in extreme conditions (e.g. heat exhaustion, dehydration) and a number of college athlete deaths have been linked to sickle cell trait

#### **Pertinent Assessment Findings**

1. Lung exam and assessment of respiratory distress
2. Altered mental status
3. Focal neurologic deficits
4. Inability to move a joint

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914165 – Other (as of 3/1/2017, no specific NEMSIS protocol exists)

#### **Key Documentation Elements**

- Documentation of normal respiratory and neuro status
- Documentation of how this pain crisis compares with others in terms of location, severity, and triggers
- Documentation of home pain medications used

#### **Performance Measures**

- Assessment for life-threatening etiology
- Mitigation of pain per the [Pain Management guideline](#)

**Reference**

1. Mitchell BL. Sickle cell trait and sudden death – bringing it home. *J Natl Med Assoc.* 2007;99(3):300-5.

**Revision Date**

September 8, 2017



# Resuscitation

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

### **Aliases**

Heart attack, arrest, full arrest

### **Patient Care Goals**

1. Return of spontaneous circulation (ROSC)
2. Preservation of neurologic function
3. High-quality chest compressions/CPR with minimal interruption from recognition of cardiac arrest until confirmation of ROSC or field termination of care

### **Patient Presentation**

#### **Inclusion Criteria**

Patients with cardiac arrest

#### **Exclusion Criteria**

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 [Do Not Resuscitate Status/Advance Directive/Healthcare Power of Attorney \(POA\) Status guideline](#)]
3. Patients in arrest due to traumatic etiology [see [General Trauma Management guideline](#)]

### **Patient Management**

#### **Assessment**

1. The patient in cardiac arrest requires a prompt balance of treatment and assessment
2. In cases of cardiac arrest, assessments should be focused and limited to obtaining enough information to reveal the patient is pulseless
3. 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 minimally interrupted 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. It is realistic for EMS providers to tailor the sequence of rescue actions to the most likely cause of arrest
  - c. There is insufficient evidence to recommend for or against delaying defibrillation to provide a period of CPR for patients in VF/pulseless VT out-of-hospital cardiac arrest

- d. For adults and children with unmonitored cardiac arrest or for whom an AED is not immediately available, it is reasonable that CPR be initiated while the defibrillator equipment is being retrieved and applied and that defibrillation, if indicated, be attempted as soon as the device is ready for use
2. The maximum setting on the defibrillator should be used for initial and subsequent defibrillation attempts. 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, the setting should be 360 J (or 4 J/kg for children)
3. Chest compressions should resume immediately after defibrillation attempts with no pauses for pulse checks for 2 minutes regardless of the rhythm displayed on the cardiac monitor
4. 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
5. If feasible, IV or IO access should be obtained. Administer epinephrine during the first or second round of compressions
6. 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 and ventilation strategy, consider the following principles:
  - a. The airway management strategy should not interrupt compressions
  - b. Successful resuscitation from cardiac arrest depends primarily on effective, minimally-interrupted chest compressions and prompt defibrillation; airway management is of secondary importance and should not interfere with compressions and defibrillation – Options for airway management include:
    - i. Passive ventilation:
      1. High flow oxygen is applied via a non-rebreather mask with an oropharyngeal airway
      2. Some oxygen will be entrained with each decompression of the chest
      3. This may be applied for the first 3-4 compression cycles (6-8 minutes), after which one may consider BVM ventilation or placement of an advanced airway (as below).
    - ii. BVM ventilation at 10 breaths per minute (1 breath every 10 compressions), applied during the upstroke between compressions, without interrupting the compressions
    - iii. BVM ventilation with 30:2 ventilation to compression ratio: Each 30 compressions, the compressions are paused briefly to allow 2 BVM ventilations, then compressions immediately resumed
      1. **Pediatric Consideration:** For multiple rescuer CPR in children, 15:2 is the recommended compression to ventilation ratio. (30:2 for single rescuer).
      2. **Pediatric Consideration:** For neonates, 3:1 is the recommended compression to ventilation ratio.
    - iv. Advanced airway placement:
      1. Either a supraglottic airway or an endotracheal tube may be placed without interruption of compressions
      2. Ventilations are provided at 10 breaths/minute for adults

3. **Pediatric Consideration:** for children, 1 breath every 3-5 seconds is recommended (12-20 breaths/minute)
- c. **Pediatric Consideration:** deliver volume needed to achieve chest rise
7. Consider use of antiarrhythmic for recurrent VF/Pulseless VT
  - a. The principal objective of antiarrhythmic drug therapy in shock-refractory VF and pulseless VT is to facilitate the restoration and maintenance of a spontaneous perfusing rhythm in concert with the shock termination of VF/VT; some antiarrhythmic drugs have been associated with increased rates of ROSC and hospital admission, but none have yet been proven to increase long-term survival or survival with good neurologic outcome
    - i. Amiodarone (5 mg/kg IV, max of 300 mg) may be considered for VF/pulseless VT that is unresponsive to CPR, defibrillation, and a vasopressor therapy
    - ii. Lidocaine (1 mg/kg IV) may be considered as an alternative to amiodarone for VF/pulseless VT that is unresponsive to CPR, defibrillation, and vasopressor therapy
    - iii. The routine use of magnesium for VF/pulseless VT is not recommended in adult patients
  - b. There is inadequate evidence to support the routine use of lidocaine and beta blockers after cardiac arrest by EMS – There is insufficient evidence to recommend for or against the routine initiation or continuation of other antiarrhythmic medications after ROSC from cardiac arrest
  - c. For torsades de pointes, give magnesium sulfate 2 g IV (or 25-50 mg/kg for **pediatrics**). There is insufficient evidence to recommend for or against the routine administration during cardiac arrest
8. Consider reversible causes of cardiac arrest which include the following:
  - a. Hypothermia – additions to care include attempts at active rewarming [see [Hypothermia/Cold Exposure guideline](#)]
  - b. The dialysis patient/known hyperkalemic patient – Additions to care include the following:
    - i. Calcium gluconate 10% 1 g IV (for **pediatrics** the dose is 100 mg/kg) OR
    - ii. Calcium chloride 10% 10ml IV (for **pediatrics**, the dose is 20 mg/kg which is 0.2 mL/kg)
    - iii. Sodium bicarbonate 1 mEq/kg IV
  - c. Tricyclic antidepressant overdose - Additions to care include sodium bicarbonate 1 mEq/kg IV
  - d. Hypovolemia - Additions to care include 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
  - f. If tension pneumothorax suspected, perform needle decompression. Assess ETT, if misplaced, replace ETT
9. If at any time during this period of resuscitation the patient regains return of spontaneous circulation, treat per [Adult Post-ROSC Care guideline](#)
10. If resuscitation remains ineffective, consider termination of resuscitation [see [Termination of Resuscitative Efforts guideline](#)]

### Patient Safety Considerations

1. Performing manual chest compressions in a moving vehicle may pose a provider safety concern
2. In addition, manual chest compressions during patient movement are less effective in regards to hands on time, depth, recoil and rate
3. Ideally, patients should be resuscitated as close to the scene as operationally possible
4. Risks and benefits should be considered before patient movement in cardiac arrest situations.

### 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) and less than 2.4 inches (6cm) for adults and children or 1.5 inches (4 cm) for infants; adolescents who have entered puberty should receive the same depth of chest compressions as an adult
  - c. Allow for complete chest recoil (avoid leaning)
  - d. Minimize interruptions in compressions
  - e. Avoid rescuer fatigue by rotating rescuers at least every 2 minutes. Some EMS pit crew approaches use a provider on either side of the chest, alternating compressions every minute or every 100 compressions to avoid fatigue
2. Avoid excessive ventilation and consider delayed airway management – If no advanced airway, consider:
  - a. Passive ventilation using an NRB with 3-4 cycles of uninterrupted chest compressions (for arrests of suspected cardiac etiology). Consider BVM ventilation or advanced airway after 3-4 cycles
  - b. BVM ventilation every 10-15 compressions with cycles of uninterrupted chest compressions. Upstroke ventilation between compressions.30:2 ventilation to compression ratio for adults, and 15:2 for children when 2 rescuers are present
  - c. If an advanced airway is placed, ventilations should not exceed 10 breaths/minute (1 breath every 6 seconds or 1 breath every 10 compressions) in adults. **Pediatric Consideration:** For children with an advanced airway, 1 breath every 3-5 seconds is recommended (equivalent to 12-20 breaths/minute)
3. Quantitative end-tidal CO<sub>2</sub> should be used to monitor effectiveness of chest compressions
  - a. If ETCO<sub>2</sub> less than 10 mmHg during the initial phases of resuscitation, attempt to improve chest compression quality
  - b. Consider additional monitoring with biometric feedback which may improve compliance with suggested [Resuscitation](#) section guidelines
4. 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.

5. There is insufficient evidence to recommend the routine use of extracorporeal CPR (ECPR) for patients with cardiac arrest – In settings where it can be rapidly implemented, ECPR may be considered for select cardiac arrest patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support
6. Chest compressions should be reinitiated immediately after defibrillation as pulses, if present, are often difficult to detect and rhythm and pulse checks interrupt compressions
7. Continue chest compressions between completion of AED analysis and AED charging
8. Effectiveness of chest compressions decreases with any movements
  - a. 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
  - b. Chest compressions are also less effective in a moving vehicle
  - c. It is also dangerous to EMS providers, patients, pedestrians, and other motorists to perform chest compressions in a moving ambulance
  - d. 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
9. The maximum setting on the defibrillator should be used for initial and subsequent defibrillation attempts. 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, the setting should be 360 J (or 4 J/kg for children)
10. IV or IO access without interrupting chest compressions
11. Administer epinephrine (0.1 mg/kg, maximum dose 1 mg) IV/IO during the first or second round of compressions
12. At present, the most effective mechanism of airway management is uncertain due to 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
    - i. Current recommendations suggest using the highest flow rate possible through NRB or BVM
    - ii. This should not be continued into the post-resuscitation phase in which the goal should be an oxygen saturation of 94-98%
  - e. **Pediatric Considerations:** 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
    - i. 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

- ii. In addition, conventional CPR is preferred in children, since it is associated with better outcomes when compared to compression-only CPR
- 13. Special Circumstances in Cardiac Arrest
  - a. Trauma, treat per the [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) – In addition to the above, consider early management of the patient’s airway. Passive ventilation with a NRB is not indicated for these patients.
- 14. 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. Use 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 – For IO access:
      - 1. The proximal humerus is the preferred site for adults
      - 2. The tibial site is preferred for infants and children
    - v. During the first four cycles of compressions/defibrillation (approximately 10 minutes) avoid advanced airway placement
    - 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

15. The EMS agency must perform a QI review of care and outcome, overseen by the agency medical director, for every patient that receives CPR
  - a. 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 in an organized cardiac arrest registry
  - b. 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**

#### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914011 – Cardiac Arrest-Asystole
- 99014013 – Cardiac Arrest-Hypothermia-Therapeutic
- 9914015 – Cardiac Arrest-Pulseless Electrical Activity
- 9914017 – Cardiac Arrest-Ventricular Fibrillation/Pulseless Ventricular Tachycardia)
- 9914055 – General-Cardiac Arrest
- 9914087 – Injury-Cardiac Arrest

#### **Key Documentation Elements**

- Should be tailored to any locally utilized data registry but may include as a minimum the following elements:
  - Resuscitation attempted and all interventions performed
  - Arrest witnessed
  - Location of arrest
  - First monitored rhythm
  - CPR before EMS arrival
  - Outcome
  - Any ROSC
  - Presumed etiology
    - Presumed cardiac
    - Trauma
    - Submersion
    - Respiratory
    - Other non-cardiac
    - Unknown

#### **Performance Measures**

- Time to scene
- Time to patient
- Time to first CPR
- Time to first shock
- Time of ROSC
- Review of CPR Quality
  - Compression Fraction
  - Average and longest peri-shock pause
  - Rate and depth of compressions

## References

1. Atkins DL, Berger S, Duff JP, et al. Part 11: Pediatric Basic Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S519-25.
2. Bobrow BJ, Clark LL, Ewy GA, et al. Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. *JAMA*. 2008;299(10):1158-65.
3. Brooks, Anderdon ML, Bruder E, et al. Part 6: alternative techniques and ancillary devices for cardiopulmonary resuscitation: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S436-43.
4. de Caen R, Berg MD, Chameides L, et al. Part 12: Pediatric Advanced Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S526-42.
5. Dorian P, Cass D, Schwartz B, Cooper R, Gelaznikas R, Barr A. Amiodarone as compared with lidocaine for shock-resistant ventricular fibrillation. *N Engl J Med*. 2002;346(12):884-90
6. Ewy GA. The cardiocerebral resuscitation protocol for treatment of out-of-hospital primary cardiac arrest. *Scand J Trauma Resusc Emerg Med*. 2012;20:65.
7. Garza AG, Gratton MC, Salomone JA, Lindholm D, McElroy J, Archer R. Improved patient survival using a modified resuscitation protocol for out-of-hospital cardiac arrest. *Circulation*. 2009;119(19):2597-605.
8. Hinchey PR, Myers JB, Lewis R, et al. Improved out-of-hospital cardiac arrest survival after the sequential implementation of 2005 AHA guidelines for compressions, ventilations, and induced hypothermia: the Wake County experience. *Ann Emerg Med*. 2010;56(4):348-357.
9. Hopkins CL, Burk C, Moser S, Meersman J, Baldwin C, Youngquist ST. Implementation of pit crew approach and cardiopulmonary resuscitation metrics for out-of-hospital cardiac arrest improves patient survival and neurological outcome. *J Am Hear Assoc*. 2016;5.
10. Hostler D, Everson-Stewart S, Rea TD, et al. Effect of real-time feedback during CPR. *BMJ*. 2011;342:d512.
11. Huang CH, Yu PH, Tsai MS, et al. Acute hospital administration of amiodarone and/or lidocaine in shockable patients presenting with out-of-hospital cardiac arrest: a nationwide cohort study. *Int J Cardiol*. 2017;227:292-8.
12. Jacobs I, Hadkarni V, Bahr J, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. *Circulation*. 2004;110(21):3385-97.
13. Kleinman ME, Brennan EE, Goldberger ZD, et al. Part 5: Adult Basic Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;312(18 Suppl 2):S414-35.
14. Kronick SL, Kurz MC, Lin S, et al. Part 4: systems of care and continuous quality improvement: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S397-413.
15. Kudenchuk PJ, Brown SP, Daya M, et al. Amiodarone, lidocaine, or placebo in out-of-hospital cardiac arrest. *N Engl J Med*. 2016;374(18):1711-1722.
16. Kudenchuk PJ, Cobb LA, Copass MK, et al. Amiodarone for resuscitation after out-of-hospital cardiac arrest due to ventricular fibrillation. *N Engl J Med*. 1999;341(12):871-878.



17. Lavonas EJ, Drennan IR, Gabrielli A, et al. Part 10: cardiac arrest in special situations: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S501-18.
18. Link MS, Berkow LC, Kudenchuk PJ, et al. Part 7: adult advanced cardiovascular life support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S444-64.
19. Neumar RW, Shuster M, Callaway CW, et al. Part 1: executive summary: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S315-67.
20. Nichol G, Leroux B, Wang H, et al. Trial of continuous or interrupted chest compressions during CPR. *N Engl J Med*. 2015;373(23):2203-14.
21. Sporer K, Jacobs M, Derevin L, Duval S, Pointer J. Continuous quality improvement efforts increase survival with favorable neurologic outcome after out-of-hospital cardiac arrest. *Prehospital Emerg Care*. 2017;21(1):1-6.

**Revision Date**

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

### **Aliases**

None noted

### **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.

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 recommended

### **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. Administer oxygen as appropriate with a target of achieving 94-98% saturation. Do not hyperoxygenate
4. Do not hyperventilate. Maintain a ventilation rate of 6-8 per minute and ETCO<sub>2</sub> of 30-40 mmHg
5. For hypotension (SBP less than 90 mmHg or MAP less than 65) [see [Shock guideline](#)]
6. Perform 12-lead EKG
7. Check blood glucose
  - a. If hypoglycemic, treat per [Hypoglycemia guideline](#)
  - b. If hyperglycemic, notify hospital on arrival
8. If patient seizes, treat per [Seizures guideline](#)
9. Post-cardiac arrest patients with evidence or interpretation consistent with ST elevation myocardial infarction (STEMI/Acute MI) should may be transported to any hospitals which offer percutaneous coronary intervention in their cardiac catheterization laboratory
10. Consider transport patients to facility which offers specialized post-resuscitative care
11. Do not allow patient to become hyperthermic

#### **Patient Safety Considerations**

1. Avoid hyperthermia
2. Prehospital initiation of therapeutic hypothermia is not routinely recommended

## 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-OSC 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

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914019 – Cardiac Arrest-Post Resuscitation Care

### Key Documentation Elements

- Immediate post-arrest rhythms, vital signs, oxygen saturation, neurologic status assessment
- Post-ROSC 12-lead EKG

### Performance Measures

- Percent of ROSC patients transported to appropriate facility as defined by the EMS system

## References

1. Aufderheide TP, Lurie KG. Death by hyperventilation: a common and life-threatening problem during cardiopulmonary resuscitation. *Crit Care Med*. 2004;32(suppl):S345–51.
2. Bernard SA, Gray TW, Buist MD, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med*. 2002;346:557–63.
3. Callaway CW, Donnino MW, Fink EL, et al. Part 8: Post cardiac arrest care: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2):S465-82.
4. De Backer D et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010;362:779-89.
5. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest. *JAMA*. 2014;311(1):45-52.
6. Nolan JP, Neumar RW, Adrie C, et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A scientific statement from the International Liaison Committee on Resuscitation; 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; the Council on Stroke. *Circulation*. 2008;79(3):350-79.
7. Garot P, Lefevre T, Eltchaninoff H, et al. Six-month outcome of emergency percutaneous coronary intervention in resuscitated patients after cardiac arrest complicating ST-elevation myocardial infarction. *Circulation*. 2007;115(11):1354–62.

8. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest: a randomized clinical trial. *JAMA*. 2014;311(1):45-52.
9. Kim F, Olsufka M, Longstreth WT Jr., et al. Pilot randomized clinical trial of prehospital induction of mild hypothermia in out-of-hospital cardiac arrest patients with a rapid infusion of 4°C normal saline. *Circulation*. 2007;115(24):3064–70.
10. Kliegel A, Janata A, Wandaller C, et al. Cold infusions alone are effective for induction of therapeutic hypothermia but do not keep patients cool after cardiac arrest. *Resuscitation*. 2007;73(1):46–53.
11. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33 degrees C versus 36 degrees C after cardiac arrest. *N Engl J Med*. 2013;369(23):2197-206.
12. Oddo M, Schaller MD, Feihl F, Ribordy V, Liaudet L. From evidence to clinical practice: effective implementation of therapeutic hypothermia to improve patient outcome after cardiac arrest. *Crit Care Med*. 2006;34(7):1865–73.
13. Quintero-Moran B, Moreno R, Villarreal S, et al. 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(6):269–72.
14. Vereczki V, Martin E, Rosenthal RE, Hof PR, Hoffman GE, Fiskum G. Normoxic resuscitation after cardiac arrest protects against hippocampal oxidative stress, metabolic dysfunction, and neuronal death. *J Cereb Blood Flow Metab*. 2006;26(6):821-35.
15. Virkkunen I, Yli-Hankala A, Silfvast T. Induction of therapeutic hypothermia after cardiac arrest in prehospital patients using ice-cold Ringer’s solution: a pilot study. *Resuscitation*. 2004;62(3):299–302.

**Revision Date**

September 8, 2017

## Determination of Death/Withholding Resuscitative Efforts

### **Aliases**

None noted

### **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:**

1. Resuscitation should 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):
    - a. Medical cause or traumatic injury or body condition clearly indicating biological death (irreversible brain death), limited to:
      - i. Decapitation: the complete severing of the head from the remainder of the patient's body
      - ii. 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
      - iii. 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
      - iv. 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
      - v. Injuries incompatible with life (such as massive crush injury, complete exsanguination, severe displacement of brain matter)
      - vi. Futile and inhuman attempts as determined by agency policy/protocol related to "compelling reasons" for withholding resuscitation
      - vii. In blunt and penetrating trauma, if the patient is apneic, pulseless, and without other signs of life upon EMS arrival including, but not limited to spontaneous movement, EKG activity, or pupillary response
      - viii. Nontraumatic arrest with obvious signs of death including dependent lividity or rigor mortis
- OR**
- a. A valid DNR order (form, card, bracelet) or other actionable medical order (e.g. POLST/ MOLST form) present, when it:
    - i. Conforms to the state specifications for color and construction
    - ii. Is intact: it has not been cut, broken or shows signs of being repaired
    - iii. 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 should be immediately initiated or continued. The [Termination of Resuscitative Efforts 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**

1. For scene safety and/or family wishes, provider may decide to implement CPR even if all the criteria for death are met
2. At a likely crime scene, disturb as little potential evidence as possible

### **Pertinent Assessment Findings**

No recommendations

## **Quality improvement**

### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914201 – Cardiac Arrest-Determination of Death/Withholding Resuscitative Efforts
- 9914169 – Cardiac Arrest-Do Not Resuscitate

### **Key Documentation Elements**

- Clinical/situational details that may be available from bystanders/caregivers
- Documentation of details surrounding decision to determine death
  - Time of contact with direct medical oversight

- Time of death determination
- Names/contact information for significant bystanders

### **Performance Measures**

None recommended

### **References**

1. 'Do Not Attempt Resuscitation' in the Out-of-Hospital Setting. American College of Emergency Physicians; October 2003. ACEP Policy Statement.
2. Millin MG, Galvagno SM, Khandker SR, Malki A, Bulger EM. Withholding and termination of resuscitation of adult cardiopulmonary arrest secondary to trauma: resource document to the joint NAEMSP-ACSCOT position statements. *J Trauma Acute Care Surg.* 2013;75(3):459-67.
3. 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. *Prehosp Disaster Med.* 1994;9(2):197-9.
4. National Association of EMS Physicians, American College of Surgeons Committee on Trauma. Termination of resuscitation for adult traumatic cardiopulmonary arrest. *Prehosp Emerg Care.* 2012;16(4):571.
5. National Association of EMS Physicians, et al. Withholding of resuscitation for adult traumatic cardiopulmonary arrest. *Prehosp Emerg Care.* 2013;17(2):291.

### **Revision Date**

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## Do Not Resuscitate Status/Advance Directives/Healthcare Power of Attorney (POA) Status

### **Aliases**

DNR, comfort care

### **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. Advance 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, and other parameters. The directives frequently do 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
  - a. If the patient has a MOLST or POLST, it may provide specific guidance on how to proceed in this situation
  - b. 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 healthcare 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 recommendations

## **Quality Improvement**

### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914201 – Cardiac Arrest-Determination of Death/Withholding Resuscitative Efforts
- 9914169 – Cardiac Arrest-Do Not Resuscitate
- 9914171 – Cardiac Arrest-Special Resuscitation Orders

### **Key Documentation Elements**

- Detailed description of the valid exclusion to resuscitation documentation used to guide resuscitation including a copy of the document if possible
- Names/contact information for significant bystanders

### **Performance Measures**

None recommended

## **References**

1. *'Do Not Attempt Resuscitation' in the Out-of-Hospital Setting*. American College of Emergency Physicians; October 2003. ACEP Policy Statement.
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. *Prehos Disaster Med.* 1994;9(2):197-9

## **Revision Date**

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## Termination of Resuscitative Efforts

### **Aliases**

Call the code

### **Patient Care Goals**

1. When there is no response to prehospital cardiac arrest treatment, it is acceptable and often preferable to cease futile resuscitation efforts in the field.
2. 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.
3. 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.
4. 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 in cardiac arrest associated with medical conditions that may have a better outcome despite prolonged resuscitation, including hypothermia (although under certain circumstances, direct medical oversight may order termination of resuscitation in these conditions)

## **Patient Management**

Resuscitation may be terminated under the following circumstances:

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. asystole or wide complex PEA less than 60 BPM, no heart sounds)
  - c. Advanced life support resuscitation is administered appropriate to the presenting and persistent cardiac rhythm.
    - i. Resuscitation may be terminated in asystole and slow wide complex PEA if there is no return of spontaneous circulation after 20 minutes in the absence of hypothermia and the ETCO<sub>2</sub> is less than 20mmHg
    - ii. Narrow complex PEA with a rate above 40 or refractory and recurrent ventricular fibrillation/ventricular tachycardia:
      1. Consider resuscitation for up to 60 minutes from the time of dispatch.
      2. Termination efforts may be ceased before 60 minutes based on factors including but not limited to ETCO<sub>2</sub> less than 20mmHg, age, co-morbidities, distance from, and resources available at the closest hospital. Termination before this timeframe should be done in consultation with direct medical oversight
  - 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 hypothermia
  - 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 VII](#); 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
4. For patients that are less than 18 yo, consultation with direct medical oversight is recommended

### **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. Recent evidence has shown that, in order to capture over 99% of potential survivors from medical cardiac arrest (especially VF and pulseless VT arrests), resuscitation should be continued for approximately 40 minutes. This does not imply, however, that all resuscitations should continue this long (e.g. asystolic rhythms)
2. 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 greater than 30 minutes of CPR (this does not apply in the case of hypothermia)
  - b. Transport to an emergency department will take greater than 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
3. Logistical factors should be considered, such as collapse in a public place, family wishes, and safety of the crew and public
4. 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
5. Quantitative end-tidal carbon dioxide measurements of less than 10 mmHg or falling greater than 25% despite resuscitation indicates a poor prognosis and provide additional support for termination

## Quality Improvement

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914201 – Cardiac Arrest-Determination of Death/Withholding Resuscitative Efforts
- 9914169 – Cardiac Arrest-Do Not Resuscitate
- 9914171 – Cardiac Arrest-Special Resuscitation Orders
- 9914055 – General-Cardiac Arrest
- 9914087 – Injury-Cardiac Arrest

### Key Documentation Elements

- 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
- 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

- Time to CPR
- Time to AED application if applicable
- Review of CPR quality
- Duration of resuscitative efforts
- Review of biometric data/CPR quality if available
- Appropriateness of termination
- Review of every patient transport from scene with patient in arrest

## References

1. American College of Emergency Physicians. Discontinuing resuscitation in the out-of-hospital setting. *Ann Emerg Med.* 2008;52(5):592.
2. Fallat ME, American College of Surgeons Committee on Trauma, American College of Emergency Physicians, National Association of EMS Physicians, American Academy of Pediatrics. Withholding or termination of resuscitation in pediatric out-of-hospital traumatic cardiopulmonary arrest. *Pediatrics*, 2014 Apr; 133(4):e1104-16.
3. Cha WC, Lee EJ, Hwang SS. The duration of cardiopulmonary resuscitation in emergency departments after out-of-hospital cardiac arrest is associated with the outcome: A nationwide observational study. *Resuscitation.* 2015;96:323-7.
4. Eckstein M, Hatch L, Malleck J, McClung C, Henderson SO. End-tidal CO<sub>2</sub> as a predictor of survival in out-of-hospital cardiac arrest. *Prehosp Disaster Med.* 2011;26(3):148-50.
5. Goldberger ZD, Chan PS, Berg RA, et al. Duration of resuscitation efforts and survival after in-hospital cardiac arrest: an observational study. *Lancet.* 2012;380(9852):1473-81.
6. Goto Y, Funada A, Goto Y. Duration of prehospital cardiopulmonary resuscitation and favorable neurological outcomes for pediatric out-of-hospital cardiac arrests: a nationwide, population-based cohort study. *Circulation.* 2016;(1):1-10.
7. Hung SC, Mou CY, Hung HC, Lin IH, Lai SW, Huang JY. Chest compression fraction in ambulance while transporting patients with out-of-hospital cardiac arrest to the hospital in rural Taiwan. *Emerg Med J.* 2016;0:1-4.
8. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest. *JAMA.* 2014;311(1):45-52.

9. Matsuyama T, Kitamura T, Kiyohara K, et al. Impact of cardiopulmonary resuscitation duration on neurologically favourable outcome after out-of-hospital cardiac arrest: a population-based study in japan. *Resuscitation*. 2017;113:1-7.
9. Millin MG, Khandker SR, Malki A. Termination of resuscitation of nontraumatic cardiopulmonary arrest: resource document for the National Association of EMS Physicians position statement. *Prehosp Emerg Care*. 2011;15(4):547-54.
10. Morrison LJ, Verbeek PR, Zhan C, Kiss A, Allan KS. Validation of a universal prehospital termination of resuscitation clinical prediction rule for advanced and basic life support providers. *Resuscitation*. 2009;80(3):324-8.
11. Ponce A, Swor R, Quest TE, Macy M, Meurer W, Sasson C. Death notification training for prehospital providers: a pilot study. *Prehosp Emerg Care*. 2010;14(4):537-42.
12. Reynolds JC, Grunau BE, Rittenberger JC, Sawyer KN, Kurz MC, Callaway CW. The association between duration of resuscitation and favorable outcome after out-of-hospital cardiac arrest: implications for prolonging or terminating resuscitation. *Circulation*. 2016;134(25):2084-94.

**Revision Date**

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## Pediatric-Specific Guidelines

### Brief Resolved Unexplained Event (BRUE)

#### **Aliases**

Apparent Life-Threatening Event, ALTE

#### **Patient Care Goals**

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

#### **Patient Presentation**

##### **Inclusion Criteria**

1. Suspected BRUE: An event in an infant less than 1 yo reported by a bystander as sudden, brief (less than 1 min), completely resolved upon EMS arrival that includes one or more of the following:
  - a. Absent, decreased, or irregular breathing
  - b. Color change (central cyanosis or pallor)
  - c. Marked change in muscle tone (hyper- or hypotonia)
  - d. Altered level of responsiveness

##### **Exclusion Criteria**

1. Any of the following present upon EMS evaluation:
  - a. Abnormal vitals signs for age (including fever)
  - b. Vomiting
  - c. Signs of trauma
  - d. Noisy breathing
2. Identifiable cause for the event, which may include:
  - a. Gastric reflux (spitting up)
  - b. Swallowing dysfunction
  - c. Nasal congestion
  - d. Periodic breathing of the newborn
  - e. Breath-holding spell
  - f. Change in tone associated with choking, gagging, crying, feeding
  - g. Seizure (eye deviation, nystagmus, tonic-clonic activity)
3. History or exam concerning for child abuse or neglect
4. Color change that involved only redness (e.g. in the face) or isolated perioral or hand/feet cyanosis



## **Patient Management**

### **Assessment**

1. History
  - a. History of circumstances and symptoms before, during, and after the event, including duration, interventions done, and patient color, tone, breathing, feeding, position, location, activity, level of consciousness
  - b. Other concurrent symptoms (fever, congestion, cough, rhinorrhea, vomiting, diarrhea, rash, labored breathing, fussy, less active, poor sleep, poor feeding)
  - c. Prior history of BRUE
  - d. Past medical history (prematurity, prenatal/birth complications, gastric reflux, congenital heart disease, developmental delay, airway abnormalities, breathing problems, prior hospitalizations, surgeries, or injuries)
  - e. Family history of sudden unexplained death or cardiac arrhythmia in other children or young adults
  - f. Social history: who lives at home, recent household stressors, exposure to toxins/drugs, sick contacts)
  - g. Considerations for possible child abuse (multiple/changing versions of the story; reported mechanism of injury does not seem plausible, especially for child's developmental stage)
2. Exam
  - a. Full set of vital signs (per [Universal Care guideline](#), includes: T, P, RR, BP, O<sub>2</sub> sat)
  - b. General assessment:
    - i. Signs of respiratory distress (grunting, nasal flaring, retracting)
    - ii. Color (pallor, cyanosis, normal)
    - iii. Mental status (alert, tired, lethargic, unresponsive, irritability)
  - a. Head to toe exam, including:
    - i. Physical exam for signs of trauma or neglect
    - ii. Pupillary response

### **Treatment and Interventions**

1. Monitoring
  - a. Cardiac monitor
  - b. Continuous pulse oximetry
  - c. Check blood glucose
  - d. Serial observations during transport for change in condition
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 [see [Airway Management guideline](#)]
  - b. Suction the nose and/or mouth (via bulb, suction catheter) if excessive secretions are present
3. Utility of IV placement and fluids
  - a. Routine IVs should not be placed on all BRUE patients
  - b. IVs should only be placed in children for clinical concerns of shock, or when administering IV medications

### **Patient Safety Considerations**

1. Regardless of patient appearance, all patients with a history of signs or symptoms of BRUE should be transported for further evaluation
2. Destination considerations
  - a. Consider transport to a facility with pediatric critical care capability for patients with high risk criteria present:
    - i. Less than 2 months of age
    - ii. History of prematurity (less than or equal to 32 weeks gestation or corrected gestational age less than or equal to 45 weeks)
    - iii. More than 1 BRUE, now or in the past
  - b. All patients should be transported to facilities with baseline readiness to care for children

### **Notes/Educational Pearls**

#### **Key Considerations**

1. BRUE is a group of symptoms, not a disease process
2. High risk BRUE patients may require ED or hospital intervention
3. All patients should be transported to an ED
4. Contact direct medical oversight if parent/guardian is refusing medical care and/or transport, especially if any high-risk criteria are present (see above)

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914197 – Medical- Apparent Life Threatening Event (ALTE)
  - **NOTE:** BRUE is the updated term replacing ALTE and NEMSIS will not be able to change the label for this code until at least mid-2018. Most ePCR software systems allow changing the displayed label for a value and local system will be able to do this. The background NEMSIS code will remain the same however, regardless of whether the guideline is called ALTE or BRUE.

#### **Key Documentation Elements**

- Document key aspect of history
  - Color change
  - Apnea
  - Change in muscle tone
  - Caregiver resuscitation efforts
  - History of prematurity
  - Prior BRUE events
  - Past medical history
- Document key aspects of the exam to assess for a change after each intervention:
  - Full set of vitals signs (T, RR, BP, P, O<sub>2</sub> sat)
  - Respiratory effort
  - Mental status
  - Color
  - Presence of signs of trauma or neglect

## **Performance Measures**

- Complete set of vital signs recorded
- Appropriate transport destination relative to risk criteria

## **References**

### **Key Reference**

1. Tieder JS, Bonkowsky JL, Etzel RA, et al. Brief resolved unexplained events (formerly apparent life-threatening events) and evaluation of lower-risk infants: a systematic review. *Pediatrics*. 2016;137(5):e20165090.

### **Supplemental References**

1. Al-Kindy H, Gelinas J, Hatzakis G, Cote A. Risk factors for extreme events in infant hospitalized for apparent life-threatening events. *J Pediatr*. 2009;154(3):332-7.
2. American Academy of Pediatrics Committee on Pediatric Emergency Medicine, American College of Emergency Physicians Pediatric Committee, Emergency Nurses Association Pediatric Committee. Joint policy statement – guidelines for care of children in the emergency department. *Pediatrics*. 2009;124(4):1233-43.
3. American Academy of Pediatrics Committee on Pediatric Emergency Medicine, American College of Emergency Physicians Pediatric Committee, Emergency Nurses Association Pediatric Committee. Joint Policy Statement – Guidelines for Care of Children in the Emergency Department. *Ann Emerg Med*. 2009;54(4):543-52.
4. Bonkowsky J, Guenther E, Filloux F, Srivastava R. Death, child abuse, and adverse neurologic outcome of infants after an apparent life-threatening event. *Pediatrics*. 2008;122(1):125-31.
5. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*. 2009;13(3):304-10.
6. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*. 2004;39(9):1376-80.
7. Gausche-Hill M, Lewis RJ, Stratton, SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA*. 2000;283(6):783-90.
8. Gausche-Hill M, Schmitz C, Lewis RL. Pediatric Preparedness of US Emergency Departments: A 2003 Survey. *Pediatrics*. Dec 2007;120(6):1229-37.
9. Guenther E, Powers A, Srivastava R, Bonkowsky JL. Abusive head trauma in children presenting with an apparent life-threatening event. *J Pediatr*. 2010;157(5):821-5.
10. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med*. 1997;32(5):585-8.
11. Hunt RC, Brown LH, Cabinum ES, et al. Is ambulance transport time with lights and siren faster than that without? *Annals of Emergency Medicine*, 1995 25(4), 507-11.
12. Kaji A, Claudius I, Santillanes G, et al. Apparent life-threatening event: multicenter prospective cohort study to develop a clinical decision rule for admission to the hospital. *Ann Emerg Med*. 2013;61(4):379-87.
13. Kaji A, Claudius I, Santillanes G, et al. Do infants less than 12 months of age with an apparent life-threatening event need transport to a pediatric critical care center? *Prehosp Emerg Care*. 2013;Vol 17(3):304-11.
14. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med*. 2009;36(4):357-62.

15. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: Are they being misused? *Ann Emerg Med.* 1997;29(2):223-7.
16. Meislin AHW, Hinsberg P. A prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med.* 1994;24(2):209-14.
17. Middleton KR, Burt CW. Availability of pediatric services and equipment in emergency departments: United States, 2002-03. *Adv Data.* 2006;367:1-16.
18. Mittal M, Sun G, Baren JM. A clinical decision rule to identify infants with apparent life-threatening event who can be discharged from the emergency department. *Pediatric Emerg Care.* 2012;28:599-605.
19. Parker K, Pitetti R. Mortality and child abuse in children presenting with apparent life-threatening events. *Ped Emerg Care.* 2011;27(7):591-5.
20. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med.* 2007;356(21):2156-64.
21. Stratton S, Taves A, Lewis R, Clements H, Henderson D, McCollough M. Apparent life-threatening events in infants: high risk in the out-of-hospital environment. *Ann Emerg Med.* 2004;43:711-7.
22. Tieder JS, Altman RL, Bonkowsky JL, et al. Management of apparent life-threatening events in infants: a systematic review. *J Pediatr.* 2013;163:94-9.

**Revision Date**

September 8, 2017

## Pediatric Respiratory Distress (Bronchiolitis)

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

### **Aliases**

None noted

### **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 less than 2 yo typically with diffuse rhonchi or an otherwise undifferentiated illness characterized by rhinorrhea, cough, fever, tachypnea, and/or respiratory distress

#### **Exclusion Criteria**

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

### **Patient Management**

#### **Assessment**

1. History
  - a. Onset of symptoms
  - b. Concurrent symptoms (e.g. 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 (3 mg in 3 mL of normal saline) 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**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914221 – Medical-Respiratory Distress-Bronchiolitis
  - Protocol Age Category: 3602005 – Pediatric Only

#### **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 (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

### **References**

1. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatr Emerg Care*. 1996;12(4):252-4.
2. Al-Ansari K, Sakran M, Davidson BL, El Sayyed R, Mahjoub H, Ibrahim K. Nebulized 5% or 3% hypertonic or 0.9% saline for treating acute bronchiolitis in infants. *J Pediatr*. 2010;157(4):630-4.
3. Cambonie G, Milési C, Jaber S, et al. Nasal continuous positive airway pressure decreases respiratory muscles overload in young infants with severe acute viral bronchiolitis. *Intensive Care Med*. 2008;34(10):1865-72.
4. Chavasse R, Seddon P, Bara A, McKean M. Short acting beta2-agonists for recurrent wheeze in children under two years of age. *Cochrane Database Syst Rev*. 2002;(3):CD002873.
5. Chowdhury MM, McKenzie SA, Pearson CC, et al. Heliox therapy in bronchiolitis: phase III multicenter double-blind randomized controlled trial. *Pediatrics*. 2013;131(4):661-9.
6. Corneli HM, Zorc JJ, Mahajan P, et al. A multicenter, randomized, controlled trial of dexamethasone for bronchiolitis. *N Engl J Med*. 2007;357(4):331-9.

7. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*. 2009;13(3):304-10.
8. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*. 2004;39(9):1376-80.
9. Everard ML, Bara A, Kurian M, Elliot TM, Ducharme F. Anticholinergic drugs for wheeze in children under the age of two years. *Cochrane Database Syst Rev*. 2002;(1):CD001279.
10. Freedman SB, Haladyn JK, Floh A, Kirsh JA, Taylor G, Thull-Freedman J. Pediatric myocarditis: emergency department clinical findings and diagnostic evaluation. *Pediatrics*. 2007;120(6):1278-85.
11. Gausche-Hill M, Lewis RJ, Stratton SJ, Haynes BE, Gunter CS, Goodrich SM, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA*. 2000;283(6):783-90.
12. Grewal S, Ali S, McConnell DW, Vandermeer B, Klassen TP. A randomized trial of nebulized 3% hypertonic saline with epinephrine in the treatment of acute bronchiolitis in the emergency department. *Arch Pediatr Adolesc Med*. 2009;163(11):1007-12.
13. Hartling L, Russell KF, Patel H, Klassen TP, Liang Y. Epinephrine for bronchiolitis. *Cochrane Database Syst Rev*. 2004;(1):CD003123.
14. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med*. 1998;32(5):585-8.
15. Ho J, Lindquist M. Time saved with the use of emergency warning lights and siren while responding to requests for emergency medical aid in a rural environment. *Prehosp Emerg Care*. 2001;5(2):159-62.
16. Hunt RC, Brown LH, Cabinum ES, Whitley TW, Prasad NH, Owens JCF, et al. Is ambulance transport time with lights and siren faster than that without? *Ann Emerg Med*. 1995;25(4):507-11.
17. Javouhey E, Barats A, Richard N, Stamm D, Floret D. Non-invasive ventilation as primary ventilatory support for infants with severe bronchiolitis. *Intensive Care Med*. 2008;34(9):1608-14.
18. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med*. 2009;36(4):357-62.
19. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med*. 1997;29(2):223-7.
20. Lashkeri T, Howell JM, Place R. Capnometry as a predictor of admission in bronchiolitis. *Pediatr Emerg Care*. 2012;28(9):895-7.
21. Liet JM, Ducruet T, Gupta V, Cambonie G. Heliox. Inhalation therapy for bronchiolitis in infants. *Cochrane Database Syst Rev*. 2010;(4):CD006915.
22. Martinon-Torres F, Rodriguez-Nunez A, Martinon-Sanchez JM. Heliox therapy in infants with acute bronchiolitis. *Pediatrics*. 2002;109(1):68-73.
23. Moses JM, Alexander JL, Agus MS. The correlation and level of agreement between end-tidal and blood gas PCO<sub>2</sub> in children with respiratory distress: a retrospective analysis. *BMC Pediatr*. 2009;9:20.
24. Mussman GM, Parker MW, Statile A, Sucharew H, Brady PW. Suctioning and length of stay in infants hospitalized with bronchiolitis. *JAMA Pediatr*. 2013;167(5):414-21.
25. Ralston RL, Lieberthal H, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics*. 2014;134:e1474–502.



26. Skjerven HO, Hunderi JO, Brüggmann-Pieper SK, et al. Racemic adrenaline and inhalation strategies in acute bronchiolitis. *N Engl J Med*. 2013;368(24):2286-93.
27. Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Hinsberg P. A prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med*. 1994;24(2):209-14.
28. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med*. 2007;356(21):2156-64.
29. Thia LP, McKenzie SA, Blyth TP, Minasian CC, Kozłowska WJ, Carr SB. Randomized controlled trial of nasal continuous positive airways pressure (CPAP) in bronchiolitis. *Arch Dis Child*. 2008;93(1):45-7.
30. Umoren R, Odey F, Meremikwu MM. Steam inhalation or humidified oxygen for acute bronchiolitis in children up to three years of age. *Cochrane Database Syst Rev*. 2011;(1):CD006435.
31. Wang HE, Mann NC, Mears G, Jacobson K, Yealy DM. Out-of-hospital airway management in the United States. *Resuscitation*. 2011;82(4):378-85.
32. Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP. Nebulized hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database Syst Rev*. 2008 Oct 8;(4):CD006458.

**Revision Date**

September 8, 2017

## Pediatric Respiratory Distress (Croup)

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

### **Aliases**

None noted

### **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**

1. Presumed underlying cause that includes one of the following:
  - a. Anaphylaxis
  - b. Asthma
  - c. Bronchiolitis (*wheezing less than 2 yo*)
  - d. Foreign body aspiration
  - e. Submersion/drowning
  - f. Epiglottitis

### **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 mg/mL (5 mg) nebulized, should be administered to all children with croup 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 maximum 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**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914223 – Medical-Respiratory Distress-Croup
  - Protocol Age Category: 3602005 – Pediatric Only

#### **Key Documentation Elements**

- Document key aspects of the exam to assess for a change after each intervention:
  - Respiratory rate
  - Oxygen saturation
  - Use of accessory muscles or tracheal tugging
  - Breath sounds
  - Air entry
  - Mental status
  - Color

#### **Performance Measures**

- Time to administration of specified interventions in the protocol
- Frequency of administration of specified interventions in the protocol

### **References**

1. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatr Emerg Care*. 1996;12(4):252-4.
2. Ausejo M, Saenz A, Pham B, et al. The effectiveness of glucocorticoids in treating croup: meta-analysis. *West J Med*. 1999;171(4):227-32.
3. Bjornson CL, Klassen TP, Williamson J, et al. A randomized trial of a single dose of oral dexamethasone for mild croup. Pediatric Emergency Research Canada Network. *N Engl J Med*. 2004;351(13):1306-13.
4. Bjornson C, Russell KF, Vandermeer B, Durec T, Klassen TP, Johnson DW. Nebulized epinephrine for croup in children. *Cochrane Database Syst Rev*. 2011;(2):CD006619.
5. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*. 2009;13(3):304-10.
6. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*. 2004;39(9):1376-80.
7. Freedman SB, Haladyn JK, Floh A, Kirsh JA, Taylor G, Thull-Freedman J. Pediatric myocarditis: Emergency department clinical findings and diagnostic evaluation. *Pediatrics*. 2007;120(6):1278-85.
8. Gausche M, Lewis RJ, Stratton SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA*. 2000;283(6):783-90.

9. Grosz AH, Jacobs IN, Cho C, Schears GJ. Use of helium-oxygen mixture to relieve upper airway obstruction in a pediatric population. *Laryngoscope*. 2001;111(9):1512-4.
10. *Guideline for the Diagnosis and Management of Croup*. Alberta, ON, Canada: Alberta Medical Association; 2013. [http://www.topalbertadoctors.org/uploads/croup\\_guideline.pdf](http://www.topalbertadoctors.org/uploads/croup_guideline.pdf) and [http://www.topalbertadoctors.org/download/254/croup\\_summary.pdf](http://www.topalbertadoctors.org/download/254/croup_summary.pdf). Accessed August 25, 2017.
11. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med*. 1998;32(5):585-8.
12. Hunt RC, Brown LH, Cabinum ES, et al. Is ambulance transport time with lights and siren faster than that without? *Ann Emerg Med*. 1995;25(4):507-11.
13. Keahey L, Bulloch B, Becker AB, Pollack CV, Clark S, Camargo CA. Initial oxygen saturation as a predictor of admission in children presenting to the emergency department with acute asthma. *Ann Emerg Med*. 2002;40(3):300-7.
14. Kline-Krammes S, Reed C, Giuliano JS Jr., et al. Heliox in children with croup: a strategy to hasten improvement. *Air Med J*. 2012;31(3):131-7.
15. Kunkel NC, Baker MD. Use of racemic epinephrine, dexamethasone, and mist in the outpatient management of croup. *Pediatr Emerg Care*. 1996;12(3):156-9.
16. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med*. 2009;36(4):357-62.
17. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med*. 1997;29(2):223-7.
18. Moses JM, Alexander JL, Agus MSD. The correlation and level of agreement between end-tidal and blood gas pCO<sub>2</sub> in children with respiratory distress: A retrospective analysis. *BMC Pediatr*. 2009;9:20.
19. Neto GM, Kentab O, Klassen TP, Osmond MH. A randomized controlled trial of mist in the acute treatment of moderate croup. *Acad Emerg Med*. 2002;9(9):873-9.
20. Russell KF, Liang Y, O'Gorman K, Johnson DW, Klassen TP. Glucocorticoids for croup. *Cochrane Database Syst Rev*, 2011 Jan 19;(1):CD001955. Scolnik D, Coates AL, Stephens D, Da Silva Z, Lavine E, Schuh S. Controlled delivery of high vs low humidity vs mist therapy for croup in emergency departments: a randomized controlled trial. *JAMA*. 2006;295(11):1274-80.
21. Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Hinsberg PA. prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med*. 1994;24(2):209-14.
22. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med*. 2007;356(21):2156-64.
23. Stoney PJ, Chakrabarti MK. Experience of pulse oximetry in children with croup. *J Laryngol Otol*. 1991;105(4):295-8.
24. Vorwerk C, Coats T. Heliox for croup in children. *Cochrane Database Syst Rev*. 2012;(10):CD006822.
25. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehosp Disast Med*. 2010;25(1):87-91.
26. Westley CR, Cotton EK, Brooks JG. Nebulized racemic epinephrine by IPPB for the treatment of croup: a double-blind study. *Am J Dis Child*. 1978;132(5):484-7.

### **Revision Date**

June 29, 2018

## Neonatal Resuscitation

### Aliases

None noted

### 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 less than 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. If immediate resuscitation is required and the newborn is still attached to the mother, clamp the cord in two places and cut between the clamps. If no resuscitation is required, warm/dry/stimulate the newborn and then cut/clamp the cord after 60 seconds or the cord stops pulsating
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 greater than 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 less than 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 less than 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 - 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
  - e. Administer epinephrine (0.1mg/mL) 0.01 mg/kg IV/IO (preferable if access obtained) or 0.1 mg/kg via the ETT (if unable to obtain access)
7. Consider checking a blood glucose for ongoing resuscitation, maternal history of diabetes, ill appearing or unable to feed
8. Administer 20 mL/kg normal saline IV/IO for signs of shock or post-resuscitative care

### **Patient Safety Considerations**

1. Hypothermia is common in newborns and worsens outcomes of nearly all post-natal complications
  - a. Ensure heat retention by drying the infant thoroughly, covering the head, and wrapping the baby in dry cloth

- b. 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
  - c. Newborn infants are prone to hypothermia which may lead to hypoglycemia, hypoxia and lethargy. Aggressive warming techniques should be initiated including drying, swaddling, and warm blankets covering body and head. Check blood glucose and follow [Hypoglycemia guideline](#) as appropriate.
2. During transport, neonate should be appropriately secured in seat or isolette and mother should be appropriately secured

## **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
9. There is no evidence to support the routine practice of administering sodium bicarbonate for the resuscitation of newborns

### **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**

### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914133 – Medical-Newborn/Neonatal Resuscitation

### **Key Documentation Elements**

- Historical elements
  - Prenatal complications
  - Delivery complications
  - Date and time of birth
  - Estimated gestational age



- Physical exam findings
  - Heart rate
  - Respiratory rate
  - Respiratory effort
  - Appearance
  - APGAR score at 1 and 5 minutes

#### **Performance Measures**

- Prehospital on-scene time
- Call time for additional resources
- Arrival time of additional unit
- Time to initiation of interventions
- Use of oxygen during resuscitation
- Presence of advanced life support (ALS) versus basic life support (BLS) providers
- ROSC and/or normalization of heart rate
- Length of stay in neonatal intensive care unit
- Length of stay in newborn nursery
- Length of stay in hospital
- Knowledge retention of prehospital providers
- Number of advanced airway attempts
- Mortality

#### **References**

1. AGOG Recommends Delayed Umbilical Cord Clamping for All Healthy Infants. Agog.org. <https://www.acog.org/About-ACOG/News-Room/News-Releases/2016/Delayed-Umbilical-Cord-Clamping-for-All-Healthy-Infants>. Published December 21, 2006. Accessed August 27, 2017.
2. Kattwinkel J, Perlman JM, Aziz K, et al. Part 15: neonatal resuscitation: 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122(18 Suppl 3):S909-19.
3. Weiner GM, Zaichkin J. Textbook of neonatal resuscitation (NRP), 7<sup>th</sup> Ed. Elk Grove Village, IL: American Academy of Pediatrics; 2016.

#### **Revision Date**

September 8, 2017

## OB/GYN

### Childbirth

#### **Aliases**

Labor, delivery, birth

#### **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 [Obstetrical/Gynecological Conditions](#) and [Eclampsia/Pre-Eclampsia](#) guidelines]

#### **Patient Management**

##### **Assessment:**

1. Signs of imminent delivery:
  - a. Contractions
  - b. Crowning
  - c. Urge to push
  - d. Urge to move bowels
  - e. Membrane rupture
  - f. 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
  - a. Support the infant's head as needed
3. Check for cord around the baby's neck
  - a. If present, slip it over the head
  - b. If unable to free the cord from the neck, double clamp the cord and cut between the clamps
4. Do not routinely suction the infant's airway (even with a bulb syringe) during delivery

5. Grasping the head with hand over the ears, gently guide head down to allow delivery of the anterior shoulder
6. Gently guide the head up to allow delivery of the posterior shoulder
7. Slowly deliver the remainder of the infant
8. After 1-3 minutes, clamp cord about 6 inches from the abdomen with 2 clamps; cut the cord between the clamps
  - a. If resuscitation is needed, clamp cord and cut as soon as possible
9. Record APGAR scores at 1 and 5 minutes
  - a. 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)
10. Dry and warm infant, wrap in towel and place on maternal chest unless resuscitation needed
11. The placenta will deliver spontaneously, often within 5-15 minutes of the infant
  - a. Do not force the placenta to deliver; do not pull on umbilical cord
  - b. Contain all tissue in plastic bag and transport
12. After delivery, massaging the uterus and allowing the infant to nurse will promote uterine contraction and help control bleeding
  - a. Estimate maternal blood loss
  - b. Treat for hypovolemia as needed
13. Transport infant secured in seat or isolette unless resuscitation needed
14. Keep infant warm during transport
15. Most deliveries proceed without complications – If complications of delivery occur, the following are recommended:
  - 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 hand into vagina and gently lift head/body off of cord
      1. Assess for pulsations in cord
      2. Maintain until relieved by hospital staff.
    - ii. Consider placing mother in prone knee-chest position or extreme Trendelenburg
    - iii. Apply high-flow oxygen to mother
    - iv. Transport as soon as possible
    - v. Contact/transport to closest appropriate receiving facility for direct medical oversight and to prepare team
  - c. Breech birth
    - i. Place mother supine, allow the buttocks and trunk to deliver spontaneously, then support the body while the head is delivered
    - ii. If head fails to deliver, place gloved hand into vagina with fingers between infant’s face and uterine wall to create an open airway

- 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
- vi. The presentation of an arm or leg through the vagina is an indication for immediate transport to hospital
- vii. Assess for presence of prolapsed cord and treat as above
- d. Excessive bleeding during active labor may occur with placenta previa
  - i. Obtain history from patient
  - ii. Placenta previa may prevent delivery of infant vaginally
  - iii. C-Section needed – transport urgently
- e. Maternal cardiac arrest
  - i. Apply manual pressure to displace uterus from right to left
  - ii. Treat per the [Cardiac Arrest 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

### **Patient Safety Considerations**

1. Supine Hypotension Syndrome:
  - a. If mother has hypotension before delivery, place patient in left lateral recumbent position or manually displace gravid uterus to the left if supine position necessary
  - b. Knee-chest position may create safety issues during rapid ambulance transport
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 (gestational age)
  - g. Prenatal care
  - h. Number of expected babies (multiple gestations)
  - i. Drug use and maternal medication use
2. Notify direct medical oversight if:
  - a. Prepartum hemorrhage
  - b. Postpartum hemorrhage
  - c. Breech presentation

- d. Limb presentation
  - e. Nuchal cord (around neck)
  - f. Prolapsed cord
3. Some bleeding is normal with any childbirth
- a. Large quantities of blood or free bleeding are abnormal

**APGAR Score**

Sign	0	1	2
<b>Appearance:</b>	Blue, Pale	Body pink, Extremities blue	Completely pink
<b>Pulse:</b>	Absent	Slow (less than 100)	≥ 100
<b>Grimace:</b>	No response	Grimace	Cough or Sneeze
<b>Activity:</b>	Limp	Some flexion	Active motion of extremities
<b>Respirations:</b>	Absent	Slow, Irregular	Good, Crying

**Quality Improvement**

**Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914155 – OB/GYN-Childbirth/Labor/Delivery
- 9914161 – OB/GYN-Pregnancy Related Disorders
- 9914163 – OB/GYN-Post-Partum Hemorrhage

**Key Documentation Elements**

- Document all times (delivery, contraction frequency and length)

**Performance Measures**

- Recognition of complications
- Documentation of APGAR scores
- Maternal reassessment

**References**

1. Stallard T, Burns B. Emergency delivery and perimortem C-section. *Emerg Med Clin N Am.* 2003;21:679-93.
2. WHO, United Nations Population Fund, UNICEF. *Pregnancy, Childbirth, Postpartum and Newborn Care: A guide for essential practice (3<sup>rd</sup> edition).* Geneva, Switzerland: WHO Press; 2015.

**Revision Date**

September 8, 2017

## Eclampsia/Pre-Eclampsia

### **Aliases**

Pregnant seizures, toxemia of pregnancy

### **Patient Care Goals**

1. Recognize serious conditions associated with pregnancy and hypertension
2. Prevention of eclampsia-related seizures
3. Provide adequate treatment for eclampsia-related seizures

### **Patient Presentation**

#### **Inclusion Criteria**

1. Female patient, more than 20-weeks gestation, presenting with hypertension and evidence of end organ dysfunction, including renal insufficiency, liver involvement, neurological, or hematological involvement
2. May occur up to 4-weeks post-partum but is rare after 48 hours post-delivery.
3. Severe features of pre-eclampsia include:
  - a. Severe hypertension (SBP *greater than* 160, DBP *greater than* 110)
  - b. Headache
  - c. Mental confusion
  - d. Vision changes
  - e. Right upper quadrant or epigastric pain
  - f. Pulmonary edema
4. Eclampsia
  - a. Pre-eclampsia symptoms plus seizures
5. Eclampsia/pre-eclampsia associated with abruptio placenta and fetal loss

#### **Exclusion Criteria**

Chronic hypertension without end organ dysfunction.

### **Patient Management**

#### **Assessment**

1. Obtain history
  - a. Gestational age or recent post-partum
  - b. Symptoms suggestive of end organ involvement such as headache, confusion, visual disturbances, seizure, epigastric pain, right upper quadrant pain, nausea, and vomiting
  - c. Previous history of hypertension or known pre-eclampsia
2. Monitoring
  - a. Vital signs including repeat blood pressures every 10 min
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. Severe hypertension (SBP greater than 160 or DBP greater than 110) lasting more than 15 min with associated preeclampsia symptoms
  - a. Labetalol 20mg IV over 2 min
    - i. May repeat every 10 min X 2 for persistent severe hypertension with preeclampsia symptoms
    - ii. Goal is to reduce MAP by 20-25% initially
    - iii. Ensure that HR is *greater than* 60 bpm prior to administration
  - OR**
  - b. Hydralazine 5 mg IV
    - i. May repeat 10mg after 20 min for persistent severe hypertension with preeclampsia symptoms
    - ii. Goal is to reduce MAP by 20-25%
  - OR**
  - c. Nifedipine 10 mg. p.o.
    - i. May repeat 10 - 20 mg p.o. every 20 minutes X 2 for persistent severe hypertension with pre-eclampsia symptoms
    - ii. Goal is to reduce MAP by 20-25%
  - d. Magnesium sulfate - 4 g IV (20% solution) over 20 min, followed by 1 g/hr IV if available
  - e. Reassess vital signs every 10 min during transport
2. Seizures associated with pregnancy greater than 20-weeks gestation
  - a. Magnesium sulfate
    - i. 4 g IV (50% solution) over 10-20 min, followed by 1 g/hr IV if available
    - ii. Contact direct medical oversight for additional orders if persistent seizure despite initial magnesium (may give additional 1-2 g IV over 5 min)
  - b. Benzodiazepine, per [Seizures guideline](#), for active seizure not responding to magnesium  
- Caution: respiratory depression
3. IV fluids:
  - a. NS or LR at KVO rate but restrict maximum rate of fluids to 80 mL/hr
  - OR**
  - b. Saline lock
4. Disposition
  - a. Transport to closest appropriate receiving facility
  - b. Patients in second or third trimester of pregnancy should be transported on left side or with uterus manually displaced to left if hypotensive

### **Patient Safety Considerations**

1. Magnesium toxicity (progression)
  - a. Hypotension followed by
  - b. Loss of deep tendon reflexes followed by
  - c. Somnolence, slurred speech followed by
  - d. Respiratory paralysis followed by
  - e. Cardiac arrest
2. Treatment of magnesium toxicity
  - a. Stop magnesium drip
  - b. Give calcium gluconate 1 g IV in cases of pending respiratory arrest
  - c. Support respiratory effort

## Notes/Educational Pearls

### Key Considerations

1. Delivery of the placenta is the only definitive management for pre-eclampsia and eclampsia
2. Early treatment of severe pre-eclampsia with magnesium and anti-hypertensive significantly reduces the rate of eclampsia - use of magnesium encouraged if signs of severe pre-eclampsia present to prevent seizure

### Pertinent Assessment Findings

1. Vital signs assessment with repeat blood pressure monitoring before and after treatment
2. Assessment of deep tendon reflexes after magnesium therapy
3. Examination for end organ involvement
4. Evaluate fundal height

## Quality Improvement

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914157 – OB/GYN-Eclampsia
- 9914159 – OB/GYN-Gynecological Emergencies
- 9914161 – OB/GYN-Pregnancy Related Disorders

### Key Documentation Elements

Document full vital signs and physical exam findings.

### Performance Measures

- Patients with signs of hypertension and *greater than* 20-weeks gestation or recent postpartum should be assessed for signs of pre-eclampsia
- Recognition and appropriate treatment of eclampsia

## References

1. American College of Obstetricians and Gynecologists Committee on Obstetric Practice Magnesium sulfate use in obstetrics. Committee opinion no 652: *Obstet Gynecol.* 2016;127(1):e52-3.
2. American College of Obstetrics and Gynecologists Task Force on Hypertension in Pregnancy. Report of the American College of Obstetricians and Gynecologists' task force on hypertension in pregnancy. *Obstet Gynecol.* 2013;122(5):1122-31.
3. Cipolla M, Kraig R. Seizures in women with preeclampsia: mechanism and management. *Fetal Maternal Med Rev.* 2011;22(02):91-108.
4. Cuero M, Varelas P. Neurologic complications in pregnancy. *Crit Care Clin.* 2016;32(1):43-59.
5. Emergent therapy for acute-onset, severe hypertension during pregnancy and the postpartum period. Committee Opinion No. 692. American College of Obstetricians and Gynecologists. *Obstet Gynecol.* 2017;129:e90-5.
6. Mol BW, Roberts CT, Thangaratinam S, Magee LA, de Groot CJ, Hofmeyr GJ. Pre-eclampsia. *Lancet.* 2016;387(10022):999-1011.
7. Olson-Chen C, Seligman N. Hypertensive Emergencies in Pregnancy. *Crit Care Clin.* 2016;32(1):29-41.



8. Shields LE, Wiesner S, Klein C, Pelletreau B, Hedriana HL. Early standardized treatment of critical blood pressure elevations is associated with reduction in eclampsia and severe maternal morbidity. *Am J Obstet Gynecol.* 2017;216(4):415.31-415.e.5.

**Revision Date**

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## Obstetrical and Gynecological Conditions

### **Aliases**

None noted

### **Patient Care Goals**

1. Recognize serious conditions associated with hemorrhage during pregnancy even when hemorrhage or pregnancy is not apparent (e.g. ectopic pregnancy, abruptio 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. Post-partum hemorrhage [see [Childbirth guideline](#)]

#### Differential Diagnosis

1. Abruptio placenta: Occurs in third trimester of pregnancy; placenta prematurely separates from the uterus causing intrauterine bleeding
  - a. Lower abdominal pain and uterine rigidity
  - b. Shock, with minimal or no vaginal bleeding
2. Placenta previa: placenta covers part or all of the cervical opening
  - a. Generally, late second or third trimester
  - b. Painless vaginal bleeding, unless in active labor
  - c. For management during active labor [See [Childbirth guideline](#)]
3. Ectopic pregnancy (ruptured)
  - a. First trimester
  - b. Abdominal/pelvic pain with or without minimal bleeding.
4. Spontaneous abortion (miscarriage)
  - a. Generally first trimester
  - b. Intermittent pelvic pain (uterine contractions) with vaginal bleeding

### **Patient Management**

#### **Assessment**

1. Obtain history
  - a. Obstetrical history [see [Childbirth guideline](#)]
  - b. Abdominal pain – onset, duration, quality, radiation, provoking or relieving factors
  - c. Vaginal bleeding – onset, duration, quantity (pads saturated)
  - d. Syncope/lightheadedness
  - e. Nausea/vomiting
  - f. 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, peritoneal signs
  - 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 - crystalloid 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. distention, rigidity, guarding)
3. If pregnant, evaluate fundal height

#### **Quality Improvement**

##### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914159 – OB/GYN-Gynecological Emergencies
- 9914161 – OB/GYN-Pregnancy Related Disorders

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

Document full vital signs and physical exam findings.

##### **Performance Measures**

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

## **References**

1. Coppola PT, Coppola M. Vaginal bleeding in the first 20 weeks of pregnancy. *Emerg Med Clin N Am.* 2003;21(3):667-77.
2. Della-Giustina D, Denny M. Ectopic Pregnancy. *Emerg Med Clin N Am.* 2003;21(3):565-84.
3. WHO, United Nations Population Fund, UNICEF. *Pregnancy, Childbirth, Postpartum and Newborn Care: A guide for essential practice (3<sup>rd</sup> edition)*. Geneva, Switzerland: WHO Press; 2015.

## **Revision Date**

September 8, 2017

# Respiratory

## Airway Management

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

### **Aliases**

Asthma, upper airway obstruction, respiratory distress, respiratory failure, hypoxemia, hypoxia, hypoventilation, foreign body aspiration, croup, stridor, tracheitis, epiglottitis

### **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. Maintain airway and administer oxygen as appropriate with a target of achieving 94-98% saturation
  - b. For severe respiratory distress or impending respiratory failure, 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
  - c. Use bag-valve mask (BVM) ventilation in the setting of respiratory failure or arrest. Two-person, two-thumbs-up BVM ventilation is more effective than one-person technique and should be used when additional providers are available
2. Oropharyngeal airways (OPA) and nasopharyngeal airways (NPA) - Consider the addition of an OPA and/or NPA to make BVM ventilation 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. 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, 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, cardiac rhythm, blood pressure, and capnography for the intubated patient
  - d. Video laryngoscopy may enhance intubation success rates, and should be used when available. Consider using a bougie, especially when video laryngoscopy is unavailable and glottic opening is difficult to visualize with direct laryngoscope
5. Post-intubation management
  - a. Confirm placement of advanced airway (endotracheal tube, SGA, or EGD) with waveform capnography, absent gastric sounds, and bilateral breath sounds
  - b. Continuously monitor placement with waveform capnography during treatment and transport
  - c. Continuously secure tube manually until tube secured with tape, twill, or commercial device
    - i. Note measurement of tube at incisors or gum line and monitor frequently for tube movement/displacement
    - ii. Cervical collar and/or cervical immobilization device may help reduce neck movement and risk of tube displacement

- d. Inflate endotracheal tube cuff with minimum air to seal airway - an ETT cuff manometer can be used to measure and adjust the ETT cuff pressure to a recommended 20 cm H<sub>2</sub>O pressure
- e. Ventilation
  - i. Tidal volume
    - 1. Ventilate with minimal volume to see chest rise, approximately 6-7 mL/kg ideal body weight
    - 2. Over-inflation may be detrimental
  - ii. Rate
    - 1. Adult: 10-12 breaths/minute
    - 2. Child: 20 breaths/minute
    - 3. Infant: 30 breaths/minute
  - iii. Continuously monitor ET<sub>CO</sub><sub>2</sub> to maintain ET<sub>CO</sub><sub>2</sub> of 35-40 mmHg - in head injury with signs of herniation (unilateral dilated pupil or decerebrate posturing), modestly hyperventilate to ET<sub>CO</sub><sub>2</sub> 30 mmHg
- f. Consider sedation with sedative or opioid medications if agitated
- 6. Gastric decompression may improve oxygenation and ventilation, so it should be considered when there is obvious gastric distention
- 7. 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
- 8. Transport to the closest appropriate hospital for airway stabilization 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 (right 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
  - a. 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
  - a. 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 SGA, EGD, and endotracheal tube placement.
3. CPAP, BiPAP, IBBP, HFNC
  - a. Contraindications to these non-invasive ventilator techniques include intolerance of the device, severely impaired consciousness, 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. Ventilation rate:
    - i. During CPR, ventilation rate should be 10 breaths per minute, one breath every 10 compressions (or one breath every 6 seconds). When advanced airway is in place, ideally ventilations should be on upstroke between two chest compressions
    - ii. In adults who are not in cardiac arrest, ventilate at rate of 12 breaths per minute
    - iii. In children, ventilating breaths should be delivered over one second, with a two second pause between breaths (20 breaths/minute) in children
5. Orotracheal 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	[age(yr)/4]+4	[age(yr)/4]+3.5

- b. Approximate depth of insertion = (3) x (endotracheal tube size)
- c. In addition to preoxygenation, apneic oxygenation (high-flow oxygen by nasal cannula) may prolong the period before hypoxia during an intubation attempt
- d. Positive pressure ventilation after intubation can decrease preload and subsequently lead to hypotension - consider providing vasopressor support for hypotension
- e. Appropriate attention should be paid to adequate preoxygenation to avoid peri-intubation hypoxia and subsequent cardiac arrest
- f. Prompt suctioning of soiled airways before intubation attempt may improve first pass success
- g. Confirm successful placement with waveform capnography. Less optimal methods of confirmation include bilateral chest rise, bilateral breath sounds, and maintenance of adequate oxygenation. Color change on end-tidal CO<sub>2</sub> is less accurate than clinical



assessment, and wave-form capnography is superior. Misting observed in the tube is not a reliable method of confirmation. Visualization with video laryngoscopy, when available, may assist in confirming placement when unclear due to capnography failure or conflicting information.

- h. 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.
  - i. 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 can be secondary to displacement or obstruction of the airway device, pneumothorax or equipment failure

#### **Quality Improvement**

##### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914133 – Medical-Newborn/Neonatal Resuscitation

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

- Initial vital signs and physical exam
- Interventions attempted including the method of airway intervention, the size of equipment used, and the number of attempts to achieve a successful result
- Subsequent vital signs and physical exam to assess for change after the interventions
- Presence of peri-intubation hypoxia, bradycardia, hypotension or cardiac arrest
- Post-intubation with advanced airway, document ETCO<sub>2</sub> value and record capnograph wave initially after intubation, with each set of vital signs, when patient is moved, and at the time of patient transfer in the ED

##### **Performance Measures**

- Percentage of providers that have received hands-on airway training (simulation or non-simulation-based) within the past 2 years
- Respiratory rate and oxygen saturation are both measured and documented
- Percentage of patients with advanced airway who have waveform capnography used for both initial confirmation and continuous monitoring during transport
- Percentage of patients who were managed upon arrival to the emergency department (ED) with each of the following: Bag-valve-mask, SGA, EGD, or endotracheal intubation
- Percentage of intubated patients with endotracheal tube in proper position upon ED arrival
- First pass intubation success without hypoxia or hypotension.
- Survival upon ED arrival

## References

1. Aguilar SA, Lee J, Castillo E, et al. Assessment of the addition of prehospital continuous positive airway pressure (CPAP) to an urban emergency medical services (EMS) system in persons with severe respiratory distress. *J Emerg Med.* 2013;45(2):210-9.
2. Angelotti T, Weiss EL, Lemmens HJ, Brock-Utne J. Verification of endotracheal tube placement by prehospital providers: is a portable fiberoptic bronchoscope of value? *Air Med J.* 2006;25(2):74-8; discussion 78-80.
3. Bair AE, Smith D, Lichty L. Intubation confirmation techniques associated with unrecognized non-tracheal intubations by pre-hospital providers. *J Emerg Med.* 2005;28(4):403-7.
4. Baker TW, King W, Soto W, Asher C, Stolfi A, Rowin ME. The efficacy of pediatric advanced life support training in emergency medical service providers. *Pediatr Emerg Care.* 2009;25(8):508-12.
5. Bankole S, Asuncion A, Ross S, et al. First responder performance in pediatric trauma: a comparison with an adult cohort. *Pediatr Crit Care Med.* 2011;12(4):e166-170.
6. Bhende MS, LaCovey DC. End-tidal carbon dioxide monitoring in the prehospital setting. *Prehosp Emerg Care.* 2001;5(2):208-13.
7. Bledsoe BE, Anderson E, Hodnick R, Johnson L, Johnson S, Dievendorf E. Low-fractional oxygen concentration continuous positive airway pressure is effective in the prehospital setting. *Prehosp Emerg Care.* 2012;16(2):217-21.
8. Bochicchio GV, Scalea TM. Is field intubation useful? *Curr Opin Crit Care.* 2003;9(6):524-9.
9. Boswell WC, McElveen N, Sharp M, Boyd CR, Frantz EI. Analysis of prehospital pediatric and adult intubation. *Air Med J.* 1995;14(3):125-7; discussion 127-8.
10. Bradley JS, Billows GL, Olinger ML, Boha SP, Cordell WH, Nelson DR. Prehospital oral endotracheal intubation by rural basic emergency medical technicians. *Ann Emerg Med.* 1998;32(1):26-32.
11. Burton JH, Baumann MR, Maoz T, Bradshaw JR, Lebrun JE. Endotracheal intubation in a rural EMS state: procedure utilization and impact of skills maintenance guidelines. *Prehosp Emerg Care.* 2003;7(3):352-6.
12. Byars DV, Brodsky RA, Evans D, Lo B, Guins T, Perkins AM. Comparison of direct laryngoscopy to Pediatric King LT-D in simulated airways. *Pediatr Emerg Care.* 2012;28(8):750-2.
13. Byhahn C, Meininger D, Walcher F, Hofstetter C, Zwissler B. Prehospital emergency endotracheal intubation using the Bonfils intubation fiberscope. *Eur J Emerg Med.* 2007;14(1):43-6.
14. Cady CE, Weaver MD, Pirrallo RG, Wang HE. Effect of emergency medical technician-placed Combitubes on outcomes after out-of-hospital cardiopulmonary arrest. *Prehosp Emerg Care.* 2009;13(4):495-9.
15. Carrey Z, Gottfried SB, Levy RD. Ventilatory muscle support in respiratory failure with nasal positive pressure ventilation. *Chest.* 1990;97(1):150-8.
16. Castle N, Owen R, Hann M, Naidoo R, Reeves, D. Assessment of the speed and ease of insertion of three supraglottic airway devices by paramedics: a manikin study. *Emerg Med J.* 2010;27(11):860-3.
17. Chen L, Hsiao AL. Randomized trial of endotracheal tube versus laryngeal mask airway in simulated prehospital pediatric arrest. *Pediatrics.* 2008;122(2):e294-7.
18. Cheskes S, Turner L, Thomson S, Aljerian N. The impact of prehospital continuous positive airway pressure on the rate of intubation and mortality from acute out-of-hospital

- respiratory emergencies. *Prehosp Emerg Care*. 2013;17(4):435-41.
19. Cimpello LB, et al. Illustrated techniques of pediatric emergency procedures. In: Fleisher GR, Ludwig S, editors. *Textbook of Pediatric Emergency Medicine*. Philadelphia: Wolters Kluwer; 2010:1744-1840.
  20. Cooper A, DiScala C, Foltin G, Tunik M, Markenson D, Welborn C. Prehospital endotracheal intubation for severe head injury in children: a reappraisal. *Semin Pediatr Surg*. 2001;10(1):3-6.
  21. Cudnik MT, Newgard CD, Wang H, Bangs C, Herrington, RT. Distance impacts mortality in trauma patients with an intubation attempt. *Prehosp Emerg Care*. 2008;12(4):459-66.
  22. Davis DP, Hoyt DB, Ochs M, et al. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. *J Trauma*. 2003;54(3):444-53.
  23. Deakin CD, Peters R, Tomlinson P, Cassidy M. Securing the prehospital airway: a comparison of laryngeal mask insertion and endotracheal intubation by UK paramedics. *Emerg Med J*. 2005;22(1):64-7.
  24. Deis JN, Abramo TJ, Crawley L. Noninvasive respiratory support. *Pediatr Emerg Care*. 2008;24(5):331-8; quiz 339.
  25. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*. 2009;13(3):304-10.
  26. Edil BH, Tuggle DW, Jones S, et al. Pediatric major resuscitation--respiratory compromise as a criterion for mandatory surgeon presence. *J Pediatr Surg*. 2005;40(6):926-8; discussion 928.
  27. Esposito TJ, Sanddal ND, Dean JM, Hansen JD, Reynolds SA, Battan K. Analysis of preventable pediatric trauma deaths and inappropriate trauma care in Montana. *J Traum*. 1999;47(2):243-51; discussion 251-3.
  28. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*. 2004;39(9):1376-80.
  29. Falcone RE, Herron H, Dean B, Werman H. Emergency scene endotracheal intubation before and after the introduction of a rapid sequence induction protocol. *Air Med*. 1996;15(4):163-7.
  30. Fleisher GR, Ludwig S. *Textbook of Pediatric Emergency Medicine, 6<sup>th</sup> Edition*. Philadelphia, PA: Lippincott Williams & Wilkins; 2010:1782.
  31. Garza AG, Algren DA, Gratton MC, Ma OJ. Populations at risk for intubation nonattempt and failure in the prehospital setting. *Prehosp Emerg Care*. 2005;9(2):163-6.
  32. Gausche M, Lewis RJ, Stratton SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome: a controlled clinical trial. *JAMA*. 2000;283(6):783-90.
  33. Gemes G, Heydar-Fadai J, Boessner T, Wildner G, Prause G. Prehospital fiberoptic intubation. *Resuscitation*. 2008;76(3):468-70.
  34. George S, Macnab AJ. Evaluation of a semi-quantitative CO<sub>2</sub> monitor with pulse oximetry for prehospital endotracheal tube placement and management. *Prehosp Disaster Med*. 2002;17(1):38-41.
  35. Gerritse BM, Draaisma JM, Schalkwijk A, van Grunsven PM, Scheffer GJ. Should EMS-paramedics perform paediatric tracheal intubation in the field? *Resuscitation*. 2008;79(2):225-9.
  36. Grmec S. Comparison of three different methods to confirm tracheal tube placement in emergency intubation. *Intensive Care Med*. 2002;28(6):701-4.
  37. Guyette FX, Roth KR, LaCovey DC, Rittenberger JC. Feasibility of laryngeal mask airway use

- by prehospital personnel in simulated pediatric respiratory arrest. *Prehosp Emerg Care*. 2007;11(2):245-9.
38. Hernandez MR, Klock PA, Ovassapian A. Evolution of the extraglottic airway: a review of its history, applications, and practical tips for success. *Anesth Analg*. 2012;114(2):349-68.
  39. Hubble MW, Wilfong DA, Brown LH, Hertelendy A, Benner RW. A meta-analysis of prehospital airway control techniques part II: alternative airway devices and cricothyrotomy success rates. *Prehosp Emerg Care*. 2010;14(4):515-30.
  40. Hutton KC, Verdile VP, Yealy DM, Paris PM. Prehospital and emergency department verification of endotracheal tube position using a portable, non-directable, fiberoptic bronchoscope. *Prehosp Disaster Med*. 1990;5(2):131-6.
  41. Jungbauer A, Schumann M, Brunkhorst V, Borgers A, Groeben H. Expected difficult tracheal intubation: a prospective comparison of direct laryngoscopy and video laryngoscopy in 200 patients. *Br J Anaesth*. 2009;102(4):546-50.
  42. Kim HJ, Kim JT, Kim HS, Kim CS, Kim SD. A comparison of GlideScope® videolaryngoscopy and direct laryngoscopy for nasotracheal intubation in children. *Paediatr Anaesth*. 2011;21(4):417-21.
  43. Knapp S, Kofler J, Stoiser B, et al. The assessment of four different methods to verify tracheal tube placement in the critical care setting. *Anesth Analg*. 1999;88(4):766-70.
  44. Kupas DF, Kauffman KF, Wang HE. Effect of airway-securing method on prehospital endotracheal tube dislodgment. *Prehosp Emerg Care*. 2010;14(1):26-30.
  45. Langan ML, Ching K, Northrup V, et al. A randomized controlled trial of capnography in the correction of simulated endotracheal tube dislodgement. *Acad Emerg Med*. 2011;18(6):590-6.
  46. Lecky F, Bryden D, Little R, Tong N, Moulton C. Emergency intubation for acutely ill and injured patients. *Cochrane Database Syst Rev*. 2008 Apr 16;(2):CD001429.
  47. Li J, Murphy-Lavoie H, Bugas C, Martinez J, Preston C. Complications of emergency intubation with and without paralysis. *Am J Emerg Med*. 1999;17(2):141-3.
  48. Losek JD, Szewczuga D, Glaeser PW. Improved prehospital pediatric ALS care after an EMT-paramedic clinical training course. *Am J Emerg Med*. 1994;12(4):429-32.
  49. Lowe L, Sagehorn K, Madsen R. The effect of a rapid sequence induction protocol on intubation success rate in an air medical program. *Air Med J*. 1998;17(3):101-4.
  50. Ma OJ, Atchley RB, Hatley T, Green M, Young J, Brady W. Intubation success rates improve for an air medical program after implementing the use of neuromuscular blocking agents. *Am J Emerg Med*. 1998;16(2):125-7.
  51. Mallampati SR, Gatt SP, Gugino LD, et al. A clinical sign to predict difficult tracheal intubation: A prospective study. *Can Anaesth Soc J*. 1985;32(4):429-34.
  52. Mick N, Dyer S, Ostermayer D, Pedro N, Jackson A, Shah MI. An evidence-based guideline for pediatric prehospital airway management using GRADE methodology. Manuscript in preparation.
  53. Mitchell MS, Lee White M, King WD, Wang HE. Paramedic King Laryngeal Tube airway insertion versus endotracheal intubation in simulated pediatric respiratory arrest. *Prehosp Emerg Care*. 2012;16(2):284-8.
  54. O'Connor, RE, Swor, RA. Verification of endotracheal tube placement following intubation, *Prehosp Emerg Car.*, 1999;3(3):248-50.
  55. Platts-Mills TF, Campagne D, Chinnock B, Snowden B, Glickman LT, Hendey GW. A comparison of GlideScope video laryngoscopy versus direct laryngoscopy intubation in the emergency department. *Acad Emerg Med*. 2009;16(9):866-71.
  56. Pointer JE. Clinical characteristics of paramedics' performance of pediatric endotracheal

- intubation. *Am J Emerg Med.* 1989;7(4):364-6.
57. Rabitsch W et al. Evaluation of an end-tidal portable ETCO<sub>2</sub> colorimetric breath indicator (COLIBRI). *Am J Emerg Med.* 2004;22(1):4-9.
  58. Rabitsch W et al. Comparison of a conventional tracheal airway with the Combitube in an urban emergency medical services system run by physicians. *Resuscitation.* 2003;57(1):27-32.
  59. Rajesh VT, Singhi S, Kataria S. Tachypnoea is a good predictor of hypoxia in acutely ill infants under 2 months. *Arch Dis Child.* 2000;82(1):46-9.
  60. Reed MJ, Dunn MJ, McKeown DW. Can an airway assessment score predict difficulty at intubation in the emergency department? *Emerg Med J.* 2005;22(2):99-102.
  61. Ritter SC, Guyette FX. Prehospital pediatric King LT-D use: a pilot study. *Prehosp Emerg Care.* 2011;15(3):401-4.
  62. Riyapan S, Lubin J. Apneic oxygenation may not prevent severe hypoxemia during rapid sequence intubation: a retrospective helicopter emergency medical service study. *Air Med J.* 2016;35(6):365-8.
  63. Rose WD, Anderson LD, Edmond SA. Analysis of intubations. Before and after establishment of a rapid sequence intubation protocol for air medical use. *Air Med J.* 1994;13(11-12):475-8.
  64. Rumball C, Macdonald D, Barber P, Wong H, Smecher C. Endotracheal intubation and esophageal tracheal Combitube insertion by regular ambulance attendants: a comparative trial. *Prehosp Emerg Care.* 2004;8(1):15-22.
  65. Russi CS, Miller L, Hartley MJ. A comparison of the King-LT to endotracheal intubation and Combitube in a simulated difficult airway. *Prehosp Emerg Care.* 2008;12(1):35-41.
  66. Silvestri S, Ralls GA, Krauss B, et al. The effectiveness of out-of-hospital use of continuous end-tidal carbon dioxide monitoring on the rate of unrecognized misplaced intubation within a regional emergency medical services system. *Ann Emerg Med.* 2005;45(5):497-503.
  67. Singh S, Allen WD, Venkataraman ST, Bhende MS. Utility of a novel quantitative handheld microstream capnometer during transport of critically ill children. *Am J Emerg Med.* 2006;24(3):302-7.
  68. Stiell IG, Nesbitt LP, Pickett W, et al. The OPALS Major Trauma Study: Impact of advanced life-support on survival and morbidity. *CMAJ.* 2008;178(9):1141-52.
  69. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med.* 2007;356(21):2156-64.
  70. Stockinger ZT, McSwain NE, Jr. Prehospital endotracheal intubation for trauma does not improve survival over bag-valve-mask ventilation. *J Trauma.* 2004;56(3):531-6.
  71. Stratton SJ. Prehospital pediatric endotracheal intubation. *Prehosp Disaster Med.* 2012;27(1):1-2.
  72. Stratton SJ, Underwood LA, Whalen SM, Gunter CS. Prehospital pediatric endotracheal intubation: a survey of the United States. *Prehosp Disaster Med.* 1993;8(4):323-6.
  73. Swanson ER, Fosnocht DE. Effect of an airway education program on prehospital intubation. *Air Med J.* 2002;21(4):28-31.
  74. Takeda T, Tanigawa K, Tanaka H, Hayashi Y, Goto E, Tanaka K. The assessment of three methods to verify tracheal tube placement in the emergency setting. *Resuscitation.* 2003;56(2):153-7.
  75. Tam RK, Maloney J, Gaboury I, et al. Review of endotracheal intubations by Ottawa advanced care paramedics in Canada. *Prehosp Emerg Care.* 2009;13(3):311-5.
  76. Teague WG. Noninvasive ventilation in the pediatric intensive care unit for children with

- acute respiratory failure. *Pediatr Pulmonol.* 2003;35(6):418-26.
77. Veenema KR, Rodewald LE. Stabilization of rural multiple-trauma patients at level III emergency departments before transfer to a level I regional trauma center. *Ann Emerg Med.* 1995;25(2):175-81.
  78. Vilke GM, Steen PJ, Smith AM, Chan TC. Out-of-hospital pediatric intubation by paramedics: the San Diego experience. *J Emerg Med.* 2002;22(1):71-4.
  79. Vlatten A, Litz S, MacManus B, Launcelott S, Soder C. A comparison of the GlideScope video laryngoscope and standard direct laryngoscopy in children with immobilized cervical spine. *Pediatr Emerg Care.* 2012;28(12):1317-20.
  80. Wang HE, Kupas DF, Greenwood MJ, et al. An algorithmic approach to prehospital airway management. *Prehosp Emerg Care.* 2005;9(2):145-55.
  81. Wang HE, Sweeney TA, O'Connor RE, Rubinstein H. Failed prehospital intubations: an analysis of emergency department courses and outcomes. *Prehosp Emerg Care.* 2001;5(2):134-41.
  82. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehosp Disaster Med.* 2010;25(1):87-91.
  83. Warner KJ, Sharar SR, Copass MK, Bulger EM. Prehospital management of the difficult airway: a prospective cohort study. *J Emerg Med.* 2009;36(3):257-65.
  84. Wayne MA, McDonnell M. Comparison of traditional versus video laryngoscopy in out-of-hospital tracheal intubation. *Prehosp Emerg Care.* 2010;14(2):278-82.
  85. Yamamoto LG. Emergency airway management – rapid sequence intubation. In: Fleisher GR, Ludwig S, editors. *Textbook of Pediatric Emergency Medicine.* Philadelphia: Wolters Kluwer; 2010:74-84.
  86. Youngquist ST, Gausche-Hill M, Squire BT, Koenig WJ. Barriers to adoption of evidence-based prehospital airway management practices in California. *Prehosp Emerg Care.* 2010;14(4):505-9.

**Revision Date**

September 8, 2017

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

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

### **Aliases**

Asthma, respiratory distress, wheezing, respiratory failure, bronchospasm, obstructive lung disease, albuterol, levalbuterol, duoneb, nebulizer, inhaler

### **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**

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

#### **Exclusion Criteria**

1. Respiratory distress due to a presumed underlying cause that includes one of the following:
  - a. Anaphylaxis
  - b. Bronchiolitis (wheezing less than 2 yo)
  - c. Croup
  - d. Epiglottitis
  - e. Foreign body aspiration
  - f. Submersion/drowning
  - g. Congestive heart failure
  - h. 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 (*less than* 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 BLS or 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, maximum dose 125 mg) IV/IM or dexamethasone (0.6 mg/kg, maximum dose of 16 mg) IV/IM/PO may be administered in the prehospital setting. Other steroids at equivalent doses may be given as alternatives
- 6. Magnesium sulfate (40 mg/kg IV, maximum dose of 2 g) over 10-15 minutes should be administered for severe bronchoconstriction and concern for impending respiratory failure
- 7. Epinephrine (0.01 mg/kg of 1 mg/mL IM, maximum 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 bi-level 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 – 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. 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 PPE should be considered, including placement of a surgical mask over the nebulizer to limit droplet spread
5. In the asthmatic patient, pharmacologic intervention should take priority over CPAP/BiPAP and be given in line with CPAP/BiPAP

#### **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**

##### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914139 – Respiratory Distress/Asthma/COPD/Croup/Reactive Airway

### **Key Documentation Elements**

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

- Respiratory rate
- Oxygen saturation
- Use of accessory muscles
- Breath sounds
- Air entry
- Mental status
- Color

### **Performance Measures**

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

### **References**

1. Abroug F, Nouira S, Bchir A, Boujdaria R, Elatrous S, Bouchoucha S. A controlled trial of nebulized salbutamol and adrenaline in acute severe asthma. *Intensive Care Med.* 1995;21(1):18-23.
2. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatr Emerg Care.* 1996;12(4):252-4.
3. Alter HJ, Koepsell TD, Hilty WM. Intravenous magnesium as an adjuvant in acute bronchospasm: a meta-analysis. *Ann Emerg Med.* 2000;36(3):191-7.
4. Barnett PLJ, Caputo GL, Baskin M, Kuppermann N. Intravenous versus oral corticosteroids in the management of acute asthma in children. *Ann Emerg Med.* 1997;29(2):212-7.
5. Becker AB, Nelson NA, Simons FER. Inhaled salbutamol (albuterol) vs injected epinephrine in the treatment of acute asthma in children. *J Pediatr.* 1983;102(3):465-9.
6. Beers SL, Abramo TJ, Bracken A, Wiebe RA. Bilevel positive airway pressure in the treatment of status asthmaticus in pediatrics. *Am J Emerg Med.* 2007;25(1):6-9.
7. Birken CS, Parkin PC, Macarthur C. Asthma severity scores for preschoolers displayed weaknesses in reliability, validity, and responsiveness. *J Clin Epidemiol.* 2004;57(11):1177-81.
8. Blitz M, Blitz S, Beasley R, Diner B, Hughes R, Knopp JA, Rowe BH. Inhaled magnesium sulfate in the treatment of acute asthma. *Cochrane Database Syst Rev.* 2005;(4):CD003898.
9. Bryant DH, Rogers P. Effects of ipratropium bromide nebulizer solution with and without preservatives in the treatment of acute and stable asthma. *Chest.* 1992;102:742-7.
10. Camargo CA, Rachelefsky G, Schatz M. Managing asthma exacerbations in the emergency department: summary of the National Asthma Education and Prevention Expert Panel Report 3 guidelines for the management of asthma exacerbations. *J Emerg Med.*

- 2009;37(Suppl 2):S6-17.
11. Carroll CL, Schramm CM. Noninvasive positive pressure ventilation for the treatment of status asthmaticus in children. *Ann Allergy Asthma Immunol.* 2006;96(3):454-59.
  12. Chalut DS, Ducharme FM, Davis GM. The preschool respiratory assessment measure (PRAM): a responsive index of acute asthma severity. *J Pediatr.* 2000;137(6):762-8.
  13. Davis DP, Wiesner C, Chan TC, Vilke GM. The efficacy of nebulized albuterol/ipratropium bromide versus albuterol alone in the prehospital treatment of suspected reactive airways disease. *Prehosp Emerg Care.* 2005;9(4):386-90.
  14. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care.* 2009;13(3):304-10.
  15. Ducharme FM, Chalut D, Plotnick L, Savdie C, Kudirka D, Zhang X et al. The pediatric respiratory assessment measure: A valid clinical score for assessing acute asthma severity from toddlers to teenagers. *J Pediatr.* 2008;152(4):476-80 408.e1.
  16. Ducharme FM, NiChroinin M, Greenstone I, Lasserson TJ. Addition of long-acting beta2-agonists to inhaled corticosteroids versus same dose inhaled corticosteroids for chronic asthma in adults and children. *Cochrane Database Syst Rev.* 2010;(5):CD005535.
  17. Edmonds M, Camargo CA, Pollack CV, Rowe BH. Early use of inhaled corticosteroids in the emergency department treatment of acute asthma. *Cochrane Database Syst Rev.* 2003;(3):CD002308.
  18. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg.* 2004;39(9):1376-80.
  19. Everard M, Bara A, Kurian M, N'Diaye T, Ducharme F, Mayowe V. Anticholinergic drugs for wheeze in children under the age of two years. *Cochrane Database Syst Rev.* 2005;(3):CD001279.
  20. Fergusson RJ, Stewart CM, Wathen CG, et al. Effectiveness of nebulized salbutamol administered in ambulances to patients with severe acute asthma. *Thorax.* 1995;50:80-2.
  21. Freedman SB, Haladyn JK, Floh A, Kirsh JA, Taylor G, Thull-Freedman J. Pediatric myocarditis: emergency department clinical findings and diagnostic evaluation. *Pediatr.* 2007;120(6):1278-85.
  22. Gausche M, Lewis RJ, Stratton SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA.* 2000;283(6):783-90.
  23. Gordon S, Tompkins T, Dayan PS. Randomized trial of single-dose intramuscular dexamethasone compared with prednisolone for children with acute asthma. *Pediatr Emerg Care.* 2007;23(8):521-7.
  24. Gorelick MH, Stevens MW, Schultz TR, Scribano PV. Performance of a novel clinical score, the Pediatric Asthma Severity Score (PASS), in the evaluation of acute asthma. *Acad Emerg Med.* 2004;11(1):10-8.
  25. Guthrie BD, Adler MD, Powell EC. End-tidal carbon dioxide measurements in children with acute asthma. *Acad Emerg Med.* 2007;14(12):1135-40.
  26. Hunt RC, Brown LH, Cabinum ES, et al. Is ambulance transport time with lights and siren faster than that without? *Ann Emerg Med.* 1995;25(4):507-11.
  27. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med.* 1998;32(5):585-8.
  28. Keahey L, Bulloch B, Becker AB, Pollack CV, Clark S, Camargo CA. Initial oxygen saturation as a predictor of admission in children presenting to the emergency department with acute

- asthma. *Ann Emerg Med.* 2002;40(3):300-7.
29. Keenan SP, Sinuff T, Cook DJ, Hill NS. Does noninvasive positive pressure ventilation improve outcome in acute hypoxemic respiratory failure? a systematic review. *Crit Care Med.* 2004;32(12):2516-23.
  30. Kornberg AE, Zuckerman S, Welliver JR, Mezzadri F, Aquino N. Effect of injected long-acting epinephrine in addition to aerosolized albuterol in the treatment of acute asthma in children. *Pediatr Emerg Care.* 1991;7(1):1-3.
  31. Kunkov S, Pinedo V, Johnson Silver E, Crain EF. Predicting the need for hospitalization in acute childhood asthma using end-tidal capnography. *Pediatr Emerg Care.* 2005;21(9):574-7.
  32. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med.* 2009;36(4):357-62.
  33. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med.* 1997;29(2):223-7.
  34. Lanes SF, Garrett JE, Wentworth CE, et al: The effect of adding ipratropium bromide to salbutamol in the treatment of acute asthma. *Chest.* 1998;114(2):365-72.
  35. Mallory MD, Shay DK, Garrett J, Bordley WC. Bronchiolitis management preferences and the influence of pulse oximetry and respiratory rate on the decision to admit. *Pediatr.* 2003;111(1):e45-51.
  36. Manser R, Reid D, Abramson MJ. Corticosteroids for acute severe asthma in hospitalized patients. *Cochrane Database Syst Rev.* 2001;(1):CD001740.
  37. Markenson D, Foltin G, Tunik M, Cooper A, Treiber M, Caravaglia K. Albuterol sulfate administration by EMT-basics: results of a demonstration project. *Prehosp Emerg Care.* 2004;8(1):34-40.
  38. Mehta SV, Parkin PC, Stephens D, Schuh S. Oxygen saturation as a predictor of prolonged, frequent bronchodilator therapy in children with acute asthma. *J Pediatr.* 2004;145(5):641-5.
  39. Moses JM, Alexander JL, Agus MSD. The correlation and level of agreement between end-tidal and blood gas PCO<sub>2</sub> in children with respiratory distress: A retrospective analysis. *BMC Pediatr.* 2009;9:20.
  40. Panickar J, Lakhanpaul M, Lambert PC, et al. Oral prednisolone for preschool children with acute virus-induced wheezing. *N Engl J Med.* 2009;360(4):329-38.
  41. Plotnick LH, Ducharme FM. Should inhaled anticholinergics be added to beta2 agonists for treating acute childhood and adolescent asthma? A systematic review. *BMJ.* 1998;317(7164):971-7.
  42. Quadrel M, Lavery RF, Jaker M, Atkin S, Tortella BJ, Cody RP. Prospective, randomized trial of epinephrine, metaproterenol, and both in the prehospital treatment of asthma in the adult patient. *Ann Emerg Med.* 1995;26(4):469-73.
  43. Ram FSF, Wellington SR, Rowe B, Wedzicha A. Non-invasive positive pressure ventilation for treatment of respiratory failure due to severe exacerbations of asthma. *Cochrane Database Syst Rev.* 2012 Dec 12;12:CD004360.
  44. Richmond NJ, Silverman R, Kusick M, Matallana L, Winokur J. Out-of-hospital administration of albuterol for asthma by basic life support providers. *Acad Emerg Med.* 2005;12(5):396-403.
  45. Rodenberg H. Effect of levalbuterol on prehospital patient parameters. *Am J Emerg Med.* 2002;20(5):481-3.
  46. Rodrigo GJ, Pollack CV, Rodrigo C, Rowe BH. Heliox for non-intubated acute asthma patients. *Cochrane Database Syst Rev.* 2006;(4):CD002884.
  47. Rowe BH, Bretzlaff J, Bourdon C, Bota G, Blitz S, Camargo CA. Magnesium sulfate for treating

- exacerbations of acute asthma in the emergency department. *Cochrane Database Syst Rev.* 2000;(1):CD001490.
48. Rowe BH, Keller JL, Oxman AD. Effectiveness of steroid therapy in acute exacerbations of asthma: a meta-analysis. *Am J Emerg Med.* 1992;10(4):301-1
  49. Rowe BH, Spooner C, Ducharme F, Bretzlaff J, Bota G. Early emergency department treatment of acute asthma with systemic corticosteroids. *Cochrane Database Syst Rev.* 2001;(1):CD002178.
  50. Scarfone RJ, Loiselle JM, Wiley Li JF, Decker JM, Henretig FM, Joffe MD. Nebulized dexamethasone versus oral prednisone in the emergency treatment of asthmatic children. *Ann Emerg Med.* 1995;26(4):480-6.
  51. Silverman R, Osborn H, Runge J, et al. IV magnesium sulfate in the treatment of acute severe asthma; a multicenter randomized controlled trial. *Chest.* 2002;122(2):489-97.
  52. Smith D, Riel J, Tiles I, Kino R, Lis J, Hoffman JR. Intravenous epinephrine in life-threatening asthma. *Ann Emerg Med.* 2003;41(5):706-11.
  53. Smith M, Rowe BH, N'Diaye T. Corticosteroids for hospitalized children with acute asthma. *Cochrane Database Syst Rev.* 2003;(1):CD002886.
  54. Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Hinsberg, P. A prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med.* 1994;24(2):209-14.
  55. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med.* 200; 356(21):2156-64.
  56. Thompson J, Petrie DA, Ackroyd-Stolarz S, Bardua DJ. Out-of-hospital continuous positive pressure ventilation vs usual care in acute respiratory failure: a RCT. *Ann Emerg Med.* 2008;52(3):232-41.
  57. Thompson M, Wise S, Rodenberg H. A preliminary comparison of levalbuterol and albuterol in prehospital care. *J Emerg Med.* 2004;26(3):271-7.
  58. Uden DL, Goetz DR, Kohen DP, Fifield GC. Comparison of nebulized terbutaline and subcutaneous epinephrine in the treatment of acute asthma. *Ann Emerg Med.* 1985;14(3):229-32.
  59. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehosp Dis Med.* 2010;25(1):87-91.

### **Revision Date**

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## Pulmonary Edema

### **Aliases**

Congestive heart failure, respiratory distress, respiratory failure, acute respiratory distress syndrome, myocardial infarct, pulmonary embolism, COPD, asthma, anaphylaxis

### **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. Administer oxygen as appropriate with a target of achieving 94-98% saturation
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 greater than 100 mmHg (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, treat per the [Altitude Illness guideline](#)

### **Patient Safety Considerations**

No 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 less than 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 non-invasive positive pressure ventilation 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. The use of nitrates should be avoided in any patient who has used a phosphodiesterase inhibitor within the past 48 hours. Examples are: sildenafil (Viagra<sup>®</sup>, Revatio<sup>®</sup>), vardenafil (Levitra<sup>®</sup>, Staxyn<sup>®</sup>), tadalafil (Cialis<sup>®</sup>, Adcirca<sup>®</sup>) which are used for erectile dysfunction and pulmonary hypertension. Also avoid use in patients receiving intravenous epoprostenol (Flolan<sup>®</sup>) or treprostenil (Remodulin<sup>®</sup>) which is used for pulmonary hypertension. Administer nitrates with extreme caution, if at all, to patients with an inferior STEMI or suspected STEMI with right ventricular involvement because these patients require adequate RV preload.
  6. Nitroglycerin reduces left ventricular 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 inhibitors 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 inhibitors or angiotensin receptor blockers therapy in the early phase of therapy of acute decompensated heart failure (i.e. the first 12 to 24 hours).
  7. Use of furosemide (Lasix<sup>®</sup>) is not recommended in the prehospital setting. Pulmonary edema is more commonly a problem of volume distribution than overload, so administration of furosemide provides no immediate benefit for most patients. Misdiagnosis of CHF and subsequent inducement of inappropriate diuresis can lead to increased morbidity and mortality in patients.
  8. 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. An approach is to give two SL NTG (0.8 mg) for SBP greater than 160 mmHg or three SL NTG (1.2 mg) when SBP is greater than 200 mmHg every 5 minutes. 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**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914137 – Pulmonary Edema/CHF



### **Key Documentation Elements**

- Vital signs
- Oxygen saturation
- Time of intervention
- Response to interventions

### **Performance Measures**

- Time to initiation of non-invasive positive pressure ventilation
- Number of CPAP/BiPAP patients who require intubation
- Time to clinical improvement
- Assessment/auscultation of lung sounds before and after each intervention

### **References**

1. Clemency BM, Thompson JJ, Tundro GN, Lindstrom HA. Prehospital high-dose nitroglycerin rarely causes hypotension. *Prehosp Disaster Med.* 2013;Oct:28(5):477-81.
2. Gheorghide M, Zannad F, Sopko G, et al. Acute heart failure syndromes: current state and framework for future research. *Circulation.* 2005;112:3958-68.
3. Heart Failure Society of America, Lindenfeld J, Albert NM, et al. HFSA 2010 Comprehensive Heart Failure Practice Guideline. *J Card Fail.* 2010;16(6):e1-194.
4. Hunt SA, Abraham WT, Chin MH, et al. 2009 focused update incorporated into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the International Society for Heart and Lung Transplantation. *Circulation.* 2009;119(4):e391-479.
5. Hubble MW, Richards ME, Jarvis R, et al. Effectiveness of prehospital continuous positive airway pressure in the management of acute pulmonary edema. *Prehosp Emerg Care.* 2006;10(4):430-9.
6. Mosesso VN, Dunford J, Blackwell T, Griswell JK. Prehospital therapy for acute congestive heart failure: state of the art. *Prehosp Emerg Care.* 2003;(7):13-23.
7. Spijker EE, de Bont M, Bax M, et al. Practical use, effects and complications of prehospital treatment of acute cardiogenic pulmonary edema using the Boussignac CPAP system. *Int J Emerg Med.* 2013;6(1):8.
8. Thompson J, Petrie D, Ackroy, Stolarz S, et al. Out of hospital continuous positive airway pressure ventilation versus usual care for acute respiratory failure: A randomized controlled trial. *Ann of Emerg Med.* 2008;52(3):232-41.
9. Williams TA, Finn J, Celenza A, et al. Paramedic identification of acute pulmonary edema in a metropolitan ambulance service. *Prehosp Emerg Care.* 2013;17(3):339-47.

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September 8, 2017

# Trauma

## General Trauma Management

### **Aliases**

None noted

### **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**

1. Patients of all ages who have sustained an injury as a result of mechanical trauma, including:
  - a. Blunt injury
  - b. Penetrating injury
  - c. Burns

#### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Primary survey
  - a. Hemorrhage control
    - i. Assess for and stop severe hemorrhage [see [Extremity Trauma/External Hemorrhage Management guideline](#)]
  - b. Airway
    - i. Assess airway patency by asking the 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 (patients with a GCS less than or equal to 8 are 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, hypotension, pale, cool clammy skin, capillary refill *greater than 2 seconds*
  - e. Disability
    - i. Perform neurologic status assessment [see [Appendix VII](#)]

- ii. Assess gross motor movement of extremities
- iii. Evaluate for clinical signs of traumatic brain injury with herniation including:
  - 1. Unequal pupils
  - 2. Lateralizing motor signs
  - 3. 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 examine the back
  - ii. Prevent hypothermia

### **Treatment and Interventions**

1. Hemorrhage control
  - a. Stop severe hemorrhage [see [Extremity Trauma/External Hemorrhage Management guideline](#)]
2. Airway
  - a. Establish patent airway with cervical spine precautions, per the [Airway Management](#) and [Spinal Care](#) guidelines
  - b. If respiratory efforts are inadequate, assist with bag-mask ventilation and consider airway adjuncts. If patient is unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basilar skull fracture)
  - c. If impending airway obstruction or altered mental status resulting in inability to maintain airway patency, secure definitive airway
3. Breathing
  - a. If absent or diminished breath sounds in a hypotensive patient, consider tension pneumothorax and perform needle decompression
  - b. For open chest wound, place semi-occlusive dressing
  - c. Monitor oxygen saturation and, if indicated, provide supplemental oxygen
4. Circulation
  - a. If pelvis is unstable and patient is hypotensive, place pelvic binder or sheet to stabilize pelvis
  - b. Establish IV access
  - c. Fluid resuscitation
    - i. Adults
      1. If SBP greater than 90 mmHg, no IV fluids required
      2. If SBP less than 90 mmHg or HR greater than 120, administer IV fluids and reassess
      3. Penetrating trauma: target SBP 90mmHg (or palpable radial pulse)
      4. Head injury: target SBP 110-120 mmHg. Hypotension should be avoided to maintain cerebral perfusion
    - ii. Pediatrics
      1. If child demonstrates tachycardia for age with signs of poor perfusion (low BP, greater than 2-second capillary refill, altered mental status, hypoxia, weak pulses, pallor, or mottled/cool skin), give 20ml/kg crystalloid bolus and reassess.
      2. Target normal BP for age [see [Appendix VIII – Abnormal Vital Signs](#)]
2. Disability
  - a. If clinical signs of traumatic brain injury [see [Head Injury](#) guideline]

3. Exposure
  - a. Avoid hypothermia
    - i. Remove wet clothing
    - ii. Cover patient to prevent further heat loss
4. **NOTE:** Patients with major hemorrhage, hemodynamic instability, penetrating torso trauma, or signs of traumatic brain injury often require rapid surgical intervention. Minimize scene time (goal is under 10 minutes) and initiate rapid transport to the highest level of care within the trauma system.
5. Decisions regarding transport destination should be based on the CDC Field Triage Guidelines for Injured Patients [see [Appendix X](#)]

### **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
        - e. Tracheal deviation
      2. Palpate for crepitus
      3. Spinal assessment per the [Spinal Care guideline](#)
    - 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 applying medial pressure on the iliac crests bilaterally
    - vi. Back
      1. Maintain spinal alignment. Refer to [Spinal Care guideline](#)
      2. Inspect for penetrating or soft tissue injuries
    - vii. Neurologic status assessment [see [Appendix VII](#)]
      1. Serial assessment of mental status

2. Gross exam of motor strength and sensation in 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 the [Spinal Care guideline](#)
  - ii. Splint obvious extremity fractures per the [Extremity Trauma/External Hemorrhage Management guideline](#)
  - iii. Provide pain medication per the [Pain Management guideline](#)

### **Patient Safety Considerations**

1. Life-threatening injuries identified on primary survey should be managed immediately with rapid transport to a trauma center, while the secondary survey is performed enroute
2. Monitor patient for deterioration over time with serial vital signs and repeat neurologic status assessment [see [Appendix VII](#)]
  - 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 (Airway, Breathing, Circulation, Disability, Exposure)
2. Target scene time less than 10 minutes for unstable patients or those likely to need surgical intervention
3. Provider training should include the *CDC Guidelines for Field Triage of Injured Patients*
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 and repeat neurologic status assessment [see [Appendix VII](#)]

#### **Traumatic Arrest: Withholding and Termination of Resuscitative Efforts**

Resuscitative efforts should be withheld for trauma patients with the following:

1. Decapitation
2. Hemiorpsectomy
3. Signs of rigor mortis or dependent lividity
4. Blunt trauma: apneic, pulseless, no organized cardiac activity on monitor
  - a. Note – Adult and Pediatric: Resuscitative efforts may be terminated in patients with traumatic arrest who have no return of spontaneous circulation after 15-30 minutes of resuscitative efforts, including airway management, evaluation/treatment for possible tension pneumothorax, fluid bolus, and minimally interrupted CPR

## Quality Improvement

### Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914207 – General Trauma Management

### Key Documentation Elements

- Mechanism of injury
- Primary and secondary survey
- Serial vital signs and neurologic status assessments
- Scene time
- Procedures performed and patient response

### Performance Measures

- Monitor scene time for unstable patients
- Monitor appropriateness of procedures
- Monitor appropriate airway management
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMSIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

## References

1. American College of Surgeons Committee on Trauma; American College of Emergency Physicians Pediatric Emergency Medicine Committee; National Association of EMS Physicians; American Academy of Pediatrics Committee on Pediatric Emergency Medicine, Fallat ME. Withholding or termination of resuscitation in pediatric out-of-hospital traumatic cardiopulmonary arrest. *Pediatrics*. 2014;133(4):e1104. Bickell WH, Wall MJ Jr., Pepe PE, et al. Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries. *N Engl J Med*. 1994;331:1105-9.
2. Cullinane DC, Schiller HJ, Zielinski MD, et al. Eastern Association for the Surgery of Trauma practice management guidelines for hemorrhage in pelvic fracture – update and systematic review. *J Trauma*. 2011;71(6):1850-68.
3. *Guidelines for the Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage, 2011.* Washington, DC: Centers for Disease Control and Prevention. *Morbidity and Mortality Weekly Report*; 2012;61(RR01):1-20.
4. Harris T, Rhys Thomas G, Brohi K. Early fluid resuscitation in severe trauma. *BMJ*. 2012;345:e5752.

5. Millin M, Galvagno SM, Khandker SR, et al. Withholding and termination of resuscitation of adult cardiopulmonary arrest secondary to trauma: Resource document to the joint NAEMSP-ACS (COT) position statements. *J Trauma Acute Care Surg.* 2013;75(3):459-67.
6. Morrison C, Carrick M, Norman M, et al. Hypotensive resuscitation strategy reduces transfusion requirements and severe postoperative coagulopathy in trauma patients with hemorrhagic shock: preliminary results of a randomized controlled trial. *J Trauma.* 2011;70(3):652-63.
7. *Prehospital Trauma Life Support, 8th Edition.* Burlington, MA: Jones & Bartlett; 2016.
8. Truhlar A, Deakin C, Soar J, et al. European resuscitation council guidelines for resuscitation 2015: section 4. Cardiac arrest in special circumstances. *Resuscitation.* 2015;95:148-201.

**Revision Date**

September 8, 2017

## Blast Injuries

### **Aliases**

None noted

### **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**

1. Patients exposed to explosive force. Injuries may include any or all of the following:
  - a. Blunt trauma
  - b. Penetrating trauma
  - c. Burns
  - d. Pressure-related injuries (barotrauma)
  - e. Toxic chemical contamination

#### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Hemorrhage Control
  - a. Assess for and stop severe hemorrhage [see [Extremity Trauma/External Hemorrhage Management guideline](#)]
2. Airway
  - a. Assess airway patency
  - b. Consider possible thermal or chemical burns to airway
3. Breathing
  - a. Evaluate adequacy of respiratory effort, oxygenation, quality of lung sounds, and chest wall integrity
  - b. Consider possible pneumothorax or tension pneumothorax (as a result of penetrating/blunt trauma or barotrauma)
4. Circulation
  - a. Look for evidence of external hemorrhage
  - b. Assess BP, pulse, skin color/character, and distal capillary refill for signs of shock
5. Disability
  - a. Assess patient responsiveness (AVPU) and level of consciousness (GCS) [see [Appendix VII](#)]
  - b. Assess pupils
  - c. Assess gross motor movement and sensation of extremities



6. Exposure
  - a. Rapid evaluation of entire skin surface, including back (log roll), to identify blunt or penetrating injuries

### **Treatment and Interventions**

1. Hemorrhage control:
  - a. Control any severe external hemorrhage [see [Extremity Trauma/External Hemorrhage Management guideline](#)]
2. Airway:
  - a. Secure airway, utilizing airway maneuvers, airway adjuncts, supraglottic device, or endotracheal tube [see [Airway Management guideline](#)]
  - b. If thermal or chemical burn to airway is suspected, early airway control is vital
3. Breathing:
  - a. Administer oxygen as appropriate with a target of achieving 94-98% saturation.
  - b. Assist respirations as needed
  - c. Cover any open chest wounds with semi-occlusive dressing
  - d. If patient has evidence of tension pneumothorax, perform needle decompression
4. Circulation:
  - a. Establish IV access with two large bore IVs or IOs
    - i. Administer NS or LR, per the [General Trauma Management guideline](#)
    - ii. If patient is burned, administer NS or LR per the [Burns guideline](#)
5. Disability:
  - a. If evidence of head injury, treat per the [Head Injury guideline](#)
  - b. Apply spinal precautions, per the [Spinal Care guideline](#)
  - c. Monitor GCS during transport to assess for changes
6. Exposure:
  - a. Keep patient warm to prevent hypothermia

### **Patient Safety Considerations**

1. Ensuring scene safety is especially important at the scene of an explosion.
  - a. Consider possibility of subsequent explosions, structural safety, possible toxic chemical contamination, the presence of noxious gasses, and other hazards
  - b. 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
    - i. Hypotension or other signs of shock associated with decreased or absent breath sounds, jugular venous distension, and/or tracheal deviation
  - b. Tympanic membrane perforation resulting in deafness which may complicate the evaluation of their mental status and their ability to follow commands
6. Primary transport to a trauma or burn center is preferable, whenever possible

#### **Pertinent Assessment Findings**

1. Evidence of multi-system trauma, especially:
  - a. Airway injury/burn
  - b. Barotrauma to lungs
  - c. Toxic chemical contamination

#### **Quality Improvement**

##### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914045 – Exposure-Explosive/Blast Injury

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

- Airway status and intervention
- Breathing status:
  - Quality of breath sounds (equal bilaterally)
  - Adequacy of respiratory effort
  - Oxygenation
- Documentation of burns, including Total Burn Surface Area (TBSA) [see [Burns guideline](#)]
- Documentation of possible toxic chemical contamination

##### **Performance Measures**

- Airway assessment and early and aggressive management
- Appropriate IV fluid management
- Transport to trauma or burn center
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMESIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

## **References**

1. Explosions and Blast Injuries; A Primer for Clinicians. CDC.gov.  
[www.cdc.gov/masstrauma/preparedness/primer.pdf](http://www.cdc.gov/masstrauma/preparedness/primer.pdf). Accessed August 27, 2017.

## **Revision Date**

September 8, 2017

## Burns

### **Aliases**

None noted

### **Patient Care Goals**

Minimize tissue damage and patient morbidity from burns

### **Patient Presentation**

1. Patient may present with:
  - a. Airway – stridor, hoarse voice
  - b. Mouth and nares – redness, blisters, soot, singed hairs
  - c. Breathing – rapid, shallow, wheezes, rales
  - d. Skin – Estimate Total Burn Surface Area (TBSA) and depth (partial vs. full thickness)
  - e. 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 significant trauma or blast injury is suspected
2. Consider air ambulance transportation for long transport times or airway management needs beyond the scope of the responding ground medic
3. Consider transport directly to burn center if partial or full thickness burns (TBSA) greater than 10%, involvement of hands/feet, genitalia, face, and/or circumferential burns

### **Scene Management**

1. Assure crew safety:
  - a. Power off
  - b. Electrical lines secure
  - c. Gas off
  - d. No secondary devices
  - e. Hazmat determinations made
  - f. 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 (CN)
  - c. Pediatric or elder abuse

2. Follow ABCs of resuscitation per the [General Trauma Management guideline](#)
3. If evidence of possible airway burn, consider aggressive airway management
4. Consider spinal precautions for those that qualify per the [Spinal Care guideline](#)
5. Estimate TBSA burned and depth of burn
  - a. Use “Rule of 9’s” [see burn related tables in [Appendix VI](#)]
  - b. First- degree burns (skin erythema only) are not included in TBSA calculations
6. Document pain scale

### **Treatments and interventions**

1. Stop the burning
  - a. Remove wet clothing (if not stuck to the patient)
  - b. Remove jewelry
  - c. Leave blisters intact
2. Minimize burn wound contamination
  - a. Cover burns with dry dressing or clean sheet
  - b. Do not apply gels or ointments
3. Monitor SPO<sub>2</sub>, ETCO<sub>2</sub> and cardiac monitor – Consider SPCO monitoring, if available
4. High flow supplemental oxygen for all burn patients rescued from an enclosed 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 Ringer’s or normal saline
  - a. If patient in shock:
    - i. Consider other cause, such as trauma or cyanide toxicity
    - ii. Administer IV fluid per the [Shock guideline](#)
  - b. If patient not in shock:
    - i. Begin fluids based on estimated TBSA [see [Appendix VI](#) – Initial Fluid Rate Chart for Burns as appropriate to patient weight]
    - ii. Pediatric patients weighing less than 40 kg, use length-based tape for weight estimate and follow
  - c. For persons over 40 kg, the initial fluid rate can also be calculated using the “Rule of 10’’:
    - i. Calculate the TBSA (round to nearest 10%)
    - ii. Multiply TBSA x 10 = initial fluid rate (mL/hr) {for persons between 40 – 80 kg}
    - iii. Add 100 mL/hr for every 10 kg of body weight over 80 kg
9. Prevent systemic heat loss and keep the patient warm

### **Special Treatment Considerations**

1. If blast mechanism, treat per the [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 the antidote (hydroxocobalamin), if available, in this circumstance
4. Particularly in enclosed-space fires, carbon monoxide toxicity is a consideration and pulse oximetry may not be accurate [see [Carbon Monoxide/Smoke Inhalation guideline](#)]
5. For specific chemical exposures (cyanide, hydrofluoric acid, other acids and alkali) [see [Topical Chemical Burn guideline](#)]
6. Consider decontamination and notification of receiving facility of potentially contaminated patient (e.g. methamphetamine (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 in shock within one hour of burn, it is not from the burn. Evaluate the patient carefully for associated trauma or cyanide toxicity.
3. If the patient is not in shock, the fluid rates recommended above will adequately maintain patient's fluid volume.
4. Pain management is critical in acute burns
5. ETCO<sub>2</sub> monitoring may be particularly useful to monitor respiratory status in patients receiving significant doses of narcotic pain medication
6. Cardiac monitor is important in electrical burns and chemical inhalations
7. TBSA is calculated only based on percent of second and third degree burns – First degree burns are not included in this calculation

## Quality Improvement

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

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914085 – Injury-Burns-Thermal

### Key Documentation Elements

- Initial airway status
- Total volume of fluid administered
- Body surface area of second and third degree burns (TBSA)
- Pulse and capillary refill exam distally on any circumferentially burned extremity
- Pain scale documentation and pain management

### Performance Measures

- Patient transported to most appropriate hospital, preferably a burn center
- Pain scale documented and pain appropriately managed
- Airway assessment and management appropriately documented
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMESIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

## **References**

1. American Burn Association. Advanced Burn Life Support (ABLS) Handbook; 2011.
2. Chung K, Salinas J, Renz E, et al. Simple derivation of the initial fluid rate for the resuscitation of severely burned adult combat casualties: in Silico validation of the rule of ten. *J Trauma*. 2010;69 Suppl 1:S49-54.
3. Fluid Rate charts (based on Parkland formula) and TBSA diagrams courtesy of the University of Utah Burn Center; 2014. As presented in [Appendix VI](#) – Initial Fluid Rate Chart for Burns.

## **Revision Date**

September 8, 2017

## Crush Injury

### **Aliases**

Crush, compartment syndrome

### **Patient Care Goals**

1. Recognizing traumatic crush injury mechanism
2. Minimize systemic effects of the crush syndrome

### **Patient Presentation**

#### **Inclusion criteria**

Traumatic crush mechanism of injury

#### **Exclusion criteria**

Non-crush injuries

### **Patient Management**

#### **Assessment**

1. Identify any severe hemorrhage
2. Assess airway, breathing, and circulation
3. Evaluate for possible concomitant injury (e.g. fractures, solid organ damage, or spinal injury)
4. Monitor for development of compartment syndrome

#### **Treatment and Interventions**

1. The treatment of crushed casualties should begin as soon as they are discovered
2. If severe hemorrhage is present, see [Extremity Trauma/External Hemorrhage Management guideline](#)
3. Administer high-flow oxygen
4. Intravenous access should be established with normal saline initial bolus of 10-15 ml/kg (prior to extrication if possible)
5. For significant crush injuries or prolonged entrapment of an extremity, consider sodium bicarbonate 1 mEq/kg (maximum dose of 50 mEq) IV bolus over 5 minutes
6. Attach cardiac monitor. Obtain/interpret 12-lead EKG, if available. Carefully monitor for dysrhythmias or signs of hypokalemia before and immediately after release of pressure and during transport (e.g. peaked T waves, wide QRS, lengthening QT interval, loss of P wave)
7. For pain control, consider analgesics [see [Pain Management guideline](#)]
8. Consider the following post extrication
  - a. Continued resuscitation with normal saline (500-1000 cc/hr for adults, 10 cc/kg/hr for children)
  - b. If EKG suggestive of hyperkalemia, If findings of hyperkalemia, administer IV fluids and consider administration of:
    - i. Calcium chloride – 1 gm IV/IO over 5 minutes, ensure IV patency and do not exceed 1 mL per minute

**OR**

  - ii. Calcium gluconate – 2 gm IV/IO over 5 minutes with constant cardiac monitoring



- c. If not already administered, for significant crush injuries with EKG suggestive of hyperkalemia, administer sodium bicarbonate 1 mEq/kg (max dose of 50 mEq) IV bolus over 5 minutes
- d. If EKG suggestive of hyperkalemia, consider albuterol 5 mg via small volume nebulizer

### **Patient Safety Considerations**

Scene safety for both rescuers and patients is of paramount importance.

### **Notes/Educational Pearls**

1. Causes of mortality in untreated crush syndrome:
  - a. Immediate
    - i. Severe head injury
    - ii. Traumatic asphyxia
    - iii. Torso injury with damage to intrathoracic or intra-abdominal organs
  - b. Early
    - i. Hyperkalemia (potassium is released from injured muscle cells)
    - ii. Hypovolemia/shock
  - c. Late
    - i. Renal failure (from release of toxins from injured muscle cells)
    - ii. Coagulopathy and hemorrhage
    - iii. Sepsis

### **Key Considerations**

1. Rapid extrication and evacuation to a definitive care facility (trauma center preferred)
2. A patient with a crush injury may initially present with very few signs and symptoms. Therefore, maintain a high index of suspicion for any patient with a compressive mechanism of injury
3. A fatal medical complication of crush syndrome is hyperkalemia. Suspect hyperkalemia if T-waves become peaked, QRS becomes prolonged (greater than 0.12 seconds), absent P wave, or prolonged QTc
4. Avoid lactated Ringer's solution as it contains potassium
5. Continue fluid resuscitation through extrication and transfer to hospital

### **Pertinent Assessment Findings**

1. Mental status/GCS
2. Evaluation for fractures and potential compartment syndrome development (neurovascular status of injured extremity)
3. Examination of spine
4. Evidence of additional trauma, potentially masked by with other painful injuries

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914089 – Injury-Crush Syndrome

### **Key Documentation Elements**

- Time of tourniquet application, if applied
- Neurovascular status of any crushed extremity
- EKG findings consistent with hyperkalemia
- Amount of IV fluid administered

### **Performance Measures**

- Initiation of fluid resuscitation prior to extrication
- EKG/monitor to monitor for dysrhythmias or changes related to hyperkalemia
- Treatment of hyperkalemia if evidence is noted on EKG

### **References**

1. Better OS. The crush syndrome revisited (1940-1990). *Nephron*. 1990;55:97-103.
2. Jagodzinski N, Weerasinghe C, Porter K. Crush injuries and crush syndrome – a review. *Trauma*. 2010;12:69–88.
3. Sever MS, Vanholder R, Lameire N. Management of crush-related injuries after disasters. *N Engl J Med*. 2006;354(10):1052-63.
4. Smith J, Greaves I. Crush injury and crush syndrome: a review. *J Trauma*. 2003;54(5):S226-30.

### **Revision Date**

September 8, 2017

## Extremity Trauma/External Hemorrhage Management

### **Aliases**

None noted

### **Patient Care Goals**

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

### **Patient Presentation**

#### **Inclusion Criteria**

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

#### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Evaluate for obvious deformity, shortening, rotation, or instability
2. Neurologic 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) and whether it is pulsatile or not

#### **Treatments and Interventions** (also, see protocol diagram below)

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
      1. Tourniquet should be placed 2-3 inches proximal to wound, not over a joint, and tightened until bleeding stops and distal pulse is eliminated
      2. If bleeding continues, place a second tourniquet proximal to the first
      3. For thigh wounds, consider placement of two tourniquets, side-by-side, and tighten sequentially to eliminate distal pulse
    - ii. If the bleeding site is not amenable to tourniquet placement (i.e. junctional injury), pack wound tightly with a hemostatic gauze and apply direct pressure

- c. Groin/axillary injury
  - i. Apply direct pressure to wound
  - ii. If still bleeding, pack wound tightly with hemostatic gauze and apply direct pressure
  - iii. Consider using a junctional hemostatic device if available
- 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. Strongly consider pain management before attempting to move a suspected fracture
  - b. If distal vascular function is compromised, gently attempt to restore normal anatomic position
  - c. Use splints as appropriate to limit movement of suspected fracture
  - d. Elevate extremity fractures above heart level whenever possible to limit swelling
  - e. Apply ice/cool packs to limit swelling in suspected fractures or soft tissue injury - do not apply ice directly to skin
  - f. Reassess distal neurovascular status after any manipulation or splinting of fractures/dislocations

#### **Patient Safety Considerations**

- 1. If tourniquet use:
  - a. Ensure that it is sufficiently tight to occlude the distal pulse, in order to avoid compartment syndrome
  - b. Ensure that it is well marked and visible and that all subsequent providers are aware of the presence of the tourniquet
  - c. Do not cover with clothing or dressings
- 2. Mark time of tourniquet placement prominently on the patient
- 3. 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 is replaced with pressure dressing, leave loose tourniquet in place so it may be retightened if bleeding resumes
- 3. Survival is markedly improved when a tourniquet is placed *before* shock ensues
- 4. Commercial/properly tested tourniquets are preferred over improvised tourniquets
- 5. If hemostatic gauze is not available, plain gauze tightly packed into a wound has been shown to be effective

6. Arterial pressure points are not effective in controlling hemorrhage
7. Amputated body parts should be transported with patient for possible re-implantation
  - a. It should remain cool but dry
  - b. Place the amputated part in a plastic bag
  - c. Place the bag with the amputated part on ice in a second bag
  - d. Do not let the amputated part come into direct contact with the ice

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914097 – Injury-Extremity
- 9914083 – Injury-Bleeding/Hemorrhage Control

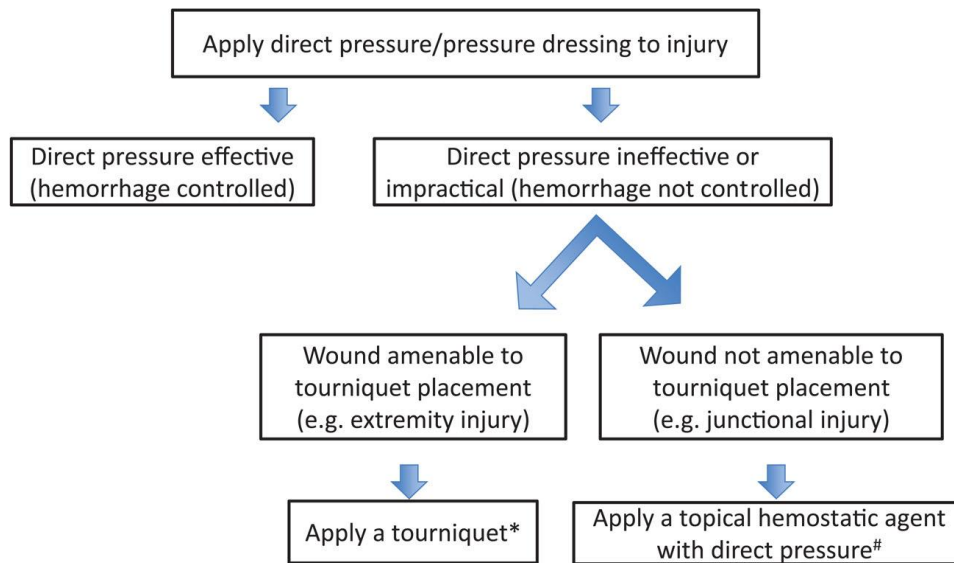
#### **Key Documentation Elements**

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

#### **Performance Measures**

- Proper placement of tourniquet (location, elimination of distal pulse)
- Proper marking and timing of tourniquet placement and notification of subsequent providers of tourniquet placement
- Appropriate splinting of fractures
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - PEDS-03: *Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMSIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4.

### Prehospital External Hemorrhage Control Protocol



\* Use of tourniquet for extremity hemorrhage is strongly recommended if sustained direct pressure is ineffective or impractical; Use a commercially-produced, windlass, pneumatic, or ratcheting device, which has been demonstrated to occlude arterial flow and avoid narrow, elastic, or bungee-type devices; Utilize improvised tourniquets only if no commercial device is available; Do not release a properly-applied tourniquet until the patient reaches definitive care

# Apply a topical hemostatic agent, in combination with direct pressure, for wounds in anatomic areas where tourniquets cannot be applied and sustained direct pressure alone is ineffective or impractical; Only apply topical hemostatic agents in a gauze format that support wound packing; Only utilize topical hemostatic agents which have been determined to be effective and safe in a standardized laboratory injury model

**Source:** 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(2):163-73.
2. Doyle G, Taillac P. Tourniquets: a review of current use with proposals for expanded prehospital use. *Prehosp Emerg Care*. 2008;12(2):241-56.
3. Kragh J, Littrel ML, Jones JA, et al. Battle casualty survival with emergency tourniquet use to stop limb bleeding. *J Emerg Med*. 2011;41(6):590-7.
4. Leonard J, Aietlow J, Morris D, et al. A multi-institutional study of hemostatic gauze and tourniquets in rural civilian trauma. *J Trauma Acute Care Surg*. 2016;81(3):441-4.
5. Mawhinney A and Kirk S. A systematic review of the use of tourniquets and topical haemostatic agents in conflicts in Afghanistan and Iraq. *J R Nav Med Serv*. 2015;101(2):147-54.
6. Meusnier J, Dewar C, Mavrovi E, et al. Evaluation of two junctional tourniquets used on the battlefield: Combat Ready Clamp® versus SAM® Junctional Tourniquet. *J Spec Oper Med*. 2016;16:41-6.

7. *Prehospital Trauma Life Support, 8th Edition*. Burlington, MA: Jones & Bartlett; 2016.
8. Van Oostendorp S, Tan E, Geeraedts L. Prehospital control of life-threatening truncal and junctional haemorrhage is the ultimate challenge in optimizing trauma care: a review of treatment options and their applicability in the civilian trauma setting. *Scand J Trauma Resusc Emerg Med*. 2016;24(1):110.
9. Watters J, Van P, Hamilton G, et al. Advanced hemostatic dressings are not superior to gauze for care under fire scenarios. *J Trauma*. 2011;70(6):1413-9.

**Revision Date**

September 18, 2017

## Facial/Dental Trauma

### **Aliases**

None noted

### **Patient Care Goals**

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

### **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 aspiration)
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
9. Lost teeth not recovered on scene may be in the airway
10. Overall trauma assessment
11. Specific re-examination geared toward airway and ability to ventilate adequately

#### **Treatment and Interventions**

1. Administer oxygen as appropriate with a target of achieving 94-98% saturation - use ETCO<sub>2</sub> to help monitor for hypoventilation and apnea
2. IV access, as needed, for fluid or medication administration
3. Pain medication per the [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, an alert and cooperative patient can hold tooth in mouth using own saliva as storage medium



5. Eye trauma:
  - a. Place 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 and have suction readily available
  - b. Preferentially transport sitting up with emesis basin/suction available (in the absence of a suspected spinal injury, see [Spinal Care guideline](#))
7. Epistaxis - squeeze nose (or have patient do so) for 10-15 minutes continuously
8. Nose/ear avulsion:
  - a. Recover tissue if it does not waste scene time
  - b. Transport with tissue wrapped in dry sterile gauze in a plastic bag placed on ice
  - c. Severe ear and nose lacerations can be addressed with a protective moist sterile dressing

### **Patient Safety Considerations**

1. Frequent reassessment of airway
2. Maintenance of a patent airway is the highest priority; therefore, conduct cervical spine assessment for field 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 with bleeding running down posterior pharynx, potentially compromising airway
3. Protect avulsed tissue and teeth
  - a. Avulsed teeth may be successfully re-implanted if done so in a very short period after injury
  - b. 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**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914205 – General-Dental Problems
- 9914057 – Injury-Facial Trauma
- 9914099 – Injury-Eye

#### **Key Documentation Elements**

- Airway patency and reassessment
- Degree and location of hemorrhage
- Mental status (GCS or AVPU)
- Technique used to transport tissue or teeth

- Eye exam documented, when applicable
- Assessment and management of cervical spine
- Patient use of anticoagulant medications

### **Performance Measures**

- Appropriate airway management and satisfactory oxygenation
- Eye shield applied to eye trauma
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMESIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4.

### **References**

1. Bord S, Linden J. Trauma to the globe and orbit. *Emerg Med Clin N Am.* 2008;26(1):97-123.
2. Patel P, Stanton D, Granquist E. Common dental and orofacial trauma: evaluation and management. *Med Clin N Am.* 2014;98(6):1261-79.

### **Revision Date**

September 8, 2017

## Head Injury

### **Aliases**

None noted

### **Patient Care Goals**

1. Limit disability and mortality from head injury by:
  - a. Promoting adequate oxygenation
  - b. Promoting adequate cerebral perfusion
  - c. Limiting development of increased intracranial pressure
  - d. 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 recommendations

### **Patient Management**

#### **Assessment**

1. Maintain cervical stabilization [see [Spinal Care guideline](#)]
2. Primary survey per the [General Trauma Management guideline](#)
3. Monitoring:
  - a. Continuous pulse oximetry
  - b. Frequent systolic and diastolic blood pressure measurement
  - c. Initial neurologic status assessment [see [Appendix VII – Neurologic Status Assessment](#)] 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 pupils 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 tenderness or deformity
  - f. Neurologic:
    - i. Perform neurologic status assessment (GCS or AVPU)
    - ii. Evaluate for focal neurologic deficit: motor and sensory

## **Treatment and Interventions**

*NOTE: These are not necessarily the order they are to be done, but are grouped by conceptual areas.*

1. Airway:
  - a. Administer oxygen as appropriate with a target of achieving 94-98% saturation
  - b. If patient unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basilar skull fracture)
  - c. Oral endotracheal intubation or supraglottic airway insertion can be used if BVM ventilation ineffective in maintaining oxygenation or if airway is continually compromised
  - d. Nasal intubation should not be used in patients with head injury
2. Breathing:
  - a. For patients with a moderate or/severe head injury who are unable to maintain their airway: use continuous waveform capnography, and EtCO<sub>2</sub> measurement if available, with a target EtCO<sub>2</sub> of 35-40 mmHg
  - b. Supraglottic airway placement or/endotracheal intubation should only be performed if BVM ventilation is inadequate to maintain adequate oxygenation with a target EtCO<sub>2</sub> of 35-40 mmHg
  - c. For patients with a severe head injury with signs of herniation: hyperventilate to a target EtCO<sub>2</sub> of 30-35 mmHg as a short-term option, and only for severe head injury 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
    - iii. Cover an injured eye with moist saline dressing and place cup over it
  - b. Moderate/severe closed head injury
    - i. Blood pressure: avoid hypotension
      1. Adult (age greater than 10 yo): maintain SBP greater than or equal to 110 mmHg
      2. Pediatric: maintain SBP:
        - a. less than 1 month: greater than 60 mmHg
        - b. 1-12 months: greater than 70 mmHg
        - c. 1-10 yo: greater than 70 + 2x age in years
  - c. Closed head injury
    - i. 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 - check blood glucose
  - b. Spinal assessment and management, per [Spinal Care guideline](#)
  - c. Perform and trend neurologic status assessment (moderate/severe: GCS 3-13, 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 3-13, 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
3. **Geriatric Consideration:** Elderly patients with ankylosing spondylitis or severe kyphosis should be padded and immobilized in a position of comfort and may not tolerate a cervical collar

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Head injury severity guideline:
  - a. Mild: GCS 13-15 / AVPU = (A)
  - b. Moderate: GCS 9-12 / AVPU = (V)
  - c. Severe: GCS 3-8 / AVPU = (P) or (U)
2. Important that providers be specifically trained in accurate neurologic status assessment [see [Appendix VII – Neurologic Status Assessment](#)]
3. If endotracheal intubation or invasive airways are used, continuous waveform capnography is required to document proper tube placement and assure proper ventilation rate
4. 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)
  - f. Decerebrate posturing

#### **Pertinent Assessment Findings**

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

### **Quality Improvement**

#### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914101 – Injury-Head

#### **Key Documentation Elements**

- Adequate oxygenation
- Airway status and management
- ETCO<sub>2</sub> monitored and documented for moderate/severe head injury (avoidance of inappropriate hyperventilation)

- Neurological status with vitals: AVPU, GCS
- Exams: Neurological and Mental Status Assessment

### **Performance Measures**

- No oxygen desaturation *less than 90%*
- No hypotension:
  - Adults: *less than 90 mmHg*
  - Pediatrics:
    - *less than 1 month: less than 60 mmHg*
    - *1-12 months: less than 70 mmHg*
    - *1-10 yo: less than 70 + 2x age in years*
- No EtCO<sub>2</sub> lower than 35 for mild head injury, 30 if severe head injury with signs of herniation
- Appropriate triage to trauma center
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMSIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

### **References**

1. Ambrosi PB, Valença MM, Azevedo-Filho H. Prognostic factors in civilian gunshot wounds to the head: a series of 110 surgical patients and brief literature review. *Neurosurg Rev.* 2012;35(3):429-35; discussion 435-6.
2. Badjatia N, Carney N, Crocco TJ, et al; Brain Trauma Foundation; BTF Center for Guidelines Management. Guidelines for prehospital management of traumatic brain injury 2<sup>nd</sup> edition. *Prehosp Emerg Care.* 2008;12 Suppl 1:S1-52.
3. Berlot G, La Fata C, Bacer B, et al. Influence of prehospital treatment on the outcome of patients with severe blunt traumatic brain injury: a single-centre study. *Eur J Emerg Med.* 2009;16(6):312-17.
4. Davis DP, Koprowicz KM, Newgard CD, et al. The relationship between out-of-hospital airway management and outcome among trauma patients with Glasgow Coma Scale scores of 8 or less. *Prehosp Emerg Care.* 2011;15(2):184-92.
5. Dumont TM, Visioni AJ, Rughani AI, Tranmer BI, Crookes B. Inappropriate prehospital ventilation in severe traumatic brain injury increases in-hospital mortality. *J Neurotrauma.* 2010 Jul;27(7):233-41.
6. Franschman G, Peerdeman SM, Andriessen TM, et al; Amsterdam Lifeline: Analysis of Results and Methods--Traumatic Brain Injury (ALARM-TBI) Investigators. Effect of secondary

- prehospital risk factors on outcome in severe traumatic brain injury in the context of fast access to trauma care. *J Trauma*. 2011;71(4):826-32.
7. Haut ER, Kalish BT, Cotton BA, et al. Prehospital intravenous fluid administration is associated with higher mortality in trauma patients: a National Trauma Data Bank analysis. *Ann Surg*. 2011;253(2):371-7.
  8. Jagoda AS, Bazarian JJ, Bruns JJ Jr, et al; American College of Emergency Physicians; Centers for Disease Control and Prevention. Clinical policy: neuroimaging and decision making in adult mild traumatic brain injury in the acute setting. *Ann Emerg Med*. 2008;52(6):714-48.
  9. Kleinman ME, Chameides L, Schexnayder SM, et al. Part 14: pediatric advanced life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122:S876-908.
  10. Reed D. *Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults: 2<sup>nd</sup> Edition*. New South Wales Institute of Trauma and Injury Management; 2011.
  11. Roberts I, Schierhout G. Hyperventilation therapy for acute traumatic brain injury. *Cochrane Database Syst Rev*. 1997;(4):CD000566.
  12. Stocchetti N, Maas AIR, Chieragato A, van der Plas AA. Hyperventilation in head injury a review. *Chest*. 2005;127(5):1812-27.
  13. Wakai A, Roberts IG, Schierhout G. Mannitol for acute traumatic brain injury. *Cochrane Database Syst Rev*. 2007;(1):CD001049.
  14. Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton SL. Early resuscitation of children with moderate-to-severe traumatic brain injury. *Pediatrics*. 2009;124(1):56-64.

**Revision Date**

September 8, 2017

## High Threat Considerations/Active Shooter Scenario

### **Aliases**

None noted

### **Definitions**

- **Hot Zone/Direct Threat Zone:** an area within the inner perimeter where active threat and active hazards exists.
- **Warm Zone/Indirect Threat Zone:** an area within the inner perimeter where security and safety measures are in place. This zone may have potential hazards, but no active danger exists.

### **Patient Care Goals**

1. Assess scene
2. Mitigating further harm
3. Accomplish goal with minimal additional injuries

### **Patient Presentation**

#### **Inclusion Criteria**

High threat environment – when greater than normal conditions exist that are likely to cause damage or danger to provider or patient

#### **Exclusion Criteria**

No significant threat exists to provider and patient allowing for the performance of routine care

### **Patient Management**

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

1. Hot Zone/Direct Threat care considerations:
  - a. Defer in depth medical interventions if engaged in ongoing direct threat (e.g. active shooter, unstable building collapse, improvised explosive device, hazardous material threat)
  - b. Threat mitigation techniques will minimize risk to patients and providers
  - c. Triage should be deferred to a later phase of care
  - d. Prioritization for extraction is based on resources available and the situation
  - e. Minimal interventions are warranted
  - f. Encourage patients to provide self-first aid or instruct aid from uninjured bystander
  - g. Consider hemorrhage control:
    - i. Tourniquet application is the primary “medical” intervention to be considered in Hot Zone/Direct Threat
    - ii. Consider instructing patient to apply direct pressure to the wound if no tourniquet available (or application is not feasible)
    - iii. Consider quickly placing or directing patient to be placed in position to protect airway, if not immediately moving patient
2. Warm Zone/Indirect Threat care considerations:
  - a. Maintain situational awareness



- b. Ensure safety of both responders and patients by rendering equipment and environment safe (firearms, vehicle ignition)
- c. Conduct primary survey, per the [General Trauma Management guideline](#), and initiate appropriate life-saving interventions
  - i. Hemorrhage control
    - 1. Tourniquet
    - 2. Wound packing if feasible
  - ii. Maintain airway and support ventilation [see [Airway Management guideline](#)]
- d. Do not delay patient extraction and evacuation for non-life-saving interventions
- e. Consider establishing a casualty collection point if multiple patients are encountered
- f. Unless in a fixed casualty collection point, triage in this phase of care should be limited to the following categories:
  - i. Uninjured and/or capable of self-extraction
  - ii. Deceased/expectant
  - iii. All others

**Patient Safety Considerations**

- 1. Anticipate unique threats based on situation
- 2. During high threat situations, provider safety should be considered in balancing the risks and benefits of patient treatment

**Notes/Educational Pearls**

**Key Considerations**

- 1. In high threat situations, novel risk assessment should be considered. Provider and patient safety will need to be simultaneously considered
- 2. During high threat situations, an integrated response with other public safety entities may be warranted
- 3. Depending on the situation, a little risk may reap significant benefits to patient safety and outcome
- 4. During these situations, maintaining communications and incident management concepts may be crucial to maximizing efficiency and mitigating dangers

**Quality Improvement**

**Associated NEMESIS Protocol(s) (eProtocol.01)**

None recommended

**Key Documentation Elements**

- Traditional documentation may not be appropriate during Hot Zone/Direct Threat and Warm Zone/Indirect Threat care
- Documentation of key intervention should be relayed:
  - Time of tourniquet application
  - GCS

## **References**

1. Callaway DW, Smith ER, Cain J, et al. The Committee for Tactical Emergency Casualty Care (C-TECC): evolution and application of TCCC guidelines to civilian high threat medicine. *J Spec Oper Med*. 2011;11(3):104–122.
2. Hartford Consensus. Facs.org. <https://www.facs.org/about-acs/hartford-consensus>. Accessed August 22, 2017.
3. TCCC-MP Guidelines and Curriculum. NAEMT.org. [http://www.naemt.org/education/TCCC/guidelines\\_curriculum](http://www.naemt.org/education/TCCC/guidelines_curriculum). Accessed August 22, 2017.
4. TECC Guidelines. C-TECC.org. <http://www.c-tecc.org/guidelines>. Committee for Tactical Emergency Casualty Care. Accessed August 22, 2017.

## **Revision Date**

September 8, 2017

## Spinal Care

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

### **Aliases**

None noted

### **Patient Care Goals**

1. Select patients for whom spinal motion restriction (SMR) is indicated
2. Minimize secondary injury to spine in patients who have, or may have, an unstable spinal injury
3. Minimize patient morbidity from the use of immobilization devices

### **Patient Presentation**

#### **Inclusion criteria**

Traumatic mechanism of injury

#### **Exclusion criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Assess the scene to determine the mechanism of injury
  - a. Mechanism alone should not determine if a patient requires spinal motion restriction – however, mechanisms that have been associated with a higher risk of injury are:
    - i. Motor vehicle crashes (including automobiles, all-terrain vehicles, and snowmobiles)
    - ii. Axial loading injuries to the spine
    - iii. Falls greater than 10 feet
2. Assess the patient in the position found for findings associated with spine injury:
  - a. Mental status
  - b. Neurologic deficits
  - c. Spinal pain or tenderness
  - d. Any evidence of intoxication
  - e. Other severe injuries, particularly associated torso injuries

#### **Treatment and Interventions**

1. Place patient in cervical collar if there are 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)
  - d. Focal or neurologic deficit
  - e. Any evidence of alcohol or drug intoxication
  - f. Another severe or painful distracting injury is present
  - g. Torticollis in children
  - h. A communication barrier that prevents accurate assessment
  - i. If none of the above apply, patient may be managed without a cervical collar

2. Patients with penetrating injury to the neck should not be placed in a cervical collar or other spinal precautions 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 is 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 manually immobilized - occipital and shoulder 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. Do not transport patients on rigid 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 situations, long boards should ideally 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" [[Appendix X](#)]
7. Patients with severe kyphosis or ankylosing spondylitis may not tolerate a cervical collar. These patients should be immobilized in a position of comfort using towel rolls or sand bags

#### **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
7. In an uncooperative patient, avoid interventions that may promote increased spinal movement
8. The preferred position for all patients with spine management is flat and supine. There are three circumstances under which raising the head of the bed to 30 degrees should be considered:
  - a. Respiratory distress
  - b. Suspected severe head trauma
  - c. Promotion of patient compliance

## 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 in this scenario 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 precautions 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. Reserve long spine board use for the movement of patients whose injuries limit ambulation and who meet criteria for the use of spinal precautions. Remove from the long board 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 severe injuries

## Quality Improvement

### Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914107 – Injury-Spinal Cord
- 9914073 – General-Spinal Precautions/Clearance

### Key Documentation Elements

- Patient complaint of neck or spine pain
- Spinal tenderness
- Mental status/GCS
- Neurologic examination
- Evidence of intoxication
- Documentation of multiple trauma
- Documentation of mechanism of injury

- Document patient capacity with:
  - Any and all barriers to patient care in the NEMSIS element “Barriers to Patient Care” (eHistory.01-required of all software systems)
  - Exam fields for Mental Status and Neurological Assessment
  - Vitals for Level of Responsiveness and Glasgow Coma Scale
  - Alcohol and drug use indicators
- Patient age
- Patients under age and not emancipated: Guardian name, contact, and relationship

### **Performance Measures**

- Percentage of patients with high risk mechanisms of injury and/or signs or symptoms of cervical spine injury who are placed in a cervical collar
- Percentage of patients without known trauma who have a cervical immobilization device placed (higher percentage creates a negative aspect of care)
- Percentage of trauma patients who are transported on a long backboard (target is a low percentage)
- Percentage of patients with a cervical spinal cord injury or unstable cervical fracture who did not receive cervical collar
- **EMS Compass Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMSIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

### **References**

1. Anders JF, Adalgais K, Hoyle JD Jr., Olsen C, Jaffe DM, Leonard JC. Comparison of outcomes for children with cervical spine injury based on destination hospital from scene of injury. *Acad Emerg Med.* 2014;21(1):55-64.
2. Armstrong BP, Simpson HK, Crouch R, Deakin CD. Prehospital clearance of the cervical spine: does it need to be a pain in the neck? *Emerg Med J.* 2007;24(7):501-3.
3. Barkana Y, Stein M, Scope A, Maor R, Abramovich Y, Friedman Z, Knoller N. Prehospital stabilization of the cervical spine for penetrating injuries of the neck - is it necessary? *Injury.* 2007;31(5):305-9.
4. Ben-Galim P, Dreiangel N, Mattox KL, Reitman CA, Kalantar SB, Hipp JA. Extrication collars can result in abnormal separation between vertebrae in the presence of a dissociative injury. *J Trauma.* 2010;69(2):447-50.
5. Benner JP, Brauning G, Green M, Caldwell W, Borloz MP, Brady WJ. Disagreement between transport team and ED staff regarding the prehospital assessment of air medically evacuated

- scene patients. *Air Med J.* 2006;25(4):165-9.
6. Brown JB, Bankey PE, Sangosanya AT, Cheng JD, Stassen NA, Gestring ML. Prehospital spinal immobilization does not appear to be beneficial and may complicate care following gunshot injury to the torso. *J Trauma.* 2009;67(4):774-8.
  7. Bureau of Emergency Medical Services. *State of New Hampshire Patient Care Protocols.* Concord, NH: New Hampshire Department of Safety; 2013.
  8. Burton JH, Dunn MG, Harmon NR, Hermanson TA, Bradshaw JR. A statewide, prehospital emergency medical service selective patient spine immobilization protocol. *J Trauma.* 2006;61(1):161-7.
  9. Burton JH, Harmon NR, Dunn MG, Bradshaw JR. EMS provider findings and interventions with a statewide EMS spine-assessment protocol. *Prehosp Emerg Care.* 2005;9(3):303-9.
  10. Chan D, Goldberg R, Tascone A, Harmon S, Chan L. The effect of spinal immobilization on healthy volunteers. *Ann Emerg Med.* 1994;23(1):48-51.
  11. Chong CL, Ware DN, Harris JH Jr. Is cervical spine imaging indicated in gunshot wounds to the cranium? *J Trauma.* 1998;44(3):501-2.
  12. Cirak B, Ziegfeld S, Knight VM, Chang D, Avellino AM, Paidas, CN. Spinal injuries in children. *J Pediatr Surg.* 2004;39(4):607-12.
  13. Cordell WH, Hollingsworth JC, Olinger ML, Stroman SJ, Nelson DR. Pain and tissue-interface pressures during spine-board immobilization. *Ann Emerg Med.* 1995;26(1):31-6.
  14. Davies G, Deakin C, Wilson A. The effect of a rigid collar on intracranial pressure. *Injury.* 1996;27(9):647-9.
  15. Decoster LC, Burns MF, Swartz EE, et al. Maintaining neutral sagittal cervical alignment after football helmet removal during emergency spine injury management. *Spine (Phila Pa 1976).* 2012;37(8):654-9.
  16. Del Rossi G, Heffernan TP, Horodyski M, Rehtine GR. The effectiveness of extrication collars tested during the execution of spine-board transfer techniques. *Spine J.* 2004;4(6):619-23.
  17. Del Rossi G, Horodyski MH, Conrad BP, Di Paola CP, Di Paola MJ, Rehtine GR. The 6-plus-person lift transfer technique compared with other methods of spine boarding. *J Athl Train.* 2008;43(1):6-13.
  18. Del Rossi G, Horodyski M, Conrad BP, Dipaola CP, Dipaola MJ, Rehtine GR. Transferring patients with thoracolumbar spinal instability: Are there alternatives to the log roll maneuver? *Spine (Phila Pa 1976).* 2008;33(14):1611-5.
  19. Del Rossi G, Rehtine GR, Conrad BP, Horodyski M. Are scoop stretchers suitable for use on spine-injured patients? *Am J Emerg Med.* 2010 28(7), 751-756
  20. Dixon, M, O'Halloran J, Cummins NM. Biomechanical analysis of spinal immobilisation during prehospital extrication: a proof of concept study. *Emerg Med J.* 2014;31(9):745-9.
  21. Domeier RM, Frederiksen SM, Welch K. Prospective performance assessment of an out-of-hospital protocol for selective spine immobilization using clinical spine clearance criteria. *Ann Emerg Med.* 2005;46(2):123-31.
  22. Domeier RM, Swor RA, Evans RW, et al. Multicenter prospective validation of prehospital clinical spinal clearance criteria. *J Trauma.* 2002;53(4):744-50.
  23. Edlich RF, Mason SS, Vissers RJ, et al. Revolutionary advances in enhancing patient comfort on patients transported on a backboard. *Am J Emerg Med.* 2011;29(2):181-6.
  24. Engsborg JR, Standeven JW, Shurtleff TL, Eggars JL, Shafer JS, Naunheim RS. Cervical spine motion during extrication. *J Emerg Med.* 2013;44(1):122-7.
  25. Hasler RM, Kehl C, Exadaktylos AK, et al. Accuracy of prehospital diagnosis and triage of a Swiss helicopter emergency medical service. *J Trauma Acute Care Surg.* 2012;73(3):709-15.
  26. Hauswald M, Hsu M, Stockoff C. Maximizing comfort and minimizing ischemia: a comparison

- of four methods of spinal immobilization. *Prehosp Emerg Care*. 2000;4(3):250-2.
27. Hauswald M, Ong G, Tandberg D, Omar Z. Out-of-hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med*. 1998;5(3):214-9.
  28. Haut ER, Kalish BT, Efron DT, et al. Spine immobilization in penetrating trauma: More harm than good? *J Trauma*. 2010;68(1):115-20; discussion 120-1.
  29. Hemmes B, Poeze M, Brink PR. Reduced tissue-interface pressure and increased comfort on a newly developed soft-layered long spineboard. *J Trauma*. 2010;68(3):593-8.
  30. Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. National Emergency X-Radiography Utilization Study Group. *N Engl J Med*. 2000;343(2):94-9.
  31. Hostler D, Colburn D, Seitz SR. A comparison of three cervical immobilization devices. *Prehosp Emerg Care*. 2009;13(2):256-60.
  32. Huerta C, Griffith R, Joyce SM. Cervical spine stabilization in pediatric patients: evaluation of current techniques. *Ann Emerg Med*. 1987;16(10):1121-6.
  33. Kim EG, Brown KM, Leonard JC, Jaffe DM, Olsen CS, Kuppermann N. Variability of prehospital spinal immobilization in children at risk for cervical spine injury. *Pediatr Emerg Care*. 2013;29(4):413-8.
  34. Kolb JC, Summers RL, Galli RL. Cervical collar-induced changes in intracranial pressure. *Am J Emerg Med*. 1999;17(2):135-7.
  35. Kwan I, Bunn F. Effects of prehospital spinal immobilization: a systematic review of randomized trials on healthy subjects. *Prehosp Disaster Med*. 2005;20(1):47-53.
  36. Leonard JC, Mao J, Jaffe DM. Potential adverse effects of spinal immobilization in children. *Prehosp Emerg Care*. 2012;16(4):513-8.
  37. Leonard JC, Kuppermann N, Olsen C, et al. Factors associated with cervical spine injury in children after blunt trauma. *Ann Emerg Med*. 2011;58(2):145-55.
  38. Lin HL, Lee WC, Chen CW, et al. Neck collar used in treatment of victims of urban motorcycle accidents: Over- or underprotection? *Am J Emerg Med*. 2011;29(9):1028-33.
  39. Lovell ME, Evans JH. A comparison of the spinal board and the vacuum stretcher, spinal stability and interface pressure. *Injury*. 1994;25(3):179-80.
  40. Luscombe MD, Williams, JL. Comparison of a long spinal board and vacuum mattress for spinal immobilisation. *Emerg Med J*. 2003;20(5):476-8.
  41. March JA, Ausband SC, Brown, LH. Changes in physical examination caused by use of spinal immobilization. *Prehosp Emerg Care*. 2002;6(4):421-4.
  42. McGuire RA, Degnan G, Amundson GM. Evaluation of current extrication orthoses in immobilization of the unstable cervical spine. *Spine (Phila Pa 1976)*. 1990;15(10):1064-7.
  43. Mohseni S, Talving P, Branco BC, et al. Effect of age on cervical spine injury in pediatric population: a National Trauma Data Bank review. *J Pediatr Surg*. 2011;46(9):1771-6.
  44. National Association of EMS Physicians/American College of Surgeons Committee on Trauma. Position statement: EMS spinal precautions and the use of the long backboard. *Prehosp Emerg Care*. 2013;17:392-3.
  45. Nypaver M, Treloar D. Neutral cervical spine positioning in children. *Ann Emerg Med*. 1994;23(2):208-11.
  46. Parent S, Mac-Thiong JM, Roy-Beaudry M, Sosa JF, Labelle H. Spinal cord injury in the pediatric population: a systematic review of the literature. *J Neurotrauma*. 2011;28(8):1515-24.
  47. Peery CA, Brice J, White WD. Prehospital spinal immobilization and the backboard quality assessment study. *Prehosp Emerg Care*. 2007;11(3):293-7.
  48. Pieretti-Vanmarcke R, Velmahos GC, Nance ML, et al. Clinical clearance of the cervical spine



- in blunt trauma patients younger than 3 years: a multi-center study of the American Association for the Surgery of Trauma. *J Trauma*. 2009;67(3):543-49; discussion 549-50.
49. Podolsky S, Baraff LJ, Simon RR, Hoffman JR, Larmon B, Ablon W. Efficacy of cervical spine immobilization methods. *J Trauma*. 1983;23(6):461-5.
  50. Prasarn ML, Zhou H, Dubose D, et al. Total motion generated in the unstable thoracolumbar spine during management of the typical trauma patient: A comparison of methods in a cadaver model. *J Neurosurg Spine*. 2012;16(5):504-8.
  51. Ramasamy A, Midwinter M, Mahoney P, Clasper J. Learning the lessons from conflict: Pre-hospital cervical spine stabilization following ballistic neck trauma. *Injury*. 2009;40(12):1342-5.
  52. Rhee P, Kuncir EJ, Johnson L, et al. Cervical spine injury is highly dependent on the mechanism of injury following blunt and penetrating assault. *J Trauma*. 2006;61(5):1166-70.
  53. Schafermeyer RW, Ribbeck BM, Gaskins J, Thomason S, Harlan M, Attkisson A. Respiratory effects of spinal immobilization in children. *Ann Emerg Med*. 1991;20(9):1017-9.
  54. Shafer JS, Naunheim RS. Cervical spine motion during extrication: A pilot study. *West J Emerg Med*. 2009;10(2):74-8.
  55. Shah MI, Kamin R, Freire J, Jaeger E, Lobo C, Sholl JM. An evidence-based guideline for pediatric prehospital spinal care using GRADE methodology. Manuscript in preparation.
  56. Sochor M, Althoff S, Bose D, Maio R, Deflorio P. Glass intact assures safe cervical spine protocol. *J Emerg Med*. 2013;44(3):631-6.e1.
  57. Office of Emergency Medical Services. *Spinal Motion Restriction Guideline*. Hartford, Connecticut. Department of Public Health; 2013.
  58. Stroh G, Braude D. Can an out-of-hospital cervical spine clearance protocol identify all patients with injuries? An argument for selective immobilization. *Ann Emerg Med*. 2001;37(6):609-15.
  59. Swartz EE, Hernandez AE, Decoster LC, Mihalik JP, Burns MF, Reynolds, C. Prehospital emergency removal of football helmets using two techniques. *Prehosp Emerg Care*. 2011;15(2):166-74.
  60. Theodore N, Hadley MN, Aarabi B, et al. Prehospital cervical spinal immobilization after trauma. *Neurosurgery*. 2013;72 Suppl 2:22-34.
  61. Vaillancourt C, Stiell IG, Beaudoin T, et al. The out-of-hospital validation of the Canadian C-Spine Rule by paramedics. *Ann Emerg Med*. 2009;54(5):663-71.e1.
  62. Vanderlan WB, Tew BE, McSwain NE Jr. Increased risk of death with cervical spine immobilisation in penetrating cervical trauma. *Injury*. 2009;40(8):880-3.
  63. Vanderlan WB, Tew BE, Seguin CY, et al. Neurologic sequelae of penetrating cervical trauma. *Spine (Phila Pa 1976)*. 2009;34(24):2646-53.
  64. Viccellio P, Simon H, Pressman BD, Shah MN, Mower WR, Hoffman JR. A prospective multicenter study of cervical spine injury in children. *Pediatrics*. 2001;108(2):e20.
  65. Werman HA, White LJ, Herron H, et al. Clinical clearance of spinal immobilization in the air medical environment: a feasibility study. *J Trauma*. 2008;64(6):1539-42.
  66. White CC IV, Domeier RM, Millin MG. EMS spinal precautions and the use of the long backboard – resource document to the position statement of the National Association of EMS Physicians and the American College of Surgeons Committee on Trauma. *Prehosp Emerg Care*. 2013;17:392-3.

### **Revision Date**

September 8, 2017

# Toxins and Environmental

## Poisoning/Overdose Universal Care

### **Aliases**

Toxin, overdose, poison, exposure

### **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 (Suspect Exposure) Criteria**

1. Presentation may vary depending on the concentration and duration of exposure. Signs and symptoms may include, but are not limited to, the following:
  - a. Absorption:
    - i. Nausea
    - ii. Vomiting
    - iii. Diarrhea
    - iv. Altered mental status
    - v. Abdominal pain
    - vi. Rapid heart rate
    - vii. Dyspnea
    - viii. Wheezing
    - ix. Seizures
    - x. Arrhythmias
    - xi. Respiratory depression
    - xii. Sweating
    - xiii. Tearing
    - xiv. Defecation
    - xv. Constricted/dilated pupils
    - xvi. Rash
    - xvii. Burns to the skin
  - b. Ingestion:
    - i. Nausea
    - ii. Vomiting
    - iii. Diarrhea
    - iv. Altered mental status
    - v. Abdominal pain
    - vi. Rapid or slow heart rate
    - vii. Dyspnea
    - viii. Seizures

- ix. Arrhythmias
  - x. Respiratory depression
  - xi. Chemical burns around or inside the mouth
  - xii. Abnormal breath odors
- c. Inhalation:
- i. Nausea
  - ii. Vomiting
  - iii. Diarrhea
  - iv. Altered mental status
  - v. Abnormal skin color
  - vi. Dyspnea
  - vii. Seizures
  - viii. Burns to the respiratory tract
  - ix. Stridor
  - x. Sooty sputum
  - xi. Known exposure to toxic or irritating gas
  - xii. Respiratory depression
  - xiii. Sweating
  - xiv. Tearing
  - xv. Constricted/dilated pupils
  - xvi. Dizziness
- d. Injection:
- i. Local pain
  - ii. Puncture wounds
  - iii. Reddening skin
  - iv. Local edema
  - v. Numbness
  - vi. Tingling
  - vii. Nausea
  - viii. Vomiting
  - ix. Diarrhea
  - x. Altered mental status
  - xi. Abdominal pain
  - xii. Seizures
  - xiii. Muscle twitching
  - xiv. Hypoperfusion
  - xv. Respiratory depression
  - xvi. Metallic or rubbery taste
1. **Toxidromes** (constellations of signs and symptoms that add in the identification of certain classes of medications and their toxic manifestations). These toxidrome constellations may be masked or obscured in poly pharmacy events
- a. Anticholinergic
- i. Red as a beet (Flushed skin)
  - ii. Dry as a bone (Dry skin)
  - iii. Mad as a hatter (Altered mental status)
  - iv. Blind as a bat (Mydriasis)
  - v. Hot as a pistol (Hyperthermia)
  - vi. Full as a flask (urinary retention)

- vii. “Tachy” like a pink flamingo (tachycardia and hypertension)
- b. Cholinergic (DUMBELS)
  - DUMBELS** is a mnemonic used to describe the signs and symptoms of acetylcholinesterase inhibitor agent poisoning – all patient age groups are included where the signs and symptoms exhibited are consistent with the toxidrome of DUMBELS
  - i. **D**iarrhea
  - ii. **U**rination
  - iii. **M**iosis/**M**uscle weakness
  - iv. **B**ronchospasm/**B**ronchorrhea/**B**radycardia (the killer Bs)
  - v. **E**mesis
  - vi. **L**acrimation
  - vii. **S**alivation/**S**weating
- c. Opioids
  - i. Respiratory depression
  - ii. Miosis (pinpoint pupils)
  - iii. Altered mental status
  - iv. Decreased bowel sounds
- d. Sedative Hypnotic
  - i. Central nervous system depression
  - ii. Ataxia (unstable gait or balance)
  - iii. Slurred speech
  - iv. Normal or depressed vital signs (pulse, respirations, blood pressure)
- e. Stimulants (Sympathomimetic)
  - i. Tachycardia, tachydysrhythmias
  - ii. Hypertension
  - iii. Diaphoresis
  - iv. Delusions/paranoia
  - v. Seizures
  - vi. Hyperthermia
  - vii. Mydriasis (dilated pupils)
- f. Serotonin Syndrome (presentation with at least three of the following)
  - i. Agitation
  - ii. Ataxia,
  - iii. Diaphoresis
  - iv. Diarrhea
  - v. Hyperreflexia
  - vi. Mental status changes
  - vii. Myoclonus
  - viii. Shivering
  - ix. Tremor
  - x. Hyperthermia
  - xi. Tachycardia

**Exclusion Criteria**

No recommendations

## **Patient Management**

### **Assessment**

1. Make sure the scene is safe. Use environmental Carbon Monoxide (CO) detector on “first in” bag if possible
2. Consider body substance isolation (BSI) or appropriate PPE
3. Assess ABCD and, if indicated, expose patient for assessment, and then re-cover to assure retention of body heat
4. Vital signs including temperature
5. Attach cardiac monitor and examine rhythm strip for arrhythmias (consider 12-lead EKG)
6. Check blood glucose level
7. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
8. Perform carboxyhemoglobin device assessment, if available
9. When indicated, identify specific medication taken (including immediate release vs sustained release), time of ingestion, dose, and quantity. When appropriate, bring all medications (prescribed and not prescribed) in the environment
10. Obtain an 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
11. If bringing in exposure agent, consider the threat to yourself and the destination facility
12. Obtain pertinent cardiovascular history and other prescribed medications
13. Check for needle marks, paraphernalia, bites, bottles, or evidence of agent involved in exposure, self-inflicted injury, or trauma
14. Law enforcement should have checked for weapons and drugs, but you may decide to re-check
15. Obtain pertinent patient history
16. Perform physical examination

### **Treatment and Interventions**

1. Assure a patent airway
2. Administer oxygen as appropriate with a target of achieving 94-98% saturation and, if there is hypoventilation noted, support breathing
3. Initiate IV access for infusion treatment medication and/or lactated Ringer’s or normal saline if indicated, 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 g/kg) PO only if within the first hour of ingestion and prolonged transport to definitive care
    - ii. Based on suspected quantity and timing, consider acetylcysteine (pediatric and adult)
      1. Loading dose is acetylcysteine 150 mg/kg IV; mix in 200 mL of D5W and infuse over 1 hr

2. Then dose acetylcysteine 50 mg/kg IV in 500 mL D5W over 4 hrs
3. If IV is not available, acetylcysteine 140 mg/kg PO
- 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
    1. As aspirin is erratically absorbed, charcoal is highly recommended to be administered early
    2. If altered mental status or risk of rapid decreasing mental status from polypharmacy, do not administer oral agents including activated charcoal
  - ii. In salicylate poisonings, let the patient breath on their own, even if tachypnea, until there is evidence of decompensation or dropping oxygen saturation. Acid/base disturbances and outcomes worsen when the patient is manually ventilated
- c. Benzodiazepine overdose:
  - i. Respiratory support
  - ii. Consider fluid challenge (20 mL/kg) for hypotension
  - iii. Consider vasopressors after adequate fluid resuscitation (1-2 liters of crystalloid) for the hypotensive patient
- d. Caustic substances ingestion (e.g. acids and alkali):
  - i. Evaluate for airway compromise secondary to spasm or direct injury associated with oropharyngeal burns
  - ii. In the few minutes immediately after ingestion, consider administration of water or milk if available. Adults: maximum 240 mL (8 ounces); Pediatrics: maximum 120 mL (4 ounces) to minimize risk of vomiting
    1. Do not attempt dilution in patients with respiratory distress, altered mental status, severe abdominal pain, nausea or vomiting, or patients who are unable to swallow or protect their airway.
    2. Do not force fluids in anyone who refuses to drink.
- e. Dystonia (symptomatic), extrapyramidal signs or symptoms, or mild allergic reactions
  - i. Consider administration of diphenhydramine
    1. Adult: diphenhydramine 25- 50 mg IV or IM
    2. Pediatric: diphenhydramine 1- 1.25 mg/kg IVP/IO or IM (maximum single dose of 25 mg)
- f. Monoamine oxidase inhibitor overdose (symptomatic; e.g. (MAOI; isocarboxazid (Marplan®), phenelzine (Nardil®), selegiline (Emsam®), tranylcypromine (Parnate®))
  - i. Consider administration of midazolam (benzodiazepine of choice) for temperature control
  - ii. Adult and Pediatric: Midazolam 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
- g. Opiate overdose, treat per the [Opioid Poisoning/Overdose guideline](#)
- h. Oral ingestion unknown poisoning:
  - i. If there is a risk of rapidly decreasing mental status or for petroleum-based ingestions, do not administer oral agents
  - ii. Consider administration of activated charcoal without sorbitol (1 g/kg) PO particularly if it is within the first 1 hour after ingestion (including acetaminophen) or prolonged transport to definitive care.

- iii. Patients who have ingested medications with extended release or delayed absorption should also be administered activated charcoal
- i. Selective serotonin reuptake inhibitors (SSRIs)
  - i. Consider early airway management
  - ii. Treat arrhythmias following ACLS guidelines
  - iii. Aggressively control hyperthermia with cooling measures
  - iv. Consider fluid challenge (20 mL/kg) for hypotension
  - v. Consider vasopressors after adequate fluid resuscitation (1-2 liters of crystalloid) for the hypotensive patient [see [Shock guideline](#)]
  - vi. For agitation, consider midazolam (benzodiazepine of choice)
    - 1. Adult: midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg
      - a. Reduce by 50% for patients 69 years or older
    - 2. Pediatric: midazolam 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 midazolam 0.2 mg/kg IN to maximum dose of 4 mg
  - vii. For seizures, treat per [Seizures guideline](#)
- j. Tricyclic Antidepressant (TCA) Overdose:
  - i. Consider early airway management
  - ii. If widened QRS (100 msec or greater), consider sodium bicarbonate 1-2 meq/kg IV, this can be repeated as needed to narrow QRS and improve blood pressure
  - iii. Consider fluid challenge (20 mL/kg) for hypotension
  - iv. Consider vasopressors after adequate fluid resuscitation (1-2 liters of crystalloid) for the hypotensive patient [see [Shock guideline](#)]
  - v. For agitation, consider midazolam (benzodiazepine of choice)
    - 1. Adult: midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg
      - a. Reduce by 50% for patients 69 years or older
    - 2. Pediatric: midazolam 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 midazolam 0.2 mg/kg IN to maximum dose of 4 mg
  - vi. For seizure, treat per [Seizures guideline](#)

### **Patient Safety Considerations**

1. Scene/environmental safety for patient and provider
  - a. Consider environmental carbon monoxide monitor use
2. Monitor patient airway, breathing, pulse oximetry, ETCO<sub>2</sub> for adequate ventilation as they may change over time
3. Repeat vital signs often
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. The regional poison center should be engaged as early as reasonably possible to aid 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 (which does not bind to all medications or agents) 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 - precautions should be taken to avoid or reduce the risk of aspiration
3. Ipecac is no longer recommended for any poisoning or toxic ingestion – the manufacturer has stopped production of this medication
4. Flumazenil is not indicated in a suspected benzodiazepine overdose as you can precipitate refractory/intractable seizures if the patient is a benzodiazepine dependent patient

### **Pertinent Assessment Findings**

Frequent reassessment is essential as patient deterioration can be rapid and catastrophic.

## **Quality Improvement**

### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914135 – General-Overdose/Poisoning/Toxic Ingestion

### **Key Documentation Elements**

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

### **Performance Measures**

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

## **References**

1. Boyer EW, Shannon MS. The serotonin syndrome. *N Engl J Med*. 2005;352:1112-20
2. Cushing TA. Selective Serotonin Reuptake Inhibitor Toxicity  
<http://emedicine.medscape.com/article/821737-overview>. Updated September 8, 2016. Accessed April 24, 2017.
3. Gresham C. Benzodiazepine toxicity treatment and management.  
<http://emedicine.medscape.com/article/813255-treatment#d10>. Updated December 22, 2016. Accessed April 24, 2017.



4. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015. <http://accessemergencymedicine.mhmedical.com/book.aspx?bookID=1163>. Accessed April 24, 2017.
5. Spiller H. A prospective evaluation of the effect of activated charcoal before N-Acetyl cysteine in acetaminophen overdose. *Ann of Emerg Med*. 1994;23(3):519-23.
6. Tsai V. Tricyclic Antidepressant Toxicity. <http://emedicine.medscape.com/article/819204-overview>. Updated July 13, 2016. Accessed April 24, 2017.
7. Wolf S. Clinical policy: critical issues in the management of patients presenting to the emergency department with acetaminophen overdose. *Ann of Emerg Med*. 2007;50(3):292-313.

**Revision Date**

September 8, 2017

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

### Aliases

Acetylcholinesterase inhibitor, ATNAA<sup>®</sup>, carbamate, Duodote<sup>®</sup>, insecticide, nerve agent, organophosphate, pesticide, weapons of mass destruction, WMD

### Patient Care Goals

1. 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
2. Carbamates and organophosphates are commonly active agents in over-the-counter insecticides
3. Accidental carbamate exposure rarely requires treatment

### Patient Presentation

#### Inclusion Criteria

1. **DUMBELS** is a mnemonic used to describe the signs and symptoms of acetylcholinesterase inhibitor agent poisoning. All patient age groups are included where the signs and symptoms exhibited are consistent with the toxidrome of DUMBELS
  - a. **D**iarrhea
  - b. **U**rination
  - c. **M**iosis/**M**uscle weakness
  - d. **B**ronchospasm/**B**ronchorrhea/**B**radycardia (the killer B's)
  - e. **E**mesis
  - f. **L**acrimation
  - g. **S**alivation/**S**weating

#### Exclusion Criteria

No recommendations

### Patient Management

1. Don the appropriate PPE
2. Remove the patient's clothing and wash the skin with soap and water
  - a. Acetylcholinesterase inhibitor 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 the antidote immediately for confirmed or suspected acetylcholinesterase inhibitor agent exposure
5. Administer oxygen as appropriate with a target of achieving 94-98% saturation and provide airway management
6. Establish intravenous access (if possible)
7. Apply a cardiac monitor (if available)
8. The heart rate may be normal, bradycardic, or tachycardic
9. Clinical improvement should be based upon the drying of secretions and easing of respiratory effort rather than heart rate or pupillary response.

10. Continuous and ongoing patient reassessment is critical

**Assessment**

1. Acetylcholinesterase inhibitor agents are highly toxic chemical agents and can rapidly be fatal
2. Patients with low-dose chronic exposures may have a more delayed presentation of symptoms
3. Antidotes (atropine and pralidoxime) are effective if administered before circulation fails
4. The patient may develop:
  - a. Miosis (pinpoint pupils)
  - b. Bronchospasm
  - c. Bradycardia
  - d. Vomiting
  - e. Excessive secretions in the form of:
    - i. Tearing
    - ii. Salivation
    - iii. Rhinorrhea
    - iv. Diarrhea
    - v. Urination
    - vi. Bronchorrhea
5. Penetration of an acetylcholinesterase inhibitor agent into the central nervous system (CNS) will cause:
  - a. Headache
  - b. Confusion
  - c. Generalized muscle weakness
  - d. Seizures
  - e. Lethargy or unresponsiveness
6. Estimated level of exposure based upon signs and symptoms
  - a. Mild
    - i. Miosis alone (while this is a primary sign in vapor exposure, it may not be present in all exposures)
    - 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
7. Onset of symptoms can be immediate with an exposure to a large amount of the acetylcholinesterase inhibitor
  - a. There is usually an asymptomatic interval of minutes after liquid exposure before these symptoms occur
  - b. Effects from vapor exposure occur almost immediately

8. Signs and symptoms with large acetylcholinesterase inhibitor agent exposures (regardless of route)
  - a. Sudden loss of consciousness
  - b. Seizures
  - c. Copious secretions
  - d. Apnea
  - e. Death
9. Obtain an accurate ingestion history (as patient may become unconscious before arrival at ED):
  - a. Time of ingestion or 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
  - e. 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 acetylcholinesterase inhibitor agents can place the patient at risk for both a vapor and skin exposure

**Treatment and Interventions** (see dosing tables below)

1. Medications:

- a. Atropine
  - i. 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
  - ii. Atropine may be provided in multi-dose vials, pre-filled syringes, or auto-injectors
  - iii. Commercially available atropine auto-injectors include:
    1. Atro-Pen® 1 mg of atropine (dark red container)
    2. Atro-Pen® 2 mg of atropine (green container)
    3. Pediatric Atro-Pen® 0.25 mg of atropine (yellow container)
    4. Pediatric Atro-Pen® 0.5 mg of atropine (blue container)
- b. Pralidoxime chloride (2-PAM)
  - i. Pralidoxime chloride is a secondary treatment and should be given concurrently in an effort to reactivate the acetylcholinesterase
  - ii. Pralidoxime chloride may be provided in a single dose vial, pre-filled syringes, or auto-injectors
  - iii. Auto-injectors contain 600 mg of pralidoxime chloride
  - iv. 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
- c. Benzodiazepines
  - i. Benzodiazepines are administered as an anticonvulsant for those patients who exhibit seizure activity [see [Seizures guideline](#) for doses and routes of administration]

- ii. Lorazepam, diazepam, and midazolam are the most frequently used benzodiazepines in the prehospital setting
  - iii. In the scenario of an acetylcholinesterase inhibitor agent exposure, the administration of diazepam or midazolam is preferable due to their more rapid onset of action
  - iv. Benzodiazepines may be provided in multi-dose or single-dose vials, pre-filled syringes, or auto-injectors
  - v. CANA<sup>®</sup> (Convulsive Antidote Nerve Agent) is a commercially available auto-injector that contains 10 mg of diazepam
  - d. Mark I<sup>®</sup> Kits
    - i. A commercially available kit of nerve agent/organophosphate antidote auto-injectors. These are being phased out and replaced with Duodote by the CDC
    - ii. A Mark I<sup>®</sup> kit consists of one auto-injector containing 2 milligrams of atropine and a second auto-injector containing 600 milligrams of pralidoxime chloride
  - e. Duodote<sup>®</sup>
    - i. A commercially available auto-injector of nerve agent/organophosphate antidote
    - ii. Duodote<sup>®</sup> is one auto-injector that contains 2.1 milligrams of atropine and 600 milligrams of pralidoxime chloride
  - f. ATNAA<sup>®</sup> (Antidote Treatment Nerve Agent Auto-injector)
    - i. An auto-injector of nerve agent/organophosphate antidote that is typically in military supplies
    - ii. ATNAA<sup>®</sup> is one auto-injector that contains 2.1 milligrams of atropine and 600 milligrams of pralidoxime chloride
    - iii. ATNAA<sup>®</sup> may be seen in civilian supplies assets when Duodote<sup>®</sup> is unavailable or in short supply
  - g. CHEMPACK
    - i. Federally-owned cache of nerve agent antidotes that is managed by the Centers for Disease Control and Prevention (CDC) and offered to states that voluntarily agree to maintain custody and security of CHEMPACK assets
    - ii. These are forward-deployed at sites determined by states that are part of the program such as hospitals and EMS centers
    - iii. Deployment of CHEMPACKs are reserved for events where the nerve agent/organophosphate exposure will deplete the local or regional supply of antidotes
    - iv. There are two types of CHEMPACK containers:
      - 1. EMS Containers: CHEMPACK assets for EMS contain a large portion of auto-injectors for rapid administration of antidotes by EMS providers of all levels of licensure/certification – They contain enough antidote to treat roughly 454 patients
      - 2. Hospital Containers: CHEMPACK assets contain a large portion of multidose vials and powders for reconstitution – they contain enough antidote to treat roughly 1000 patients
2. Medication Administration:
- a. Atropine in extremely large, and potentially multiple, doses is the antidote for an acetylcholinesterase inhibitor agent poisoning
  - b. Atropine should be administered immediately followed by repeated doses until the patient's secretions resolve

- c. Pralidoxime chloride (2-PAM) is a secondary treatment and, when possible, should be administered concurrently with atropine
  - d. The stock of atropine and pralidoxime chloride available to EMS providers is usually not sufficient to fully treat the victim of an acetylcholinesterase inhibitor agent exposure; however, EMS providers should initiate the administration of atropine and, if available, pralidoxime chloride
  - e. 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. However, intramuscular absorption may be more clinically efficacious than the intranasal route in the presence of significant rhinorrhea
  - f. The patient should be emergently transported to the closest appropriate medical facility as directed by direct medical oversight
3. Recommended Doses (see dosing tables below)

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:

- a. For organophosphate or severe acetylcholinesterase inhibitor 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. Atropine must be given until the acetylcholinesterase inhibitor agent has been metabolized. It may require up to 2000 mg of atropine over several days to weeks
- b. Since the antidotes in the Mark I<sup>®</sup> 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<sup>®</sup> or generic atropine auto-injectors are not available and/or intravenous atropine is not an immediate option
- c. Due to the fact that Duodote<sup>®</sup> auto-injectors contain pralidoxime chloride, they should not be used for additional dosing of atropine beyond the recommended administered dose of pralidoxime chloride
- d. 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 acetylcholinesterase inhibitor agents, intramuscular administration is highly recommended to eliminate the inherent delay associated with establishing intravenous access
- e. The antidotes can be administered via the intraosseous route. However, due to the rapidity of onset of signs, symptoms, and potential death from acetylcholinesterase inhibitor 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 Acetylcholinesterase Inhibitor Agent Exposure**

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

**Mild to Moderate Acetylcholinesterase Inhibitor Agent Exposure**

Patient (Weight)	Atropine Dose IM or via Auto-injector	Pralidoxime Chloride Dose IM or via 600 mg Auto-injector
<b>Infant:</b> 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
<b>Child:</b> 3-7 yo (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 <b>OR</b> One auto-injector (600 mg)
<b>Child:</b> 8-14 yo (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 <b>OR</b> One auto-injector (600 mg)
<b>Adolescent/ Adult</b>	2-4 mg IM or via auto-injector	600 mg IM <b>OR</b> One auto-injector (600 mg)
<b>Pregnant Women</b>	2-4 mg IM or via auto-injector	600 mg IM <b>OR</b> One auto-injector (600 mg)
<b>Geriatric/ Frail</b>	2 mg IM or via auto-injector	10 mg/kg IM <b>OR</b> One auto-injector (600 mg)

**Severe Acetylcholinesterase Inhibitor 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>
<b>Infant:</b> 0-2 yo	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
<b>Child:</b> 3-7 yo (13-25 kg)	0.1 mg/kg IM <b>OR</b> 2 mg via auto-injector <i>(e.g. one 2 mg auto-injector or four 0.5 mg auto-injectors)</i>	45 mg/kg IM <b>OR</b> One auto-injector (600mg)
<b>Child:</b> 8-14 yo (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 <b>OR</b> Two auto-injectors (1200 mg)
<b>Adolescent:</b> 14 yo or older	6 mg IM or via auto-injector <i>(e.g. three 2 mg auto-injectors)</i>	Three auto-injectors (1800 mg)
<b>Adult</b>	6 mg IM or via auto-injector <i>(e.g. three 2 mg auto-injectors)</i>	Three auto-injectors (1800 mg)
<b>Pregnant Women</b>	6 mg IM or via auto-injector <i>(e.g. three 2 mg auto-injectors)</i>	Three auto-injectors (1800 mg)
<b>Geriatric/ Frail</b>	2-4 mg IM or via auto-injector <i>(e.g. one to two 2 mg auto-injectors)</i>	25 mg/kg IM <b>OR</b> two to three auto-injectors (1200 mg-1800 mg)



**Guidance for the Treatment of Seizures Secondary to Acetylcholinesterase Inhibitor Agent Exposure**

Patient	Diazepam	Midazolam
<b>Infant</b> (0-2 yo)	0.2-0.5 mg/kg IM Repeat every 2-5 minutes	0.2 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: 0.4 mg/kg
<b>Child</b> (3-13 yo)	0.2-0.5 mg/kg IM Repeat every 2-5 minutes	0.2 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 less than 5 years	Total maximum dose: 0.4 mg/kg Not to exceed 20 mg
	Total maximum dose: 10 mg if age 5 years or older 1 CANA® auto-injector	
<b>Adolescent</b> (14 yo or older)	2-3 CANA® auto-injectors	0.2 mg/kg IM Total 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
<b>Adult</b>	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
<b>Pregnant Women</b>	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
<b>Geriatric</b>	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:
  - a. Although Duodote® and ATNAA® contains atropine, the primary antidote for an acetylcholinesterase inhibitor 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:
    - i. Pediatrics: an overdose of pralidoxime chloride may cause profound neuromuscular weakness and subsequent respiratory depression
    - ii. Adults: Especially for the geriatric victim, excessive doses of pralidoxime chloride may cause severe systolic and diastolic hypertension, neuromuscular weakness, headache, tachycardia, and visual impairment
    - iii. Geriatrics: 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, Duodote® and ATNAA® 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 Acetylcholinesterase inhibitor 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 acetylcholinesterase inhibitor 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 (certain Insecticides)
  - a. Can be legally purchased by the general public
  - b. Organophosphates (e.g. 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
  - e. Nerve agents can persist in the environment and remain chemically toxic for a prolonged period of time

#### **Pertinent Assessment Findings**

The signs and symptoms exhibited with the toxidrome of DUMBELS [see [Patient Presentation – Inclusion Criteria](#) above]

#### **Quality Improvement**

##### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914047 – Exposure-Nerve Agents

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

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

##### **Performance Measures**

- Ability of the EMS system to rapidly locate additional and adequate antidote assets
- Ability of the EMS system to rapidly deploy additional and adequate antidote assets
- Survival rates of victims
- Complication rates from the toxin
- Complication rates from the antidotes
- Long-term clinical sequelae of the victims

#### **References**

1. Barkin RM, Rosen P, Seidel JS, Caputo GL, Jaffe DM. *Pediatric Emergency Medicine: Concepts and Clinical Practice*. St Louis, MO: Mosby; 1992:490-1.
2. Burillo-Putze G, Nogue Xarau SN. In Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 8<sup>th</sup> Edition*. McGraw-Hill Education; 2016:1318-21.
3. Eddelston M, Buckley NA, Eyer P, Dawson AH. Management of acute organophosphorus poisoning. *Lancet*. 2008;371(9612):597-607.
4. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015.
5. Horowitz BZ, Hendrickson RG. Chemical disasters. In Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 8<sup>th</sup> Edition*. McGraw-Hill Education; 2016:44-5.
6. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*. 2014:825-6,2057-60,2476-7.

7. Nelson LS. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw-Hill Education; 2015:1450-76.
8. Nerve Agents - Prehospital Management. Chemm.nlm.nih.gov.  
[https://chemm.nlm.nih.gov/na\\_prehospital\\_mmg.htm](https://chemm.nlm.nih.gov/na_prehospital_mmg.htm). Updated April 28, 2017. Accessed August 27, 2017.

**Revision Date**

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## Radiation Exposure

### **Aliases**

None noted

### **Patient Care Goals**

1. Prioritize identification and treatment of immediately life-threatening medical conditions and traumatic injuries above any radiation-associated injury
2. Identify and appropriately treat acute radiation injury
3. Reduce risk for contamination of personnel while caring for patients potentially or known to be contaminated with radioactive material

### **Patient Presentation**

#### **Inclusion Criteria**

1. Patients who have been acutely exposed to ionizing radiation from accidental environmental release of a radioactive source
2. Patients who have been acutely exposed to ionizing radiation from a non-accidental environmental release of a radioactive source
3. Patients who have been contaminated with material emitting ionizing radiation

#### **Exclusion Criteria**

1. Patients exposed to normal doses of ionizing radiation from medical imaging studies
2. Patients exposed to normal doses of ionizing radiation from therapeutic medical procedures

### **Patient Management**

#### **Assessment**

1. Identification and treatment of life-threatening injuries and medical problems takes priority over decontamination
2. Don standard PPE capable of preventing skin exposure to liquids and solids (gown and gloves), mucous membrane exposure to liquids and particles (face mask and eye protection), and inhalational exposure to particles (N95 face mask or respirator)
3. Do not eat or drink any food or beverages while caring for patients with radiation injuries until screening completed for contamination and appropriate decontamination if needed
4. Use caution to avoid dispersing contaminated materials
5. Provide appropriate condition-specific care for any immediately life-threatening injuries or medical problems

#### **Treatment and Interventions**

1. If patient experiences nausea, vomiting, and/or diarrhea:
  - a. Provide care, per [Nausea-Vomiting guideline](#)
  - b. Document the time gastrointestinal symptoms started
2. If seizure occurs:
  - a. Consider a primary medical cause or exposure to possible chemical agents unless indicators for a large whole body radiation dose (greater than 20Gy), such as rapid onset of vomiting, are present
  - b. Treat per [Seizures guideline](#)

## **Patient Safety Considerations**

Treat life-threatening medical problems and traumatic injuries prior to assessing for and treating radiation injuries or performing decontamination

## **Notes/Educational Pearls**

### **Key Considerations**

1. Irradiated patients pose no threat to medical providers
2. Contaminated patients pose very little threat to medical providers who use appropriate PPE including N95 masks or respirators, gloves, gowns, and face and eye protection
3. 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
4. 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
5. 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)
6. 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
7. 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
8. EMS providers may be asked to assist public health agencies in the distribution and administration of potassium iodide in a mass casualty incident involving radiation release or exposure

### **Pertinent Assessment Findings**

1. Treatment of life-threatening injuries or medical conditions takes priority over assessment for contamination or initiation of decontamination
2. Time to nausea and vomiting is a reliable indicator of the received dose of ionizing radiation. The more rapid the onset of vomiting, the higher the whole-body dose of radiation
3. Tissue burns are a late finding (weeks following exposure) of ionizing radiation injury. If burns are present acutely, they are from a thermal or chemical mechanism
4. Seizures may suggest acute radiation syndrome if accompanied by early vomiting. If other clinical indicators do not suggest a whole-body dose of greater than 20Gy, consider other causes of seizure
5. 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
  - e. Spontaneous internal and external bleeding

### **Quality Improvement**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914049 – Exposure-Radiologic Agents

#### **Key Documentation Elements**

- Duration of exposure to the radioactive source or environment
- Distance (if able to be determined) from the radioactive source (if known)
- Time of onset of vomiting

#### **Performance Measures**

- Use of appropriate PPE
- Use of dosimetry by EMS provider
- Scene measurements of radioactivity

### **References**

1. Center for Disease Control and Prevention, Emergency Preparedness and Response, Specific Hazards: *Radiation*, 2013
2. Cone DC, Koenig KL. Mass casualty triage in the chemical, biological, radiological, or nuclear environment. *Eur J Emerg Med*;12(6):287–302.
3. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 1937-1939
4. The Medical Aspects of Radiation Incidents.  
<https://orise.orau.gov/reacts/documents/medical-aspects-of-radiation-incident.pdf>.  
Revised January 2017. Accessed August 28, 2017.
5. Radiation Emergency Assistance Center/Training Site (REAC/TS) Training Site. Orise.orau.gov. <https://orise.orau.gov/reacts/>. Accessed August 28, 2017.

### **Revision Date**

September 8, 2017

Updated January 5, 2019

## Topical Chemical Burn

### **Aliases**

Chemical Burn

### **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**

1. Patients of all ages who have sustained exposure to a chemical that can cause a topical chemical burn may develop immediate or in some cases a delayed clinical presentation
2. Agents that are known to cause chemical burns include alkali, acids, mustard agent, and lewisite

#### **Exclusion criteria**

None recommended

### **Patient Management**

1. Don the appropriate PPE
2. Remove the patient's clothing, if necessary
3. Contaminated clothing should preferably be placed in double 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 including materials safety data sheet if available
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. Class of agent (alkali injury or acid injury)
  - b. Concentration of the chemical the (higher the concentration, the greater the risk of injury)
  - c. pH of the chemical
    - i. Alkali-increased risk with pH greater than or equal to 11
    - ii. Acid-increased risk with pH less than or equal to 3
  - 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
4. Special attention to assessment of ocular or oropharyngeal exposure - evaluate for airway compromise secondary to spasm or direct injury associated with oropharyngeal burns
5. Some acid and alkali agents may manifest systemic effects



### **Treatment and Interventions**

1. If dry chemical contamination, carefully brush off solid chemical prior to flushing the site as the irrigating solution may activate a chemical reaction
2. If wet chemical contamination, flush the patient's skin (and eyes, if involved) with copious amounts of water or normal saline
3. Provide adequate analgesia per the [Pain Management guideline](#)
4. Consider the use of topical anesthetic eye drops (e.g. tetracaine) for chemical burns of the eye
5. For eye exposure, administer continuous flushing of irrigation fluid to eye - Morgan lens may facilitate administration
6. Early airway intervention for airway compromise or spasm associated with oropharyngeal burns
7. Take measures to minimize hypothermia
8. 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. Hydrofluoric acid readily penetrates intact skin and there may be underlying tissue injury. It is unlikely that low concentration HF will cause an immediate acid-like burn however there may be delayed onset of pain to the exposed area. Higher concentration HF may cause immediate pain as well as more of a burn appearance that can range from mild erythema to an obvious burn. An oral or large dermal exposure can result in significant systemic hypocalcemia with possible QT prolongation and cardiovascular collapse.

1. For all patients in whom a hydrofluoric acid exposure is confirmed or suspected:
  - a. Vigorously irrigate all affected areas with water or normal saline for a minimum of 15 minutes
  - b. Apply a cardiac monitor for oral or large dermal exposures significant HF exposures
  - c. Apply calcium preparation:
    - i. Calcium prevents tissue damage from hydrofluoric acid
    - ii. Topical calcium preparations:
      1. Commercially manufactured calcium gluconate gel
      2. If commercially manufactured calcium gluconate gel is not available, a topical calcium gluconate gel preparation can be made by combining 150 mL (5 ounces) of a sterile water-soluble gel (e.g. Surgilube® or KY® jelly) with one of the following:
        - a. 35 mL of calcium gluconate 10% solution
        - b. 10 g of calcium gluconate tablets (e.g. Tums®)
        - c. 3.5 g calcium gluconate powder or
      3. If calcium gluconate is not available, 10 mL of calcium chloride 10% solution in 150 mL in sterile water soluble gel (e.g. Surgilube® or KY® jelly)
      4. Apply generous amounts of the calcium gluconate gel to the exposed skin sites to neutralize the pain of the hydrofluoric acid
        - a. Leave in place for at least 20 minutes then reassess
        - b. This can be repeated as needed

5. Although generally low yield, there may be benefit to intravenous pain medication along with the topical calcium gluconate gel for pain control
6. 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
7. For patients who have ingested hydrofluoric acid or who have a large dermal exposure consider intravenous calcium gluconate, 1-2 amps of 10% solution, as symptomatic hypocalcemia can precipitate rapidly as manifest by muscle spasms, seizures, hypotension ventricular arrhythmias and QT prolongation

#### **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 an exothermic reaction will occur and cause serious thermal injury to the patient
5. Expeditious 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

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

##### **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 VI](#)]
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 “sealed” 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. Inhalation of HF should be considered in any dermal exposure involving the face and neck or if clothing is soaked in the product
4. Decontamination is critical for both acid and alkali agents to reduce injury - removal of 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
5. 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**

### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914213 – Injury-Topical Chemical Burn

### **Key Documentation Elements**

- Burn site
- Body surface area involved
- Identification of the chemical
- Reported or measured pH of the chemical
- Acquisition and transfer of MSDS, chemical container, or other pertinent substance information to the receiving the facility

### **Performance Measures**

- Accurate (overtriage/undertriage) triage of patients to designated burn centers
- Early recognition of a topical chemical burn with appropriate treatment
- Early recognition of hydrofluoric acid burns followed by expeditious initiation of treatment with calcium gluconate and/or calcium chloride and appropriate analgesia
- Measures taken to prevent further contamination

## **References**

1. American Heart Association. *Advanced Pediatric Life Support*. Jones & Bartlett Learning LLC; 2013.
2. Ferng M, Gupta R, Bryant SM. Hazardous Brick Cleaning. *J Emergency Medicine*. 2009;37(3):305-7.
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015.
4. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 769-770
5. O'Sullivan SB, Schmitz TJ. *Physical Rehabilitation*, 5<sup>th</sup> Edition. F.A. Davis; 2007: 1098.
6. *Recommended Medical Treatment for hydrofluoric Acid Exposure*. Morristown, NJ: Honeywell Performance Materials and Technologies; October 2012.
7. Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 7<sup>th</sup> Edition*. McGraw-Hill Education; 2011: 1297, 1351, 1381-1382.

## **Revision Date**

September 8, 2017

## Stimulant Poisoning/Overdose

### **Aliases**

Stimulant, cocaine, methamphetamine, amphetamines, PCP, phencyclidine, bath salts

### **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 severe tachycardia and hypertension, agitation, hallucinations, chest pain, seizure, and arrhythmia

### **Patient Presentation**

#### **Inclusion Criteria**

1. Tachycardia/tachydysrhythmias
2. Hypertension
3. Diaphoresis
4. Delusions/paranoia
5. Seizures
6. Hyperthermia
7. Mydriasis (dilated pupils)
8. Stimulant/hallucinogenic (with stimulant properties) agents:
  - a. Cocaine
  - b. Amphetamine/methamphetamine
  - c. Phencyclidine (PCP) (hallucinogen)
  - d. Bupropion
  - e. Synthetic stimulant drugs of abuse (some having mixed properties)
  - f. Ecstasy
  - g. Methamphetamine
  - h. Synthetic cathinones (bath salts)
  - i. Spice
  - j. K2
  - k. Synthetic THC
  - l. Khat

#### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Begin with the ABCDs:
  - a. Airway is patent
  - b. Breathing is oxygenating
  - c. Circulation is perfusing
  - d. Mental status
  - e. Treat any compromise of these parameters

- f. Ask about chest pain and difficulty breathing
2. Vital signs including temperature for hyperthermia
3. Apply a cardiac monitor and examine rhythm strip for arrhythmias
4. Check blood glucose level
5. Monitor ETCO<sub>2</sub> for respiratory decompensation
6. Check a 12-lead EKG when possible
7. Check for trauma, self-inflicted injury
8. Law enforcement should have checked for weapons and drugs, but you may decide to repeat the inspection

### **Treatment and Interventions**

1. 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
4. Consider treating shortness of breath as atypical ACS
  - a. Administer oxygen as appropriate with a target of achieving 94-98% saturation
5. Consider soft physical management devices 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 agitation and other significant sympathomimetic findings for the safety of the patients and providers. This may improve behavior and compliance [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)]
  - a. If haloperidol or droperidol is used, monitor 12-lead for QT-interval if feasible
7. Consider prophylactic use of anti-emetic:
  - a. Adult: administer ondansetron 8 mg SLOW IV over 2–5 minutes or 4–8 mg IM or 8 mg orally disintegrating tablet
  - b. Pediatric: Administer ondansetron 0.15 mg/kg SLOW IV over 2–5 minutes.
  - c. Do not use promethazine if haloperidol or droperidol are to be or have been given. They all increase QT prolongation but ondansetron has less seizure risk
8. If hyperthermia suspected, begin external cooling

### **Patient Safety Considerations**

1. Apply the least amount of physical management devices that are necessary to protect the patient and the providers [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)]
2. Assessment for potential weapons or additional drugs is very important since these items can pose a threat not just to the patient but also to the EMS crew

### **Notes/Educational Pearls**

#### **Key Considerations**

1. Recognition and treatment of hyperthermia (including sedatives to decrease heat production from muscular activity) is essential as many deaths are attributable to hyperthermia
2. If law enforcement has placed the patient in handcuffs, this patient needs ongoing physical security for safe transport. Have law enforcement in back of ambulance for the handcuffed patient or make sure proper physical management devices are in place before law enforcement leaves and ambulance departs from scene

3. If patient has signs and symptoms of ACS, strive to give nitroglycerin SL q 3-5 minutes as long as SBP greater than 100 mmHg and until pain resolves (if range not desired, use q 3 minutes)
  - a. Vasospasm is often the problem in this case as opposed to a fixed coronary artery lesion
  - b. Consider administration of benzodiazepines as if to treat anxiety.
4. 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
  - a. If agitated, consider restraining the patient to facilitate patient assessment and lessen likelihood of vascular access or monitor displacements
5. Cocaine has sodium channel blocking effects and can cause significant cardiac conduction abnormalities with a widened QRS. Treatment is with sodium bicarbonate similar to a tricyclic antidepressant. Check a 12-lead EKG to assess for these complications

### **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. Neuroleptic malignant syndrome, serotonin syndrome and excited delirium can present in with similar signs and symptoms
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**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914225 – Medical-Stimulant Poisoning/Overdose

#### **Key Documentation Elements**

- Reason for psychologic and physical management procedures used and neurologic/circulatory exams with device use.
- Reason for medications selected
- Documentation of QT interval when antiemetic medications, haloperidol, or droperidol is used and result conveyed to ED staff

#### **Performance Measures**

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

## **References**

1. Warrcik BJ, Hill M, Hekman K, et al. A 9-state analysis of designer stimulant, “bath salt,” hospital visits reported to poison control centers. *Ann Emerg Med.* 2013;62(3):244-51.
2. *White Paper Report on Excited Delirium Syndrome.* ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009.

## **Revision Date**

September 8, 2017

## Cyanide Exposure

### **Aliases**

Cyanide, hydrogen cyanide, blood agent

### **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 binds to the ferric ion in cells, blocking the enzyme cytochrome oxidase, thus preventing the use of oxygen by the cell's mitochondria, leading to cellular hypoxia.

### **Inclusion Criteria**

1. Depending on its form, cyanide can enter the body through inhalation, ingestion, or absorption through the skin. Cyanide should be suspected in occupational or other smoke exposures (e.g. 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
2. High concentrations of cyanide will produce:
  - a. Markedly altered level of consciousness, including rapid collapse
  - b. Seizures
  - c. Respiratory depression or respiratory arrest
  - d. Cardiac dysrhythmias (other than sinus tachycardia)
3. The rapidity of onset is related to the severity of exposure (inhalation or ingestion) and may be dramatic with immediate effects that include early hypertension with subsequent hypotension, sudden cardiovascular collapse or seizure/coma, and rapid death

### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose the patient, and then re-cover the patient to assure retention of body heat
3. Assess vital signs including temperature and pulse oximetry (which may not correlate with tissue oxygenation in cyanide/smoke exposure)
4. Attach a cardiac monitor and examine rhythm strip for arrhythmias
  - a. Perform a 12-lead EKG
5. Check blood glucose level
6. Monitor pulse oximetry and ETCO<sub>2</sub>



7. Monitor patient for signs of hypoxia (pulse oximetry *less than 94%*) and respiratory decompensation regardless of pulse oximetry reading
8. Identify the specific agent of exposure, time of ingestion/inhalation, and quantity/timing of exposure
9. Obtain patient history including cardiovascular history and prescribed medication
10. Obtain other pertinent patient history
11. Perform physical exam

### **Treatment and Interventions**

There is no widely available, rapid, confirmatory cyanide blood test. Many hospitals will not be able to rapidly assess cyanide levels. Therefore, 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 significant cyanide exposure signs or symptoms, treat with:

1. 100% oxygen via non-rebreather mask or bag valve mask
2. Collect a pre-treatment blood sample in the appropriate tube for lactate and cyanide levels
3. Administer one of the following medication regimes
  - a. Hydroxocobalamin (the preferred agent)
    - i. Adult: Administer hydroxocobalamin
      1. Initial dose is 5 g administered over 15 minutes slow IV
      2. Each 5 g vial of hydroxocobalamin for injection is to be reconstituted with 200 mL of LR, NS or D5W (25 mg/mL) and administered at 10-15 mL/minute
      3. An additional 5 g dose may be administered with medical consultation.
    - ii. Pediatric: Administer hydroxocobalamin 70 mg/kg (reconstitute concentration is 25 mg/mL)
      4. Each 5 g vial of hydroxocobalamin for injection is to be reconstituted with 200 mL of LR, NS or D5W (25 mg/mL) and administered at 10-15 mL/minute
    - iii. Maximum single dose is 5 g
  - OR
  - b. Sodium thiosulfate
    - i. Adult: Sodium thiosulfate 12.5 g IV (50 mL of 25% solution)
    - ii. Pediatric: Sodium thiosulfate 0.5 g/kg IV (2 mL/kg of 25% solution)
4. If seizure, treat per [Seizures guideline](#)

### **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 the patient ingests cyanide, it will react with the acids in the stomach generating hydrogen cyanide gas. Be sure to maximize air circulation in closed spaces (ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching
3. Do not use nitrites in conjunction with suspected carbon monoxide poisoning as it worsens the hemoglobin oxygen carrying capacity even more than carbon monoxide (CO)
4. Hydroxocobalamin is only agent safe for treatment of cyanide poisoning 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 in possible cyanide and/or carbon monoxide toxicity
2. After hydroxocobalamin has been administered, pulse oximetry levels are no longer accurate
3. If the patient ingests cyanide, it will react with the acids in the stomach generating hydrogen cyanide gas. Be sure to maximize air circulation in closed spaces (ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching
4. Amyl nitrite and sodium nitrite are no longer being used and no longer available in commercial kits

### **Pertinent Assessment Findings**

Early and repeated assessment is essential

## **Quality Improvement**

### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914043 – Exposure-Cyanide

### **Key Documentation Elements**

- Repeat evaluation and documentation of signs and symptoms as the patient's clinical condition may deteriorate rapidly.
- Identification of possible etiology of poisoning.
- Time of symptom onset and time of initiation of exposure-specific treatments.
- Therapy and response to therapy.

### **Performance Measure**

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

## **References**

1. Amyl Nitrite - Medical Countermeasures Database. Chemm.nlm.nih.gov. [https://chemm.nlm.nih.gov/countermeasure\\_amyl-nitrite.htm](https://chemm.nlm.nih.gov/countermeasure_amyl-nitrite.htm). Updated January 2, 2013. Accessed August 28, 2017.
2. Bebartá VS, Tanen DA, Laitret J, Dixon PS, Valtier S, Bush A. Hydroxocobalamin and sodium thiosulfate versus sodium nitrite and sodium thiosulfate in the treatment of acute cyanide toxicity in a swine (*Sus scrofa*) model. *Ann Emerg Med*. 2010;55(4):345-51.

3. Cyanide Poisoning. UpToDate.com. [https://www.uptodate.com/contents/cyanide-poisoning?source=search\\_result&search=cyanide%20and%20pulse%20oximetry&selectedTitle=3~150](https://www.uptodate.com/contents/cyanide-poisoning?source=search_result&search=cyanide%20and%20pulse%20oximetry&selectedTitle=3~150). Updated September 28, 2016. Accessed August 28, 2017.
4. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition. China: McGraw-Hill Education; 2015.
5. Marraffa JM, Cohen V, Howland MA. Antidotes for toxicological emergencies: a practical review. *Am J Health Syst Pharm*. 2012;69(3):199-212.
6. Meridian Cyanokit (package insert). Semoy, France: Merck Santé; [http://www.meridianmeds.com/sites/default/files/pi/CYANOKIT\\_PI.pdf](http://www.meridianmeds.com/sites/default/files/pi/CYANOKIT_PI.pdf). Accessed August 28, 2017.
7. Roderique EJ, Gebre-Giorgis AA, Stewart DH, Feldman MJ, Pozez AL. Smoke inhalation injury in a pregnant patient: a literature review of the evidence and current best practices in the setting of a classic case. *J Burn Care Res*. 2012;Sep-Oct;33(5):624-33.
8. Shepherd G, Velez LI. Role of hydroxocobalamin in acute cyanide poisoning. *Ann Pharmacotherapy*. 2008;42(5):661-9.
9. Thompson JP, Marrs TC. Hydroxocobalamin in cyanide poisoning. *Clin Toxicol (Phila)*. 2012;50(10):875-85.

**Revision Date**

September 8, 2017

## Beta Blocker Poisoning/Overdose

### **Aliases**

Anti-hypertensive

### **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**

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

### **Inclusion Criteria**

1. Patients may present with:
  - a. Bradycardia
  - b. Hypotension
  - c. Altered mental status
  - d. Weakness
  - e. Shortness of breath
  - f. Possible seizures
2. Beta blocker agents examples:
  - a. Acebutolol hydrochloride (Sectral®)
  - b. Atenolol (Tenormin®)
  - c. Betaxolol hydrochloride (Kerlone®)
  - d. Bisoprolol fumarate (Zebeta®)
  - e. Carteolol hydrochloride (Cartrol®)
  - f. Esmolol hydrochloride (Brevibloc®)
  - g. Metoprolol (Lopressor®, Toprol XL®)
  - h. Nadolol (Corgard®)
  - i. Nebivolol (Bystolic®)
  - j. Penbutolol sulfate (Levatol®)
  - k. Pindolol (Visken®)
  - l. Propranolol (Inderal®, InnoPran®)
  - m. Timolol maleate (Blocadren®)
  - n. Sotalol hydrochloride (Betapace®)
3. Alpha/beta-adrenergic blocking agents examples:
  - a. Carvedilol (Coreg®)
  - b. Labetalol hydrochloride (Trandate®, Normodyne®)

### **Exclusion Criteria**

No 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 g/kg) PO
  - a. If risk of rapid decreasing mental status, do not administer oral agent without adequately protecting the airway
2. Check blood glucose level 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: Atropine 1 mg IV q 5 minutes to maximum of 3 mg
  - b. Pediatric: Atropine 0.02 mg/kg (0.5 mg maximum) q 5 minutes, maximum total dose 1 mg
4. Consider fluid challenge (20 mL/kg) for hypotension with associated bradycardia
5. For symptomatic patients with cardiac effects (i.e. hypotension, bradycardia) consider:
  - a. Adult: Glucagon – initial dose 5 mg IVP - this can be repeated in 5-10 minutes for a total of 10 mg
  - b. Pediatric:
    - i. Glucagon 1 mg IVP (25-40 kg) – every 5 minutes as necessary
    - ii. Glucagon 0.5 mg IVP (less than 25 kg) – every 5 minutes as necessary
6. Consider vasopressors after adequate fluid resuscitation (1-2 liters of crystalloid) for the hypotensive patient [see [Shock guideline](#) for pediatric vs. adult dosing]
7. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
8. If seizure, treat per [Seizures guideline](#)
9. If widened QRS (100 msec or greater), consider sodium bicarbonate 1-2meq/kg IV. This can be repeated as needed to narrow QRS

### **Patient Safety Considerations**

1. Transcutaneous pacing may not always capture nor correct hypotension when capture is successful
2. Aspiration of activated charcoal can produce a patient where airway management is nearly impossible. Do not administer activated charcoal to any patients that may have a worsening mental status

## Notes/Educational Pearls

### Key Considerations

1. **Pediatric Considerations:**
  - a. Pediatric patient may develop hypoglycemia from beta blocker overdose therefore it is important to perform glucose evaluation
  - b. A single pill can kill a toddler. It is very important that a careful assessment of medications the toddler could have access to is done by EMS and all suspect medications should be brought into the ED
2. Glucagon has a side effect of increased vomiting at these doses and ondansetron prophylaxis should be considered
3. Atropine may have little or no effect (likely to be more helpful in mild overdoses) - the hypotension and bradycardia may be mutually exclusive and the blood pressure may not respond to correction of bradycardia
4. Propranolol crosses the blood brain barrier and can cause altered mental status, seizure, and widened QRS similar to TCA toxicity

### 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

### Associated NEMSIS Protocol(s) (eProtocol.01)

- 9914215 – Medical-Beta Blocker Poisoning/Overdose

### Key Documentation Elements

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

### Performance Measures

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

## **References**

1. 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;20(3):266-7.
2. Hephherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm*. 2006;63(19):1828-35.
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015.
4. Kerns W 2<sup>nd</sup>. Management of beta-adrenergic blocker and calcium channel antagonist toxicity. *Emerg Med Clin N Am*. 2007;25(2):309–31.
5. Marraffa JM, Cohen V, Howland MA. Antidotes for Toxicological Emergencies. *Am J Health Syst Pharm*. 2012;69(3):199-212.
6. Review. Erratum in. *Am J Health Syst Pharm*. 2008;65(17):1592.
7. Wax PM. b-Blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. *Clinical Toxicology*. 2005;43:131–46.

## **Revision Date**

September 8, 2017

## Bites and Envenomation

### Aliases

Stings

### 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

1. Bites, stings, and envenomations can come from a variety of marine and terrestrial animals and insects causing local or systemic effects
2. Patients may present with toxin specific reactions which may include:
  - a. Site pain
  - b. Swelling
  - c. Muscle pain (hallmark of black widow spider bites)
  - d. Erythema
  - e. Discoloration
  - f. Bleeding
  - g. Nausea
  - h. Abdominal pain
  - i. Hypotension
  - j. Tachycardia
  - k. Tachypnea
  - l. Muscle incoordination
  - m. Confusion
  - n. Anaphylaxis/allergic reactions
3. There is a spectrum of toxins or envenomations and limited EMS interventions that will have any mitigating effect on the patient in the field
  - a. 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 with special consideration to area of envenomation especially crotalid bite

### **Treatment and Interventions**

1. Consider an IV fluid bolus (normal saline or lactated Ringer's) 20 mL/kg up to 2 liters
2. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient [for adult vs. pediatric dosing see [Shock guideline](#)]
3. If seizure, treat per [Seizures guideline](#)
4. Specific therapy for select bites, stings, or envenomation
  - a. Envenomations that are known to antivenom readily available in the USA (e.g. black widow spider, bark scorpions, crotalid snakes, coral snakes)
    - i. For these envenomations, consider transport to hospital that has access to antivenom, if feasible
  - b. Jellyfish (*Medusozoan cnidarians*):
    - i. As there is a significant variety and diversity of Jellyfish, it is important to be familiar with the species and the appropriate treatment for your local aquatic creatures
    - ii. Generally, scrape off any remaining tentacles or nematocysts, then immerse affected body part in hot water (113°F/45°C). Except for certain species of jellyfish (e.g. *Physalia*, a species found in Australian waters) which may have nematocysts activated by vinegar (acetic acid), it may be used to reduce pain due to deactivation of the nematocysts remaining in the skin. Vinegar may also activate the nematocysts of sea nettles and is not recommended after this type of jellyfish exposure.
  - c. Lionfish, scorpionfish, stingray:
    - i. Immerse affected body part in hot water to reduce the pain associated with the toxin
5. Provide adequate analgesia per the [Pain Management guideline](#)

### **Patient Safety Considerations**

1. Do not:
  - a. Apply tourniquets, tight Ace®/crepe bandage, or constricting bands above or below the site of the envenomation
  - b. Incision and/or suction wound to remove toxin
  - c. Apply cold packs or immerse the affected extremity in ice water (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

1. Vinegar has potential to increase pain associated jellyfish sting as it can increase nematocysts discharge in certain species. Providers must be familiar with endemic species and how to best address exposure.

### 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

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914079 – Injury-Bites and Envenomations-Land
- 9914081 – Injury-Bites and Envenomations-Marine

### Key Documentation Elements

- It is helpful to accurately describe the suspect bite or sting source without risking patient or EMS provider
- Only transport source animal or insect if can be done safely in a hard-sided container
- Repeat evaluation and documentation of signs and symptoms as patient clinical conditions may deteriorate rapidly
- Time of symptoms onset and time of initiation of exposure-specific treatments
- Therapy and response to therapy

### Performance Measures

- Offending organism was managed appropriately without secondary exposure
- Appropriate and timely definitive treatment was provided
- Appropriate pain management

## References

1. Acharya RP, Gastmans C, Denier Y. Emergency department triage: an ethical analysis. *BMC Emerg Med.* 2011;11:16.
2. American College of Medical Toxicology, American Academy of Clinical Toxicology, American Association of Poison Control Centers, European Association of Poison Control Centres, International Society on Toxinology, Asia Pacific Association of Medical Toxicology. Pressure immobilization after North American crotalinae snake envenomation. *J Med Toxicol.* 2011;7(4):322-3.
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition.* China: McGraw-Hill Education; 2015.
4. Lavonas EJ, Ruha AM, Banner W, et al. Unified treatment algorithm for the management of crotaline snakebite in the United States: results of evidence-informed consensus workshop. *BMC Emerg Med.* 2011;11:2.
5. Prestwich H, Jenner R. Best evidence topic report. Treatment of jellyfish stings in UK coastal waters: vinegar or sodium bicarbonate? *Emerg Med J.* 2007;24(9):664.

6. Ward N. Evidence-based treatment of jellyfish stings in North America and Hawaii. *Ann Emerg Med.* 2012;60(4):399-414.
7. Weinstein SA, Dart RC, Stables A. Envenomations: an overview of clinical toxicology for the primary care physician. *Am Fam Physician.* 2009;80(8):793-802.

**Revision Date**

September 8, 2017

## Calcium Channel Blocker Poisoning/Overdose

### **Aliases**

Anti-hypertensive

### **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 blockers interrupt 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. Patients may present with:

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

### **Inclusion Criteria**

1. Patients who have may have taken/been administered calcium channel blockers
  - a. Calcium channel blocker examples:
    - i. Amlodipine (Norvasc®)
    - ii. Diltiazem (Cardizem®, Tiazac®)
    - iii. Felodipine
    - iv. Isradipine
    - v. Nicardipine
    - vi. Nifedipine (Adalat CC®, Afeditab CR®, Procardia®)
    - vii. Nisoldipine (Sular®)
    - viii. Verapamil (Calan®, Verelan®)

### **Exclusion criteria**

No 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. Physical exam

### **Treatment and Interventions**

1. Consider activated charcoal without sorbitol (1 g/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: atropine 1 mg IV q 5 minutes to maximum of 3 mg
  - b. Pediatric: atropine 0.02 mg/kg (0.5 mg maximum) q 5 minutes, maximum total dose 1 mg
3. Consider calcium gluconate or calcium chloride
  - a. Calcium gluconate
    - i. Adult: Calcium gluconate 2-6 g slow IVP over 10 minutes
    - ii. Pediatric: Calcium gluconate 60 mg/kg IVP over 10 minutes
  - b. Calcium chloride
    - i. Adult: Calcium chloride 0.5 - 1 g slow IVP (50 mg/minute)
    - ii. Pediatric: Calcium chloride 20 mg/kg (0.2 mL/kg) slow IVP/IO (50 mg/mL)  
Maximum dose 1 g or 10 mL (Calcium gluconate is preferred as Calcium chloride has increased risk of tissue damage in pediatrics)
4. Consider IV fluid bolus (normal saline or lactated Ringer's) 20 mL /kg up to 2 liters
5. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient [see [Shock guideline](#) for adult vs. pediatric dosing]
6. If atropine, calcium, and vasopressors have failed in the symptomatic bradycardia patient, consider
  - a. Adult: Glucagon initial 5 mg then 1 mg every 5 minutes IVP (may require 5-15 mg to see effect)
  - b. Pediatric:
    - i. Glucagon 1 mg IVP (25-40 kg); every 5 minutes as necessary
    - ii. Glucagon 0.5 mg IVP (less than 25 kg); every 5 minutes as necessary
7. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
8. If seizure, consider midazolam (benzodiazepine of choice)
  - a. Adult: Midazolam 0.1 mg/kg IV 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: Midazolam 0.1 mg/kg IV in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg or midazolam 0.2 mg/kg IN to maximum dose of 4 mg

### **Patient Safety Considerations**

Transcutaneous pacing may not always capture nor correct hypotension when capture is successful.

### **Notes/Educational Pearls**

#### **Key Considerations**

1. While most calcium channel blockers cause bradycardia, dihydropyridine class calcium channel blockers (e.g. nifedipine, amlodipine) can cause a reflex tachycardia (torsade de

- pointes) early in the ingestion. The patient can become bradycardic as the intoxication worsens
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 at these doses and ondansetron prophylaxis should be considered
  4. A single pill can kill a toddler. It is very important that a careful assessment of medications the toddler could have access to is done by EMS and suspect medications brought into the ED
  5. Calcium channel blockers can cause many types of rhythms that can range from sinus bradycardia to complete heart block
  6. Hyperglycemia is the result of the blocking of L-type calcium channels in the pancreas. This can help differentiate these ingestions from beta blockers. There may also be a relationship between the severity of the ingestion and the extent of the hyperglycemia
  7. Atropine may have little or no effect (likely to be more helpful in mild overdoses)
    - a. Hypotension and bradycardia may be mutually exclusive and the blood pressure may not respond to correction of bradycardia

#### **Pertinent Assessment Findings**

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

#### **Quality Improvement**

##### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914217 – Medical-Calcium Channel Blocker Poisoning/Overdose

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

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

##### **Performance Measures**

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

## References

1. Ashraf M, Chaudhary K, Nelson J, Thompson W. Massive overdose of sustained-release verapamil: a case report and review of literature. *Am J Med Sci.* 1995;310(6):258-63.
2. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition.* China: McGraw-Hill Education; 2015.
3. Levine M. Critical care management of verapamil and diltiazem overdose with a focus on vasopressors: a 25-year experience at a single center. *Ann Emerg Med.* 2013;62(3):252-8.
4. Levine M, Boyer EW, Pozner CN, et al. Assessment of hyperglycemia after calcium channel blocker overdoses involving diltiazem or verapamil. *Crit Care Med.* 2007;35(9):2071-5.
5. Levine M, Nikkanen H, Pallin DJ. The effects of intravenous calcium in patient are with digoxin toxicity. *J Emerg Med.* 2011;40(1);41-6.
6. Marraffa JM, Cohen J, Howland MA. Antidotes for toxicological emergencies. *Am J Health Syst Pharm.* 2012;69(3):199-212.
7. Shepherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm.* 2006;63(19):1828-35. Review. Erratum in: *Am J Health Syst Pharm.* 2008;65(17):1592.
8. Olsen KR, Erdman AR, Woolf AD, et al. Calcium channel blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. *Clin Toxicol (Phila).* 2005;(7):797-822.
9. Olsen K. What is the best treatment for acute calcium channel blocker overdose? *Ann Emerg Med.* 2013;62(3):259-61.
10. St-Onge M, Anseeuw K, Cantrell FL, et al. Experts consensus recommendations for the management of calcium channel blocker poisoning in adults. *Crit Care Med.* 2017;45(3):e306-15.
11. St-Onge M, Dubé PA, Gosselin S, et al. Treatment for calcium channel blocker poisoning: a systematic review. *Clin Toxicol (Phila).* 2014;52(9):926-44.

## Revision Date

September 8, 2017

## Carbon Monoxide/Smoke Inhalation

### **Aliases**

CO

### **Patient Care Goals**

1. Remove patient from toxic environment.
2. Assure adequate ventilation, oxygenation and correction of hypoperfusion.
3. Consider use of environmental carbon monoxide (CO) monitors on “first in” bags to assist in detection of occult CO toxicity.

### **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 (pulse oximetry less than 94%). A significant reduction in oxygen delivery to tissues and organs occurs with carbon monoxide poisoning. Carbon monoxide is also a cellular toxin which can result in delayed or persistent neurologic sequelae in significant exposures. With any form of combustion (fire/smoke [e.g. propane, kerosene, or charcoal stoves or heaters], combustion engines [e.g. generators, lawn mowers, motor vehicles, home heating systems]), carbon monoxide will be generated. People in a fire may also be exposed to cyanide from the combustion of some synthetic materials. Cyanide toxicity may need to be considered in the hemodynamically unstable patient removed from a fire.

### **Inclusion Criteria**

1. Patients exposed to carbon monoxide may present with a spectrum of symptoms:
  - a. Mild intoxication:
    - i. Nausea
    - ii. Fatigue
    - iii. Headache
    - iv. Vertigo
    - v. Lightheadedness
  - b. Moderate to severe:
    - i. Altered mental status
    - ii. Tachypnea
    - iii. Tachycardia
    - iv. Convulsion
    - v. Cardiopulmonary arrest

### **Exclusion Criteria**

No recommendations

### **Patient Management**

#### **Assessment**

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose patient and re-cover to assure retention of body heat
3. Vital signs including pulse oximetry, temperature, and ETCO<sub>2</sub> if available
4. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and obtain a 12-lead EKG if available



5. Check blood glucose level
6. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
7. Patient pertinent history
8. Patient physical examination

#### **Treatment and Interventions**

1. 100% oxygen via non-rebreather mask or bag valve mask or advanced airway as indicated
2. If seizure, treat per [Seizures guideline](#)
3. Consider transporting patients with severe carbon monoxide poisoning directly to a facility with hyperbaric oxygen capabilities if feasible and patient does not meet criteria for other specialty care (e.g. trauma or burn)

#### **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 and exit scene) to assist with detection of occult CO toxicity
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 an unusual 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. Consider cyanide toxicity if carbon monoxide poisoning is from a fire
4. 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 symptom onset and time of initiation of exposure-specific treatment
4. Response to therapy

#### **Quality Improvement**

##### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914167 – Exposure-Carbon Monoxide
- 9914173 – Exposure-Smoke Inhalation

### **Key Documentation Elements**

- If using an environmental carbon monoxide detector, record the level detected
- Evidence of soot or burns around the face, nares or pharynx
- 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
- Accurate exposure history
  - Time of ingestion/exposure
  - Route of exposure
  - Quantity of medication or toxin taken (safely collect all possible medications or agents)
  - Alcohol or other intoxicant taken
- Signs and symptoms of other patients encountered at same location, if present

### **Performance Measures**

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

### **References**

1. Buckley NA, Juurlink DN, Isbister G, Bennett MH, Lavonas EJ. Hyperbaric oxygen for carbon monoxide poisoning. *Cochrane Database Syst Rev*. 2011 Apr 13;(4): CD002041.
2. *Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department with Acute Carbon Monoxide Poisoning*. ACEP Clinical Policies Subcommittee (Writing Committees) on Carbon Monoxide Poisoning, American College of Emergency Physicians; *Ann Emerg Med*. 2017;69:98-107.
3. Hampson N. Practice Recommendations: the diagnosis, management and prevention of carbon monoxide poisoning. *Am J Respir Crit Care Med*. 2012;186(11):1095-101.
4. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015.
5. Hampson NB. Pulse oximetry in severe carbon monoxide poisoning. *Chest*. 1998;114(4):1036-41.
6. Jones A. Recent advances in the management of poisoning. *Ther Drug Monit*. 2002;24(1):150-5.
7. Touger M, Birnbaum A, Wang J, Chou K, Pearson D, Bijur P. Performance of the RAD-57 pulse co-oximeter compared with standard laboratory carboxyhemoglobin measurement. *Ann Emerg Med*. 2010;56(4):382-8.

### **Revision Date**

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## Opioid Poisoning/Overdose

### **Aliases**

Carfentanil, Dilaudid®, drug abuse, EVZIO®, fentanyl, heroin, hydrocodone, hydromorphone, methadone, morphine, naloxone, Narcan®, opiate, opioid, overdose, oxycodone, Oxycontin®, Percocet®, Percodan®, Suboxone, U-47700, Vicodin®

### **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 exhibiting miosis (pinpoint pupils), decreased mental status, and respiratory depression of all age groups with known or suspected opioid use or abuse.

#### **Exclusion Criteria:**

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

### **Patient Management**

1. Don the appropriate PPE
2. Therapeutic interventions to support the patient's airway, breathing, and circulation should be initiated prior to the administration of naloxone
3. If possible, identify specific medication taken (including immediate release versus sustained release) 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 respiratory depression in a confirmed or suspected opioid overdose
7. Naloxone administration via the intravenous route provides more predictable bioavailability and flexibility in dosing and titration
8. Naloxone administration via the intranasal or intramuscular routes or as a nebulized solution provide additional options of medication delivery
9. If naloxone was administered to the patient prior to the arrival of EMS, obtain the dose and route through which it was administered and, if possible, bring the devices containing the dispensed naloxone with the patient along with all other medications on scene

#### **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 (pulse oximetry less than 94%), hypoglycemia, hypotension, and traumatic head injury
4. Legally prescribed opioids are also manufactured as an adhesive patch for transdermal absorption, and if found, should be removed from the skin

### **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 has respiratory depression from a confirmed or suspected opioid overdose, consider naloxone administration
  - a. 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
  - a. **Adults:** The typical initial adult dose ranges between 0.4-2 mg IV, IM, or ETT or up to a dose of 4 mg IN
  - b. **Pediatrics:** The pediatric dose of naloxone is 0.1 mg/kg IV, IM, IN, or ETT
    - i. Maximum dose of 2 mg IV, IM, or ETT
    - ii. Maximum dose of 4 mg IN
  - c. Naloxone provided to laypersons and non-medical first responders via public access programs or prescriptions may be provided as a pre-measured dose in an auto-injector or nasal spray or as a pre-measured, but variable, dose and/or concentration in a needleless syringe with a mucosal atomization device (MAD) on the hub
  - d. Naloxone auto-injectors contain 0.4 mg/0.4 mL or 2 mg/0.4 mL
    - i. The cartons of naloxone auto-injectors prescribed to laypersons contain two naloxone auto-injectors and one trainer
  - e. Naloxone nasal spray is manufactured in a single-use bottle that contains 4 mg/0.1 mL
  - f. For the intranasal route when naloxone is administered via a needleless syringe (preferably with MAD on the hub), divide administration of the dose equally between the nostrils to a maximum of 1 mL per nostril
  - g. The administration of naloxone can be titrated until adequate respiratory effort is achieved if administered with a syringe IV, IM, IN, or ETT
4. High-potency opioids [see [Key Considerations](#)] may require higher and/or more frequently administered doses of naloxone to reverse respiratory depression and/or to maintain adequate respirations
5. Regardless of the doses of naloxone administered, airway management with provision of adequate oxygenation and ventilation is the primary goal in patients with confirmed or suspected opioid overdose

### **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 therefore the goal is to use the lowest dose as possible to avoid precipitating 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. Some opioids have additional toxic effects (e.g. methadone can produce QT prolongation, and tramadol can produce seizures)
3. Overuse and abuse of prescribed and illegal opioids has led to an increase in accidental and intentional opioid overdoses
4. DEA and Opioids:
  - a. Legally prescribed opioids are controlled under the Drug Enforcement Administration (DEA)
  - b. Opioids have a high potential for abuse, but have an accepted medical use in patient treatment and can be prescribed by a physician
  - c. Frequent legally prescribed opioids include codeine, fentanyl, hydrocodone, morphine, hydromorphone, methadone, morphine, oxycodone, and oxymorphone
  - d. Opioid derivatives, such as heroin, are illegal in the United States
5. 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
6. High-potency opioids:
  - a. Fentanyl is 50-100 times more potent than morphine - it is legally manufactured in an injectable and oral liquid, tablet, and transdermal (worn as a patch) forms however much of the fentanyl adulterating the heroin supply are illegal fentanyl analogs such as acetyl fentanyl
  - b. Carfentanil is 10,000 times more potent than morphine
    - i. It is legally manufactured in a liquid form – however, a powder or tablet is the most common form of this drug that is illegally produced
    - ii. In the concentration in which it is legally manufactured (3 mg/mL), an intramuscular dose of 2 mL of carfentanil will sedate an elephant
  - c. Synthetic opioids (e.g. W-18, are 10,000 times more potent than morphine) – many synthetic opioids are not detectable by routine toxicology screening assays
7. The IN route has the benefit of no risk of needle stick to the provider
8. Patients with opioid overdose from fentanyl or fentanyl analogs may rapidly exhibit chest wall rigidity and require positive end expiratory pressure (PEEP), in addition to multiple and/or larger doses of naloxone, to achieve adequate ventilation

9. PPE that provides additional cutaneous, respiratory, or ocular protection may be considered when providing care in jurisdictions experiencing an increased incidence of overdose from high potency opioids

### **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. Respiratory depression
  - c. 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 (pulse oximetry *less than* 94%), hypercarbia, and aspiration may be increased when other substances such as alcohol, benzodiazepines, or other medications have also been taken by the patient
  - b. **Pediatric Considerations:** 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 may be narcotic dependent and should be monitored closely for seizures

### **Quality Improvement**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914219 – Medical-Opioid Poisoning/Overdose

#### **Key Documentation Elements**

- Rapid and accurate identification of signs and symptoms of opioid poisoning
- Pulse oximetry (oxygen saturation) and, if available, capnometry or capnography
- Blood glucose assessment
- Naloxone dose and route of administration
- Clinical response to medication administration
- Number of doses of naloxone to achieve a clinical response

#### **Performance Measures**

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

### **References**

1. American College of Medical Toxicology and the American Academy of Clinical Toxicology, *Preventing Occupational Fentanyl and Fentanyl Analog Exposure to Emergency Responders*, [http://www.acmt.net/Library/Fentanyl/Position/Fentanyl\\_PPE\\_Emergency\\_Responders .pdf](http://www.acmt.net/Library/Fentanyl/Position/Fentanyl_PPE_Emergency_Responders.pdf). Accessed August 29, 2017.
2. Burns G, DeRienz RT, Baker DD, Casavant M, Spiller HA. Could chest wall rigidity be a factor in rapid death from illicit fentanyl abuse? *Clin Toxicol*. 2016;54(5):420-3.

3. Drug Approval Package, EVZIO (Naloxone hydrochloride) Injection. [Accessdata.fda.gov. https://www.accessdata.fda.gov/drugsatfda\\_docs/nda/2014/205787Orig1s000TOC.cfm](https://www.accessdata.fda.gov/drugsatfda_docs/nda/2014/205787Orig1s000TOC.cfm). Created December 18, 2014. Accessed August 28, 2017.
4. Drugs@FDA: FDA Approved Drug Products. FDA.gov. <https://www.accessdata.fda.gov/scripts/cder/daf/>. New Drug Application (NDA) #208411. Accessed August 28, 2017.
5. Drugs@FDA: FDA Approved Drug Products. FDA.gov. <https://www.accessdata.fda.gov/scripts/cder/daf/>. New Drug Application (NDA) #209862. Accessed August 28, 2017.
6. *Fentanyl: Preventing Occupational Exposure to Emergency Responders*. Atlanta, GA: Centers for Disease Control and Prevention, the National Institute for Occupational Safety and Health; Updated November 28, 2016.
7. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10<sup>th</sup> Edition*. China: McGraw-Hill Education; 2015.
8. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2014 2052-2056
9. Nelson, LS et al. *Goldfrank's Toxicologic Emergencies*, 2014, 559-578
10. Title 21 United States Code (USC) Controlled Substance Act, Section 812. Springfield, VA: US Department of Justice, Drug Enforcement Administration.

**Revision Date:**

September 8, 2017

## Airway Respiratory Irritants

### **Aliases**

Respiratory irritant, airway injury, respiratory injury, chemical respiratory injury, toxic inhalation

### **Patient Care Goals**

Rapid recognition of the signs and symptoms of confirmed or suspected airway respiratory irritants.

### **Patient Presentation**

#### **Inclusion Criteria**

1. Inhalation of a variety of gases, mists, fumes, aerosols, or dusts may cause irritation or injury to the airways, pharynx, lung, asphyxiation, or other systemic effects
2. Inhaled airway/respiratory irritant agents will interact with the mucus membranes, upper and lower airways based on solubility, concentration, particle size, and duration of exposure
3. The less soluble and smaller the particle size of the agent the deeper it will travel into the airway and respiratory systems the inhaled toxic agent will go before reacting with adjoining tissues thus causing a greater delay in symptom onset

#### **Signs and Symptoms**

1. As the type, severity and rapidity of signs and symptom onset depends on agent, water solubility, concentration, particle size, and duration of exposure, the below signs and symptoms are often overlapping and escalating in severity
2. Many airway and respiratory irritant agents have “warning properties” such as identifiable or unpleasant smells or irritation to eyes or airways
3. Some agents do not have clear warning properties and will often have delayed onset of any sign or symptom:
  - a. Unusual odor /smell
  - b. Tearing or itchy eyes
  - c. Burning sensation and burns to the nose, pharynx and respiratory tract
  - d. Sneezing
  - e. General excitation
  - f. Cough
  - g. Chest tightness
  - h. Nausea
  - i. Shortness of breath /dyspnea
  - j. Wheezing
  - k. Stridor
  - l. Dyspnea on exertion
  - m. Dizziness Upper
  - n. Change in voice
  - o. Airway obstruction include laryngospasm and laryngeal edema
  - p. Pulmonary edema (non-cardiogenic)
  - q. Seizures
  - r. Cardiopulmonary arrest
4. High water solubility/highly irritating (oral/nasal and pharynx, particle size greater than 10 micrometers)
  - a. Acrolein



- b. Ammonia
- c. Chloramine
- d. Ethylene oxide
- e. Formaldehyde
- f. Hydrogen chloride
- g. Methyl bromide
- h. Sodium azide
- i. Sulfur dioxide
- 5. Intermediate water solubility (bronchus and bronchiole, particle size 5 to 10 micrometers)
  - a. Chlorine
- 6. Low water solubility/less irritating (alveolar, particle size less than 5 micrometers)
  - a. Cadmium fume
  - b. Fluorine
  - c. Hydrogen sulfide (rotten egg odor; olfactory fatigue)
  - d. Mercury fume
  - e. Mustard gas (also delayed blistering skin manifestations)
  - f. Nickel carbonyl
  - g. Ozone
  - h. Phosgene
- 7. Asphyxia agents (two categories)
  - a. Oxygen deprivation below 19.5% oxygen atmosphere (“simple asphyxiants”)
 

*Any gas that reduces oxygen fraction or displaces oxygen from the inspired air*

    - i. Argon
    - ii. Carbon dioxide
    - iii. Ethane
    - iv. Helium
    - v. Methane
    - vi. Natural gas (e.g. heptane, propane)
    - vii. Nitrogen
    - viii. Nitrogen dioxide (delayed symptom onset)
  - b. Chemical interfering with oxygen delivery or utilization (“chemical asphyxiants”)
    - i. Carbon monoxide [see [Carbon Monoxide/Smoke Exposure guideline](#)]
    - ii. Cyanide [see [Cyanide Exposure guideline](#)]
    - iii. Hydrogen sulfide
- 8. Inhalants of abuse
  - a. These agents or substances are a diverse class of substances that include volatile solvents, aerosols, and gases
  - b. These chemicals are intentionally inhaled to produce a state that resembles alcohol intoxication with initial excitation, drowsiness, lightheadedness, and agitation
  - c. The abusers of these inhaled agents are often called huffers, sniffers, baggers, or snorters
    - i. These individuals often present after inhaling an aerosol or gas with a loss of consciousness and the presence of the aerosol can or residue/paint around or in the mouth, nose, and oral pharynx
  - d. Common household products that are used as inhalants of abuse
    - i. Volatile solvents
      - 1. Paint remover
      - 2. Degreasers

3. Dry-cleaning fluids
4. Gasoline
5. Lighter fluid
6. Correction fluid
7. Felt tip markers
8. Glue
- ii. Cosmetic/paint spray
  1. Deodorant spray
  2. Vegetable oil spray
  3. Fabric protector spray
  4. Spray paint
- iii. Propellants/asphyxiants/nitrous oxide
  1. Propane gas
  2. Balloon tanks (helium)
  3. Computer keyboard cleaner
  4. Ether
  5. Halothane
  6. Chloroform
  7. Butane
  8. Propane
  9. Whipped cream dispensers
9. Riot Control Agents [see [Riot Control Agent guideline](#)]
10. A prototype agent is identified with each region of the effected airway respiratory track for ***mild to moderate exposures***, as severe concentrated exposures of many of these agents overlap in signs and symptoms – the deeper the symptoms are in the respiratory track and the slower the rate of symptom onset the less water soluble the airway respiratory irritant
  - a. Nasal and oral pharynx irritation – highly water-soluble agents (ammonia)
  - b. Bronchial irritation (chlorine)
  - c. Acute pulmonary edema/deep alveolar injury – poorly water soluble (phosgene)
  - d. Direct neurotoxin (hydrogen sulfide)
  - e. Asphyxia agent with additional symptoms (nitrogen dioxide – Silo Filler’s disease)
  - f. Inhalants of abuse (volatile solvents, cosmetics/paints, propellants/asphyxiants/nitrous oxide)
  - g. Riot control agents [see [Riot Control Agents guideline](#)]
  - h. Anticholinesterase inhibitors [see [Acetylcholinesterase Inhibitors guideline](#)]
11. Ammonia
  - a. Immediate detection of unique sharp smell
  - b. Nasal pharyngeal burning/irritation sensation
  - c. Ocular tearing and irritation
  - d. Sneezing
  - e. Altered mental status – Sleepy to agitated
  - f. Cough
  - g. Shortness of breath
  - h. Chest tightness
  - i. Bronchospasm wheezing
  - j. Change in voice
  - k. Upper airway obstruction includes laryngospasm and laryngeal edema
  - l. Corneal burns or ulcers

- m. Skin burns
  - n. Pharyngeal, tracheal, bronchial burns
  - o. Dyspnea/tachypnea
  - p. High concentrations and or protracted exposure may develop non-cardiac pulmonary edema
  - q. Esophageal burns
12. Chlorine
- a. All the above (Ammonia)
  - b. Increased likelihood of the following
    - i. Bronchiole burns
    - ii. Bronchospasm wheezing
    - iii. Non-cardiac pulmonary edema develops within 6 to 24 hours of higher exposures
13. Phosgene
- a. Often have **none** of the above symptoms for first half hour to several hours then are much milder until more severe lower respiratory tract symptoms develop
    - i. Only warning is report of “fresh mowed hay” odor
    - ii. Mild airway irritation or drying
    - iii. Mild eye irritation
    - iv. Fatigue
    - v. Chest tightness
    - vi. Dyspnea/tachypnea
    - vii. Significant delay up to 24 hours for
      - 1. Exertional dyspnea
      - 2. Bronchospasm wheezing
      - 3. Hypoxia
      - 4. Severe non-cardiac pulmonary edema
      - 5. Cardiopulmonary arrest
14. Hydrogen sulfide – A direct neurotoxin and is rapidly absorbed through lung generating systemic effects
- a. Distinctive rotten egg smell which rapidly causes olfactory fatigue/loss of sense of smell
  - b. Cough
  - c. Shortness of breath
  - d. Rapid alternations in cognition or consciousness
  - e. Bronchiole and lung hemorrhage/hemoptysis
  - f. Non-cardiac pulmonary edema
  - g. Hydrogen sulfide is known as the “knock down” gas because of near immediate and sudden loss of consciousness with high concentrations
  - h. Asphyxia
  - i. Death
15. Nitrogen dioxide (also called Silo Filler’s disease)
- a. Heavier than air displacing oxygen from low lying areas and closed spaces causing direct asphyxia
  - b. Low concentrations may cause
    - i. Ocular irritation
    - ii. Cough
    - iii. Dyspnea/tachypnea
    - iv. Fatigue

- c. High concentrations:
  - i. Altered mental status including agitation
  - ii. Cyanosis
  - iii. Vomiting
  - iv. Dizziness
  - v. Loss of consciousness
  - vi. Cardiopulmonary arrest
- 16. Inhalants of abuse (e.g. felt tip markers, spray paint)
  - a. Physical presences of paint or residue on individual from the inhaled agent
  - b. Slurred speech
  - c. Altered mental status (excitation, drowsiness to unconsciousness)
  - d. Loss of consciousness
  - e. Cardiac dysrhythmias
  - f. Cardiopulmonary arrest

### **Patient Management**

1. Don appropriate PPE – respiratory protection critical
2. Remove patient from the toxic environment
  - a. Remove the patient’s clothing that may retain gases or decontaminate if liquid or solid contamination
  - b. Flush irrigated effected/burned areas
3. Rapidly assess the patient’s respiratory status, mental status, and oxygenation
4. Administer (humidified if available) oxygen
5. Establish intravenous access (if possible)
6. Apply a cardiac monitor (if available)
7. Continuous and ongoing patient reassessment is critical

### **Assessment**

1. Make sure the scene is safe as many gases are heavier than air and will build up in low lying areas. This is especially true of hydrogen sulfide and it’s “knock down” effect of the initial unprotected responder and subsequence casualties associated with unprotected rescuers attempting to safe the first downed responder
2. Consider BSI or appropriate PPE
3. Remove patient from toxic environment
4. Decontaminate
5. Assess ABCD and if indicated, expose the patient and then cover the patient to assure retention of body heat
6. Vital signs which include temperature
7. Place cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
8. Check blood glucose Level
9. Monitor pulse oximetry and ETCO<sub>2</sub> for respiratory decompensation
10. Perform carboxyhemoglobin and cyanide device assessment, if available
11. Identify specific suspected agent if possible
12. Pertinent cardiovascular history or other prescribed medications for underlying disease
13. Patient pertinent history
14. Patient physical examination

### **Treatment and Interventions**

1. Assure a patent airway
2. Administer (humidified if available) oxygen and if hypoventilation, toxic inhalation or desaturation noted, support breathing
  - a. Maintain the airway and assess for airway burns, stridor, or airway edema and if indicated, perform intubation early (recommendation to avoid supraglottic airways - cricothyroidotomy may be required in rarer severe cases)
  - b. Non-invasive ventilation techniques.
    - i. 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
    - ii. Use bag-valve-mask (BVM) ventilation in the setting of hypoventilation, respiratory failure or arrest
3. Albuterol 5 mg nebulized (or 6 puffs metered dose inhaler) should be administered to all patients in respiratory distress with signs of bronchospasm either by basic life support BLS or ALS providers. This medication should be repeated at this dose with unlimited frequency for ongoing distress
4. Ipratropium 0.5 mg nebulized should be given up to 3 doses, in conjunction with albuterol
5. Initiate IV access for infusion of lactated Ringer's or normal saline and obtain blood samples in effort to record pre-treatment levels associated with EMS management (e.g. glucose, lactate, cyanide)
6. Fluid bolus (20 mL/kg) if evidence of hypoperfusion
7. If the patient is experiencing significant pain, administer IV/IO analgesics
  - a. Morphine sulfate 0.1 mg/kg IV or IO
  - b. Fentanyl 1 mcg/kg IV or IO
8. Eye irrigation early
9. Treat topical chemical burns [see appropriate [Toxins and Environmental](#) section guideline(s)]
10. In severe respiratory irritation, in particular hydrogen sulfide, with altered mental status and no improvement with removal from the toxic environment, administer oxygen (humidified if available) as appropriate with a target of achieving 94-98% saturation - consider consultation for transfer to a hyperbaric oxygen therapy

### **Medication Administration**

1. If wheezing is present, consider administering inhaled albuterol (2.5-5 mg) as nebulized, or four to eight puffs metered dose inhaler
2. Ipratropium 0.5 mg nebulized should be given in conjunction with albuterol, up to three doses

### **Patient Safety Considerations**

1. Generally, speaking to patients with exposure to highly soluble airway/respiratory irritants you will find that they have self-extricated due to the warning properties such as the smell, rapidity of onset of irritation, and other symptoms
2. The less soluble agents may generate only an odor (e.g. mowed hay smell for Phosgene) symptom and will have delayed serious symptoms such as acute pulmonary edema, hypoxia, and shortness of breath with minimal exertion

## Notes/Educational Pearls

### Key Considerations

1. Airway respiratory irritants can exacerbate underlying reactive airway diseases (e.g. asthma, COPD) and precipitated or exacerbate bronchospasm, respiratory distress, and hypoxia
2. As patients may be off gassing (particularly hydrogen sulfide and hydrogen cyanide) in the back of the transport vehicle, it is recommended to have adequate ventilation of the patient compartment
3. Removal from the toxic environment, oxygen (humidified if available), general supportive therapy, bronchodilators, respiratory support, and time are core elements of care as there are no specific antidotes for any of these inhaled agents with the exception of heavy metals that may be chelated by physicians after agent identification
4. Hydrogen sulfide causes the cells responsible for the sense of smell to be stunned into inaction and therefore with a very short exposure will shut down and the exposed victim will not perceive the smell yet the victim continues to absorb the gas as it is still present
5. Inhaled agents have become popular as a means of committing suicide. If there is some form of suicide signage, hoses, or buckets of substances visible as you arrive at the vehicle or residence, immediately retreat to well ventilated area and don SCBA before opening the vehicle or making entry as these gases may be highly concentrated and potentially lethal to EMS responders
6. Household bathroom, kitchen, and oven cleaners when mixed can generate a varied of these airway respiratory irritants (ammonia, chloramine, and chlorine gas releases are particularly common). A very common exposure is to chloramine, a gas liberated when bleach (hypochlorite) and ammonia are combined. Chloramine then hydrolyzes in the distal airways and alveoli to ammonia and hypochlorous acid
7. Sudden sniffing death can result from a single use of inhalant of abuse
  - a. Some inhalants can cause the heart to beat rapidly and erratically and cause cardiac arrest
  - b. This syndrome most often is associated with abuse of butane, propane and effects of the chemicals in the aerosols

### Pertinent Assessment Findings

1. Patient may describe a specific odor (chlorine swimming pool smell, ammonia smell, fresh mowed hay smell [phosgene]) which may be helpful but should not be relied upon as the human nose is a poor discriminator of scent
2. Respiratory distress (retractions, wheezing, stridor)
3. Decreased oxygen saturation
4. Skin color
5. Neurologic status assessment
6. Reduction in work of breathing after treatment
7. Improved oxygenation after breathing

## Quality Improvement

### Associated NEMESIS Protocol(s) (eProtocol.01)

- 9914033 – Exposure-Airway/Inhalation Irritants
- 9914139 – Medical-Respiratory Distress/Asthma/COPD/Reactive Airway

### **Key Documentation Elements**

- Document key aspects of the exam to assess for a change after each intervention:
  - Respiratory rate
  - Oxygen saturation
  - Use of accessory muscles or tracheal tugging
  - Breath sounds
  - Air entry /stridor
  - Mental status
  - Color
  - Reduction of burning sensation in airway/pharynx

### **Performance Measures**

- Clinical improvement in patient and response to therapy
- Survival rates of victims
- Long term sequelae of the victims
- No EMS providers injured while managing these incidents

### **References**

1. Ainslie G. Inhalational injuries produced by smoke and nitrogen dioxide. *Respir Med*. 1993;87:169–74.
2. Arwood R, Hammond J, Ward GG. Ammonia inhalation. *J Trauma*. 1985;25:444–7.
3. Baydala L, Canadian Paediatric Society, First Nations, Inuit and Métis Health Committee. Inhalant Abuse. *Paediatr Child Health*. 2010;15(7):443–8.
4. Chenuel B, Sonobe T, Haouzi P. Effects of infusion of human methemoglobin solution following hydrogen sulfide poisoning. *Clin Toxicol (Phila)*. 2015;53(2):93-101.
5. Chlorine Toxicity. Emedicine.medscape.com.  
<http://www.emedicine.com/emerg/topic851.htm>. Updated Dec 11, 2015. Accessed August 29, 2017.
6. D’Alessandro A, Kushner W, Wong H, et al. Exaggerated responses to chlorine inhalation among persons with nonspecific airway hyperreactivity. *Chest*. 1996;109:331–7.
7. Douglas WW, Hepper NGG, Colby TV. Silo-filler’s disease. *Mayo Clin Proc*. 1989;64:291–304.
8. Fuller DC, Suruda AJ. Occupationally related hydrogen sulfide deaths in the United States from 1984 to 1994. *J Occup Environ Med*. 2000;42(9):939-42.
9. Gorguner M, Akgun M. Acute Inhalation Injury. *Eurasian J Med*. 2010;42(1):28–35.
10. Guloglu C, Kara IH, Erten PG. Acute accidental exposure to chlorine gas in the Southeast of Turkey: a study of 106 cases. *Environ Res*. 2002;88:89–93.
11. Haouzi P, Chenuel B, Sonobe T. High-dose hydroxocobalamin administered after H2S exposure counteracts sulfide poisoning induced cardiac depression in sheep. *Clin Toxicol (Phila)*. 2015 Jan;51(1): 28-36.
12. Hydrogen Sulfide Toxicity. Emedicine.medcape.com.  
<http://www.emedicine.com/emerg/topic258.htm>. Updated December 29, 2016. Accessed August 29, 2017.
13. Issley S, Lang E. Ammonia Toxicity. Emedicine.medscape.com.  
<http://www.emedicine.com/emerg/topic846.htm>. Updated December 29, 2015. Accessed August 29, 2017.
14. Leduc D, Gris G, Lheureux P, et al. Acute and long term respiratory damage following inhalation of ammonia. *Thorax*. 1992;47:755–7.

15. Lim SC, Yang JY, Jang AS, et al. Acute lung injury after phosgene inhalation. *Korean J Intern Med*. 1996;11:87–92.
16. Mowry JB, Spyker DA, Brooks DE, Zimmerman A, Schauben JL. 2015 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 33rd Annual Report. *Clin Toxicol (Phila)*. 2016;(10):924-1109.
17. Newman LS, Gottschall EB. Toxic Inhalational Lung Injury. In: Albert RK, Spiro SG, Jett JR, ed. *Clinical Respiratory Medicine. 2nd Edition*. Philadelphia, PA: Mosby; 2004:759–64.
18. Phosgene Toxicity. Emedicine.medscape.com. <http://www.emedicine.com/emerg/topic849.htm>. Updated January 30, 2016. Accessed August 29, 2017.
19. Noltkamper D, Burgher SW. Toxicity Phosgene 2006. Available at: <http://www.emedicine.com/emerg/topic849.htm>. Accessed January 26, 2017.
20. Reiffenstein RJ, Hulbert WC, Roth SH. Toxicology of hydrogen sulfide. *Ann Rev Pharmacol Toxicol*. 1992;32:109–34.
21. Sams RN, Carver HW 2nd, Catanese C, Gilson T. Suicide with hydrogen sulfide. *Am J Forensic Med Pathol*. 2013;34(2):81-2.
22. Truscott A. Suicide fad threatens neighbors, rescuers. *CMAJ*. 2008 Aug 12;179(4):312-3.
23. Weinberger B, Laskin DL, Heck DE, et al. The toxicology of inhaled nitric oxide. *Toxicol Sci*. 2001;59:5–16.

### **Revision**

September 8, 2017



## Riot Control Agents

### **Aliases**

CN (Mace®), CS, OC (pepper spray), tear gas, harassing agents, incapacitating agents, chemical crowd control agents, lacrimators

### **Patient Care Goals**

1. Address side effects of exposed individuals
2. Decontamination of affected individuals
3. Minimize effect to provider

### **Patient Presentation**

#### **Inclusion Criteria**

1. Exposure to identifiable agents that are not intended to cause significant injury or fatality

#### **Exclusion Criteria**

1. Exposure to chlorine, phosgene, ammonia or other agents that are intended to cause significant injury or fatality
2. Exposure to an unknown agent

### **Patient Management**

#### **Assessment**

1. Assess scene safety: evaluate for hazards to EMS personnel, patient, bystanders
  - a. Determine riot control agent being used
  - b. Don appropriate PPE
  - c. Determine number of patients
2. Note symptoms exhibited by the exposed individual
3. Examine as appropriate to complaints

#### **Treatment and Interventions**

1. Move affected individuals from contaminated environment into fresh air if possible
2. Remove contaminated clothing as able
3. Have patient remove contact lenses if appropriate
4. Irrigation with water or saline may facilitate resolution of symptoms and is recommended for decontamination of dermal and ocular exposure
5. If patient is in respiratory distress, go to [Respiratory](#) section
6. If patient is wheezing, go to [Bronchospasm guideline](#)
7. For persistent pain of the eye or skin, go to [Topical Chemical Burn guideline](#)
8. Exposed individuals who are persistently symptomatic warrant further evaluation and treatment per local standards

#### **Patient Safety Considerations**

1. Toxicity is related to duration of exposure and concentration of agent used (exposure in non-ventilated space)
2. Patients with pre-existing pulmonary conditions (e.g. asthma, COPD) may be prone to more severe respiratory effects

3. Traumatic injury may result when exposed individuals are in proximity to the device used to disperse the riot control agent (e.g hose/stream under pressure, riot control agent projectile, grenade)

### **Notes/Educational Pearls**

#### **Key Considerations**

1. CN, CS, and OC are the most commonly encountered riot control agents
2. CN, CS and OC have a high safety ratio. All three have a high median lethal concentration (LCt50) and a low median effective concentration (ECt50).
3. Toxicity is related to time of exposure and concentration of agent used (exposure in non-ventilated space).
4. Symptoms that may be experienced after exposure:
  - a. Eyes: tearing, pain, conjunctivitis, blurred vision
  - b. Nose/mouth/throat: rhinorrhea, burning/pain, trouble swallowing, drooling
  - c. Lungs: chest tightness, coughing, choking sensation, wheezing, dyspnea
  - d. Skin: burning, redness, dermatitis
  - e. GI: nausea and vomiting are rare and may be posttussive
5. Symptoms begin within seconds of exposure, are self-limited and are best treated by removing patient from ongoing exposure. Symptoms frequently decrease over time (15-45 minutes) after exposure ends.

### **Pertinent Assessment Findings**

1. Riot control agent used
2. Symptoms of exposed
3. Lung sounds
4. Evidence of other traumatic injuries

### **Quality Improvement**

#### **Key Documentation Elements**

- Type of riot control agent if known
- Symptoms being treated
- Treatment provided
- Response to treatment

#### **Performance Measures**

- Riot control agent identified before making patient contact and providing treatment
- PPE used by responders
- Affected individuals removed from ongoing exposure
- Contaminated clothing and contact lenses removed as able

## **References**

1. Barry JD, Hennessy R, McManus JG Jr. A randomized controlled trial comparing treatment regimens for acute pain for topical oleoresin capsaicin (pepper spray) exposure in adult volunteers. *Prehosp Emerg Care*. 2008 Oct-Dec;12(4):432-7.
2. Dimitroglou Y, Rachiotis G, Hadjichristodoulou C. Exposure to the Riot Control Agent CS and Potential Health Effects: A Systematic Review of the Evidence. *Int. J. Environ. Res. Public Health* 2015, 12(2), 1397-1411.
3. Menezes RG, Hussain SA, Rameez MA, Kharoshah MA, Madadin M, Anwar N, Senthilkumaran S, Chemical crowd control agents. *Med Leg J*. 2016 Mar;84(1):22-5.
4. Riot-control agents. Army.mil.  
<http://www.amedd.army.mil/FileDownloadpublic.aspx?docid=7b262b4c-19a4-4cd5-8f2d-69880a9226b4>. Accessed August 29, 2017.
5. Riot control agents. Fas.org.  
<https://fas.org/nuke/guide/usa/doctrine/army/mmcch/RiotAgnt.htm>. Accessed August 29, 2017.
6. Riot control agents/tear gas. CDC.gov.  
<https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp>. Accessed August 29, 2017.
7. Schep LJ, Slaughter RJ, McBride DI. Riot control agents: the tear gases CN, CS and OC- a medical review. *J R Army Med Corps*. 2015 Jun;161(2):94-9.  
<http://jramc.bmj.com/content/161/2/94.long>. Epub 2013 Dec 30. Accessed August 29, 2017.

## **Revision Date**

September 8, 2017

## Hyperthermia/Heat Exposure

### **Aliases**

Hyperthermia, heat cramps, heat exhaustion, heat syncope, heat edema, heat stroke

### **Definitions**

1. Heat Cramps: are minor muscle cramps usually in the legs and abdominal wall. Patient 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. Patient temperature is usually *greater than* 104°F. When no thermometer is available, it is distinguished from heat exhaustion by altered level of consciousness
4. Heat Syncope: is a transient loss of consciousness with spontaneous return to normal mentation attributable to heat exposure
5. Heat Edema: is dependent extremity swelling caused by interstitial fluid pooling

### **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. Heat syncope
5. Heat edema
6. Stimulant drug abuse
7. Excited delirium [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)]

#### **Exclusion Criteria**

1. Fever from infectious or inflammatory conditions
2. Malignant hyperthermia
3. Serotonin syndrome
4. 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. Confined space
    - i. **Pediatric Considerations:** Children left in cars who show signs of altered mental status and elevated body temperature should be presumed to have hyperthermia
3. Associated Symptoms:
  - a. Cramps
  - b. Headache
  - c. Orthostatic symptoms
  - d. Nausea
  - e. Weakness
  - f. Mental status changes, including
    - i. Confusion
    - ii. Coma
    - iii. Seizures
    - iv. Psychosis
4. Vital signs:
  - a. Temperature - usually 104°F or greater (if thermometer available)
  - b. Skin:
    - i. Flushed and hot
    - ii. Dry or sweaty
    - iii. Signs of first or second degree burns from sun exposure
  - c. 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. Manage airway as indicated.
6. Place on cardiac monitor and record ongoing vital signs and level of consciousness

7. If temperature is greater than 104°F (40°C) or if altered mental status is present, begin active cooling by:
  - a. Ice bath immersion provides the most rapid cooling mechanism but may not be available to EMS - If shivering occurs during cooling:
    - i. Adult:
      1. Midazolam
        - a. 2.5mg IV/IN, may repeat once in 5 minutes
        - OR**
        - b. 5mg IM may repeat once in 10 minutes
      2. Lorazepam
        - a. 1mg IV, may repeat once in 5 minutes
        - OR**
        - b. 2mg IM, may repeat once in 10 minutes
        - c. Diazepam – 2mg IV, may repeat once in 5 minutes
    - ii. Pediatric:
      1. Midazolam (single maximum dose 1mg)
        - a. 0.1mg/kg IV
        - OR**
        - b. 0.2mg/kg IN/IM
        - c. **NOTE**: a 5mg/mL concentration is recommended for IN/IM administration
      2. Lorazepam (single maximum dose 1mg)
        - a. 0.1mg/kg IV/IM
      3. Diazepam
        - a. 0.1 mg/kg IV (maximum single dose 2.5 mg)
        - b. May repeat once, for maximum total IV/IM dose 5 mg
        - OR**
        - c. 0.5mg/kg PR (maximum single dose 10 mg)
        - d. May repeat once for maximum total PR dose 20 mg
  - b. Continually misting the exposed skin with tepid water while fanning the victim (most effective)
  - c. Truncal ice packs may be used, but are less effective than evaporation
  - d. DO NOT apply wet cloths or wet clothing, as they may trap heat and prevent evaporative cooling
8. Cooling efforts should continue until the patient's temperature is less than 102.2°F (39°C) and the patient demonstrates improvement in mental status
9. Establish IV access for patients suffering from heat stroke - give cool fluids at 20 mL/kg boluses and reduce to 10 mL/kg/hr boluses when vitals are stable
10. Monitor for arrhythmia and cardiovascular collapse [see [Cardiovascular](#) section guidelines]
11. Treat seizures, per the [Seizures guideline](#)
12. All patients suffering from life threatening heat illness (including heat stroke) should be transported to the hospital

### **Patient Safety Considerations**

Consider use of physical securing devices [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)] to protect vascular 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
  - a. Environments with temperature *greater than* 90°F and humidity *greater than* 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, or, in the proper circumstances (e.g. endurance exercise events), consider exercise associated hyponatremia (EAH), especially in the patient with altered mental status, normal blood glucose, and normal temperature
6. *Controversy*: shivering may occur while treating heat stroke
  - a. It is uncertain how harmful shivering is to heat stroke patients
  - b. Cooling should be continued until the above temperature and mental status goals are met
  - c. Treat shivering as above
  - d. 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
  - f. Mental status changes without hyperthermia in the correct circumstances could be exercise associated hyponatremia
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

### Associated NEMIS Protocol(s) (eProtocol.01)

- 9914027 – Environmental - Heat Exposure/Heat Exhaustion
- 9914029 – Environmental - Heat Stroke /Heat Exposure

### **Key Documentation Elements**

- Patient assessment includes all types of medication/drug use and detailed past medical history
- Environmental assessment performed
- Cooling interventions considered and implemented
- Decision-making regarding securing devices
- Decision-making regarding monitoring ABCs

### **Performance Measures**

- Blood glucose level obtained.
- Fluids given for hypotension
- Attempts to reduce core temperature
- All decompensations during EMS care reviewed
- **EMS Compass Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia
  - *PEDS-03: Documentation of estimated weight in kilograms.* Frequency that weight or length-based estimate are documented in kilograms

### **References**

1. Bouchama A, Knochel JP. Heat Stroke. *NEJM*. 2002;346(25):1978-88.
2. Bouchama A, Dehbi M, Chaves-Carballo E. Cooling and hemodynamic management in heatstroke: practical recommendation. *Crit Care Lond Engl*. 2007;11(3):R54.
3. The Futility of Orthostatic Measurements. Lifeinthefastlane.com. <http://lifeinthefastlane.com/futility-orthostatic-measurements/>. Published January 14, 2014. Accessed August 9, 2014
4. Heled Y, Rav-Acha M, Shani Y et al. The “Golden Hour” for heatstroke treatment. *Mil Med*, 2004 169(3)184-186
5. Lipman G, Eifling K, Ellis MA, et. al. Wilderness Medical Society practice guidelines for the prevention and treatment of heat-related illness. *Wilderness Environ Med*. 2013;24(4):351-61.
6. Vicario SJ, Okabajue R, Haltom T. Rapid cooling in classic heatstroke treatment: effect on mortality rates. *Am J Emerg Med*. 1986;4(5):394-8.

### **Revision Date**

September 8, 2017



## Hypothermia/Cold Exposure

### **Aliases**

Hypothermia, frost bite, cold induced injuries

### **Patient Care Goals**

1. Maintain hemodynamic stability
2. Prevent further heat loss
3. Rewarm the patient in a safe manner
4. Appropriate management of hypothermia induced cardiac arrest
5. Prevent loss of limbs

### **Patient Presentation**

1. Patients may suffer from hypothermia due to 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
2. Patients may suffer systemic effects from cold (hypothermia) or localized effects (e.g. frostbite)
3. 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
4. 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**

1. Patients without cold exposure  
**OR**
2. 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
  - a. 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
  - b. 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:
  - a. Attention to any associated injury or illness
  - b. Duration of cold exposure
  - c. Ambient temperature
  - d. 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°-24°C – 82.4°- 75.2°F
  - d. Profound: less than 24°C (75.2°F)
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 to cold injury and rescuers have likely had to enter the same environment. Maintain rescuer safety by preventing cold injury to rescuers
2. Manage airway per the [Airway Management guideline](#)
3. 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/blanket. 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
    - i. 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
    - i. Indications for IV access and IV fluids in the mildly hypothermic patient are similar to those of the non-hypothermic patient
    - ii. IV fluids, if administered, should be warmed, ideally to 42°C
    - iii. Bolus therapy is preferable to continuous drip
    - iv. The recommended fluid for volume replacement in the hypothermic patient is normal saline
  - h. If alterations in mental status, consider measuring blood glucose and treat as indicated (treat per [Hypoglycemia](#) or [Hyperglycemia](#) guidelines) and assess for other causes of alterations of mentation
  - i. Transport to a hospital capable of rewarming the patient
4. Moderate or severe hypothermia:
- a. Perform ABCs, pulse checks for patients suffering hypothermia should be performed for 60 seconds, and obtain core temperature if possible for patients exhibiting signs or symptoms of moderate/severe hypothermia
    - i. Core temperatures are best measured by esophageal probe, if one is available, the patient's airway is secured, and the provider has been trained in its insertion and use.
    - ii. If esophageal temperature monitoring is not available or appropriate, use an epitympanic thermometer designed for field conditions with an isolating ear cap
    - iii. Rectal temperatures may also be used, but only once the patient is in a warm environment - 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
    - i. Care must be taken not to hyperventilate the patient as hypocarbia may reduce the threshold for ventricular fibrillation in the cold patient
    - ii. Indications and contraindications for advanced airway devices are similar in the hypothermic patient as in the normothermic patient
  - c. Prevent further heat loss by removing the patient from the environment and 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/blanket. Cover the patient with a vapor barrier and, if available, move the patient to a warm environment
  - 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
    - i. Chemical or electrical heat sources should never be applied directly to the skin
    - ii. Use a barrier between the skin and heat source to prevent burns
    - iii. Forced air warming blankets (e.g. Bair Hugger®) can be an effective field rewarming method if available
  - e. Handle the patient gently
    - i. 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
    - ii. Once in a warm environment, clothing should be cut off (rather than removed by manipulating the extremities)

- iii. 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 blood glucose and treat as indicated (treat per [Hypoglycemia](#) or [Hyperglycemia](#) guidelines) and assess for other causes of alterations of mentation
  - i. Transport as soon as possible to a hospital capable of resuscitation - if cardiac arrest develops consider transport to a center capable of extracorporeal circulation (ECMO) or cardiopulmonary bypass (if feasible)
  - j. Warm the patient compartment of the ambulance to 24°C (75.2°F) during transport
5. Frostbite:
- a. 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.
    - i. If rewarming is feasible and refreezing can be prevented use circulating warm water (37 - 39°C /98.6 - 102°F) to rewarm effected body part, thaw 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.
    - ii. 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. Treat per 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
3. Devices that self-generate heat (e.g. heat packs) that are being utilized during the rewarming process should be wrapped in a barrier to avoid direct contact with the skin and to prevent burns. Available evidence suggests that heat packs with peak temperatures above 45°C (113°F) are most likely to cause burns. In patients who are unresponsive, or unable to recognize a developing injury, please check the area in which the heating pad is placed regularly to ensure no tissue damage occurs.

### **Notes/Educational Pearls**

#### **Key Considerations**

Considerations in cardiac arrest

1. The following are contraindications for initiation of resuscitation in the hypothermic patient:
  - a. Obvious fatal injuries (such as decapitation)
  - b. The patient exhibits signs of being frozen (such as ice formation in the airway)
  - c. Chest wall rigidity such that compressions are impossible
  - d. Danger to rescuers or rescuer exhaustion
  - e. Avalanche victims buried for 35 minutes or longer with airway obstruction by ice or snow

2. Fixed and dilated pupils, apparent rigor mortis, and dependent lividity may not be contraindication for resuscitation in the severely hypothermic patient
3. The mainstay of therapy in severe hypothermia and cardiac arrest should be effective chest compressions and attempts at rewarming
  - Chest compressions should be provided at the same rate as in normothermic patients
4. 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.
  - a. Per the American Heart Association (AHA), 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
  - b. 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
    - i. If defibrillation is unsuccessful and the patient’s core temperature is *less than* 30°C (86°F), do not make further attempts at defibrillation until the core temperature has increased to greater than 30°C (86°F)
    - ii. Continue CPR and attempt to rewarm the patient
  - c. An alternate strategy, per the Wilderness Medical Society’s accidental hypothermia guideline, suggests that if the patient’s core temperature is below 30°C (86°F), attempt defibrillation once, then wait until the patient has been rewarmed at least 1° - 2°C or to 30°C (86°F) before attempting additional shocks. It is noted that the likelihood of successful defibrillation increases with every one-degree increase in temperature
  - d. If defibrillation is unsuccessful and the patient’s core temperature is greater than 30°C (86°F), follow guidelines for normothermic patients
  - e. If available monitors reveal asystole, CPR alone is the mainstay of therapy
  - f. If monitoring reveals an organized rhythm (other than VF or VT) and no pulses are detected, do not start CPR, but continue to monitor
    - i. 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
    - ii. In the case of PEA, the rhythm will deteriorate rapidly to asystole, in which case, CPR should be initiated
    - iii. Given the potential to cause VF with chest compressions, the Alaska guidance offers that it is better to maintain effective cardiac activity than to start CPR and cause VF
5. Manage the airway per standard care in cardiac arrest victims [see [Cardiac Arrest guideline](#)]
  - a. In the absence of advanced airways, ventilate the patient at the same rate as a normothermic patient
  - b. If the patient has an advanced airway, ventilate at half the rate recommended for a normothermic patient to prevent hyperventilation. If ET<sub>CO</sub><sub>2</sub> is available, ventilate to maintain normal ET<sub>CO</sub><sub>2</sub> levels
6. 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 2014 Alaska guidelines and the Wilderness Medical Society’s accidental hypothermia guideline for the management of hypothermic patients advises medications should be withheld until the patient’s core temperature is greater than 30°C (86°F)

- a. Above 30°C (86°F), intervals between medication provision should be doubled until the patient reaches 35°C (95°F), at which time, normal medication intervals may be adopted
7. Upon ROSC, treat per [Adult Post-ROSC guideline](#)
8. 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
  - a. Patients should not be considered deceased until rewarming has been attempted
9. 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

### **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**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914023 – Environmental-Cold Exposure
- 9914031 – Environmental-Hypothermia
- 9914025 – Environmental-Frostbite/Cold Injury

#### **Key Documentation Elements**

- Duration of cold exposure
- Ambient temperature and recent range of temperatures
- Rewarming attempts or other therapies performed prior to EMS arrival
- Patient use of alcohol/drugs

#### **Performance Measures**

- Patient core temperature and means of measurement (when available)
- Presence of cardiac dysrhythmias
- Documentation of associated trauma (when present)
- Blood glucose level obtained
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Hypoglycemia-01: Treatment administered for hypoglycemia.* Measure of patients who received treatment to correct their hypoglycemia
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain

### **References**

1. Alaska Emergency Medical Services. *State of Alaska Cold Injury Guidelines – 2014*. Anchorage, AK: Department of Health and Social Services, Division of Public Health; July 15, 2014 (early release version, provided by Dr. Ken Zafren).

2. Brown DJ, Brugger H, Boyd J, Paal P. Accidental Hypothermia. *NEJM*. 2012;367(2):1930-8.
3. Bureau of Emergency Medical Services. *State of New Hampshire Patient Care Protocols: Hypothermia adult & pediatric*. Concord, NH: New Hampshire Department of Safety. <http://www.nh.gov/safety/divisions/fstems/ems/advlifesup/documents/ptprotocols.pdf>. Effective 2013. Accessed June 11, 2013.
4. Danzl DF. Accidental Hypothermia. In Auerbach PS, ed. *Wilderness Medicine, 6<sup>th</sup> Edition*. Philadelphia, PA: Elsevier; 2012:116-142.
5. Freer L, Imray CHE. Frostbite. In Auerbach PS, ed. *Wilderness Medicine, 6<sup>th</sup> Edition*. Philadelphia, PA: Elsevier; 2012:181-201.
6. Jackson Hole Fire/EMS. *Operations Manual: Hypothermia/frostbite*. Jackson Hole, WY: Teton County. <http://www.tetonwyo.org/fire/docs/Policies/Div17-EMSOperations/Article4-TreatmentProtocols/174.25HypothermiaFrostbite.pdf>. Effective September 2011. Accessed March 15, 2014.
7. Massachusetts Office of EMS. *EMS Statewide Treatment Protocols: Hypothermia/cold emergencies*. Boston, MA: Massachusetts Department of Public Health. <http://www.mass.gov/eohhs/provider/guidelines-resources/clinical-treatment/public-health-oems-treatment-protocols.html>. Effective March 1, 2012. Accessed June 11, 2013.
8. Maine EMS. *Maine EMS Prehospital Treatment Protocols: Hypothermia*. Augusta, ME: Maine Department of Public Safety. [http://www.maine.gov/ems/documents/2013\\_Maine\\_EMS\\_Protocols.pdf](http://www.maine.gov/ems/documents/2013_Maine_EMS_Protocols.pdf). Effective December 1, 2011. Accessed June 11, 2013.
9. McIntosh SE, Hamonko M, Freer L, et al. Wilderness Medical Society guidelines for the prevention and treatment of frostbite. *Wilderness Environ Med*. 2011;22(2):156-66.
10. McIntosh SE, Opacic M, Freer L, et al. Wilderness Medical Society practice guidelines for the prevention and treatment of frostbite: 2014 update. *Wilderness Environ Med*. 2014;25(4):S43-54.
11. Pennsylvania Bureau of Emergency Medical Services. *Pennsylvania Statewide Advanced Life Support Protocols: Hypothermia/cold injury/frostbite*. Harrisburg, PA: Pennsylvania Department of Health. [http://www.portal.state.pa.us/portal/server.pt/community/emergency\\_medical\\_services/14138/ems\\_statewide\\_protocols/625966](http://www.portal.state.pa.us/portal/server.pt/community/emergency_medical_services/14138/ems_statewide_protocols/625966). Effective July 1, 2001. Accessed June 11, 2013.
12. Rhode Island Center for Emergency Medical Services. *Rhode Island Statewide Emergency Medical Services Protocols: Cold exposure – frostbite*. Providence, RI: Rhode Island Department of Health. [http://www.health.ri.gov/publications/protocols/EMSProtocols\\_Aug2011\\_RevisedOnly.pdf](http://www.health.ri.gov/publications/protocols/EMSProtocols_Aug2011_RevisedOnly.pdf). Effective October 1, 2010. Accessed June 11, 2013.
13. Venden Hoek et al. Part 12: cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122;(18 Suppl 3):S829-61.
14. Zafren K, Giesbrecht GG, Danzl DF, et al. Wilderness Medical Society practice guidelines for the out-of-hospital evaluation and treatment of accidental hypothermia: 2014 update. *Wilderness Environ Med*. 2014;25(4 Suppl):S66-85.

### **Revision Date**

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## Drowning

### **Aliases**

Near-drowning, non-fatal drowning, fatal drowning, submersion, immersion

### **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 [Universal 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
  - a. Practice the safest water rescue technique possible, given circumstances on scene
  - b. Evacuate to land or a water craft as soon as possible
  - c. 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 per the [Airway Management guideline](#)
3. Follow [Cardiac Arrest guideline](#) as indicated with consideration of ABC strategy for drowning victims in cardiac arrest
  - a. Initiate 5 rescue breaths followed by 30 chest compressions
  - b. 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, per the [Spinal Care guideline](#)
5. Monitor vital signs including oxygen saturations



6. If O<sub>2</sub> saturations are less than 92%, administer oxygen as appropriate with a target of achieving 94-98% saturation. Consider positive pressure ventilation in patients with signs or symptoms of respiratory difficulty
7. Consider hypothermia, treat per [Hypothermia/Cold Exposure guideline](#)
8. If the victim was involved in underwater diving 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
  - d. Gas mix
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. **Pediatric Considerations:**
  - a. Drowning is a common cause of death in children
  - b. Risk factors for drowning include male gender, age less than 14 yo, 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
  - a. The initial ventilations may be more difficult to achieve as water in the airways may impede alveolar expansion
  - b. 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. Long-standing teaching has suggested that rescuers should always assume c-spine injury in victims of drowning
  - a. 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
  - b. 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**

#### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914093 – Injury-Drowning/Near Drowning
- 9914091 – Injury-Diving Emergencies

#### **Key Documentation Elements**

- Mechanism of injury or history suggesting cervical spine injury
- Submersion time
- Water temperature
- Activities leading to drowning
- Consider a standardized data collection metrics such as the Utstein drowning data reporting elements

#### **Performance Measures**

- Recognition and appropriate care of pulmonary/respiratory complaints
- Cervical spine management when appropriate
- Adherence to [Cardiac Arrest guideline](#)

## **References**

1. Harris M. ABC of resuscitation, near drowning. *BMJ*. 2003;327(7427):1336-8.
2. Idris AH, Berg RA, Bierens J, et al. Recommended guidelines for uniform reporting of data from drowning: The "Utstein Style." *Circulation*. 2003;108(20):2565-74.
3. Layon J, Modell JH. Drowning, update 2009. *Anesthesiology*. 2009;110(6):1390-401.
4. Olshaker J. Submersion. *Emerg Med Clin N Am*. 2004;22(2):357-67.
5. Szpilman D, Bierens JJ, Handley AJ, Orłowski JP. Drowning. *N Engl J Med*. 2012;366(22):2102-10.
6. Vanden Hoek T, Morrison LJ, Shuster M, et al. Part 12: Cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122(18 Suppl 3):S829-61.

## **Revision Date**

September 8, 2017

## Dive (SCUBA) Injury/Accidents

### **Aliases**

Barotrauma, bends, squeeze

### **Patient Care Goals**

1. Rapid assessment and management of life-threatening injuries
2. Rescue from the water-based environment
3. Transport patients suffering from self-contained underwater breathing apparatus (SCUBA) diving injury/illness for hospital evaluation and consideration of repressurization/hyperbaric oxygen therapy (HBOT)

### **Patient Presentation**

#### **Inclusion Criteria**

Patients with history of recent (within 48 hours) SCUBA diving activity who are exhibiting potential signs and/or symptoms of dive related illness/injury, regardless of dive table compliance. NOTE: SCUBA-related complications may occur anywhere, particularly when divers travel by air within 24-hours of diving

#### **Exclusion Criteria**

Patients without history of recent (within 48 hours) 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, depth of dive, compliance with dive tables/decompression stops, gas mixture used, and water temperature (if available)
3. Be alert for signs of barotrauma (pulmonary barotrauma, arterial gas embolism, pneumothorax, ear/sinus/dental barotrauma etc.) and/or decompression sickness (joint pain, mental status change, other neurologic symptoms including paralysis) or nitrogen narcosis (confusion, intoxication).
4. Assess for other associated injury such as injury to the head or spine (if mechanism and symptoms suggest), marine envenomation, hypothermia, or other injury

#### **Treatment and Interventions**

1. If a 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 (patient lying with the left side down, knees drawn upward, and flat)
  - a. Trendelenburg position is sometimes recommended to help trap the air in the dependent right ventricle, and may be useful if a central venous catheter is being used to withdraw the air, but this position may increase cerebral edema
4. Monitor vital signs including oxygen saturations and cardiac rhythm (if possible)

5. Administer oxygen as appropriate with a target of achieving 94-98% saturation
  - a. Use positive pressure ventilation (e.g. CPAP) carefully in patients for whom pulmonary barotrauma is a consideration [see [Airway Management guideline](#)]
6. Patients with symptoms suspicious for decompression illness, should be placed on supplemental oxygen regardless of saturations to enhance washout of inert gasses
7. Assess for hypothermia, 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, and gas mix
9. Establish IV access
10. Fluid bolus as indicated

#### **Patient Safety Considerations**

1. If the patient is still in the water, seek safest and most rapid means of removal safe (within your scope of training) while minimizing risk of further injury
2. Seek assistance early for special rescue/extrication and transportation 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 that the patient is rapidly accessed and safely removed from the water if diver unable to do so themselves
2. If air medical transport is necessary, the patient should be transported with the cabin pressurized to lowest possible altitude. If an unpressurized aircraft is used (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

##### **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**

##### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914211 – Injury-SCUBA Injury/Accidents
- 9914091 – Injury-Diving Emergencies

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

- Water temperature, if available
- Dive history
  - Number of dives in recent history (days)

- “Bottom time” in dives
- Dive profiles
- Maximum depth
- Rate of ascent
- Safety stops utilized, if any
- Dive gas (e.g. air vs. mixed gases such as Nitrox, Heliox or Trimix)
- Timing of onset of symptoms
- History of altitude exposure after diving (air travel)
- Any associated injuries or exposures

### **Performance Measures**

- Recognition and appropriate care of pulmonary/respiratory complaints
- Patient transported to nearest appropriate facility (HBOT if available and indicated)
- Need for HBOT recognized and communicated to receiving facility if indicated

### **References**

1. Doolette DJ, Mitchell SJ. Recreational technical diving part 2: decompression from deep technical dives. *Diving Hyperb Med*. 2013;43(2):96-104.
2. FAA Aeronautical Information Manual - Decompression Sickness after Scuba Diving. <http://www.faraim.org/aim/aim-4-03-14-536.html>. Accessed August 28, 2017.
3. Fock A, Harris R, Slade M. Oxygen exposure and toxicity in recreational technical divers. *Diving Hyperb Med*. 2013;43(2):67–71.
4. Fock AW. Analysis of recreational closed-circuit rebreather deaths 1998-2010. *Diving Hyperb Med*. 2013;43(2):78–85.
5. Gordy S, Rowell S. Vascular Air Embolism. *Int J Crit Illn Inj Sci*. 2013;3(1):73-6.
6. Madden D, Lozo M, Dujic Z, Ljubkovic M. Exercise after SCUBA diving increases the incidence of arterial gas embolism. *J Appl Physiol (1985)*. 2013;115(5):716-22.
7. Mitchell SJ, Doolette DJ. Recreational technical diving part 1: an introduction to technical diving methods and activities. *Diving Hyperb Med*. 2013;43(2):86–93.
8. Muth C-M, Tetzlaff K. [Scuba diving and the heart. Cardiac aspects of sport scuba diving]. *Herz*. 2044;29(4):406–13.
9. Sykes O, Clark JE. Patent foramen ovale and scuba diving: a practical guide for physicians on when to refer for screening. *Extrem Physiol Med*. 2013;2(1):10.
10. Türkmen N, Okan A, Selçuk C, Bülent E, Murat SG, Umit NG. Scuba diver deaths due to air embolism: two case reports. *Soud Léč*. 2013;58(2):26-8.
11. Winkler BE, Muth CM, Kaehler W, Froeba G, Georgieff M, Koch A. Rescue of drowning victims and divers: Is mechanical ventilation possible underwater? A pilot study. *Diving Hyperb Med*. 2013;43(2):72–7.
12. Vann RD, Gerth PJ, Denoble CF, Pieper CF, Thalmann ED. Experimental trials to assess the risks of decompression sickness in flying after diving. *Undersea Hyberb Med*. 2004 Winter;3(4):431-44.

### **Revision Date**

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## Altitude Illness

### **Aliases**

Altitude sickness, High Altitude Cerebral Edema (HACE), High Altitude Pulmonary Edema (HAPE), Acute Mountain Sickness (AMS)

### **Definitions**

1. 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)
2. High altitude pulmonary edema (HAPE): Progressive dyspnea, cough, hypoxia, and weakness in high altitude environments (considered greater than 8000 feet). Patients may or may not exhibit symptoms if acute mountain sickness precedes symptoms of HAPE
3. 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)
4. Feet to meters conversion reference:

Feet	Meters
8000 ft	Approximately 2400 m
7000 ft	Approximately 2100 m
5000 ft	Approximately 1500 m
1000 ft	Approximately 300 m
500 ft	Approximately 150 m

### **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**

1. Patients suffering from altitude illness, including
  - a. Acute mountain sickness
  - b. High altitude pulmonary edema
  - c. High altitude cerebral edema

#### **Exclusion Criteria**

Patients who have not been exposed to altitude.

### **Patient Management**

#### **Assessment**

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
  - a. Patients with acute mountain sickness only may remain at their current altitude and initiate symptomatic therapy
  - b. Patients with HACE or HAPE should initiate descent
3. Perform ABCs and manage airway as necessary
4. Administer supplemental oxygen, if available, with goal to keep oxygen saturations  $\geq 90\%$
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 *greater than* 90 mm Hg
  - c. Monitor cardiac rhythm
6. 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 - 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.
  - a. 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 maximum of 250 mg twice a day
      2. Acetazolamide speeds acclimatization and therefore helps in treating acute mountain sickness
    - iv. Dexamethasone – 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
  - b. HACE - All therapies listed below should be considered as adjunctive to descent. Descent should always be the primary treatment modality
    - i. Dexamethasone – 8 mg IM, IV, or PO once followed by 4 mg every 6 hours
      1. Pediatric dosing: 0.15 mg/kg/dose every 6 hours
      2. 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 therapies listed below should be considered as adjunctive to descent. Descent should always be the primary treatment modality
  - i. Nifedipine – 30 mg ER PO twice a day – If nifedipine is not available:
    1. Tadalafil – 20-40 mg PO once daily may be used

**OR**

    2. Sildenafil – 20 mg PO three times a day may be used
  - ii. Multiple pulmonary vasodilators should not be used concurrently

### **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

#### **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**

#### **Associated NEMSIS Protocol(s) (eProtocol.01)**

- 9914021 – Environmental-Altitude Sickness

#### **Key Documentation Elements**

- Patient's itinerary, including starting altitude, highest altitude gained and rate of ascent
- Presence (or absence) of prophylaxis against altitude (including medications such as acetazolamide, sildenafil)
- Total altitude descended

### **Performance Measures**

- Mechanism of treatment for acute mountain sickness, HACE, or HAPE
- Medical decision-making regarding treatment choice (e.g. weather, inability to descend)

### **References**

1. Barry P, et al. Clinical review: altitude illness. *BMJ*, 2003
2. Bartsch P, Swenseon ER. Acute high-altitude illness. *N Engl J Med*. 2013;368:2294-302.
3. Gallagher SA, Hackett PH. High-altitude illness. *Emerg Med Clin N Am*. 2004;22(2):329-55.
4. Imray C, Wright A, Subudhi A, Roach R. Acute mountain sickness: pathophysiology, prevention and treatment. *Prog Cardiovasc Dis*. 2010;52(6):467-84.
5. Jackson Hole Fire/EMS. *Operations Manual: Altitude illness*. Jackson Hole, WY: Teton County.
6. Luks AM, McIntosh SE, Grissom CK, et al. Wilderness Medical Society consensus guidelines for the prevention and treatment of acute altitude illness. *Wilderness Environ Med*. 2010;25(4 Suppl):S4-14
7. Luks AM, McIntosh SE, Grissom CK, et al. Wilderness Medical Society Practice guidelines for the prevention and treatment of acute altitude illness: 2014 update. *Wilderness Environ Med*. 2014;25(4 Suppl):S4-14.
8. West JB. High-altitude medicine. *Am J Respir Crit Care Med*. 2012;186(12):1229-37.

### **Revision Date**

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## Conducted Electrical Weapon Injury (e.g. TASER®)

### **Aliases**

Tased

### **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 [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)]
2. Make sure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and staff [see [Agitated or Violent Patient/Behavioral Emergency guideline](#)]
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
  - a. 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 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 with assistance of law enforcement to protect the patient and staff. Consider psychologic management medications if patient struggling against physical devices 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. The patient may have underlying pathology before being tased (refer to appropriate 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**

1. Conducted electrical weapon can be discharged in three fashions:
  - a. Direct contact without the use of the darts
  - b. A single dart with addition contact by direct contact of weapon
  - c. From a distance up to 35 feet with two darts
2. 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
3. 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**

1. Thoroughly assess the tased patient for trauma as the patient may have fallen from standing or higher
2. 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**

#### **Associated NEMIS Protocol(s) (eProtocol.01)**

- 9914203 – Injury-Conducted Electrical Weapon (e.g. Taser)

#### **Key Documentation Elements**

- If darts removed, document the removal location in the patient care report
- Physical exam trauma findings
- Cardiac rhythm and changes
- Neurologic status assessment findings

#### **Performance Measures**

- Comprehensive patient documentation as this is a complex patient
- Abnormal findings or vital signs were addressed
- Patient received EKG or 12-lead EKG evaluation
- If indicated, review for appropriate securing technique

## **References**

1. Ho JD, Dawes DM, Buttman LL, Moscati RM, Janchar TA, Miner JR. Prolonged TASER use on exhausted humans does not worsen markers of acidosis. *Am J Emerg Med.* 2009;27(4):413-8.
2. Ho JD, Dawes DM, Cole JC, et al. Corrigendum to “lactate and pH evaluation in exhausted humans with prolonged TASER X26 exposure or continued exertion.” *Forensic Sci Int.* 2009;190(1-3):80-6.
3. Ho JD, Dawes DM, Cole JB, Hottinger JC, Overton KG, Miner JR. Lactate and pH evaluation in exhausted humans with prolonged TASER X26 exposure or continued exertion. *Forensic Sci Int.* 2009;190(1-3):80-6.
4. Ho JD, Dawes DM, Nelson RS, et al. Acidosis and catecholamine evaluation following simulated law enforcement “use of force” encounters. *Acad Emerg Med.* 2010;17(7):e60-8.
5. Ho JD, Dawes DM, Nystrom PC, et al. Markers of acidosis and stress in a sprint versus a conducted electrical weapon. *Forensic Sci Int.* 2013;233(1-3):84-9.
6. *White Paper Report on Excited Delirium Syndrome.* ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009.

## **Revision Date**

September 8, 2017

## Electrical Injuries

### **Aliases**

Electrical burns, electrocution

### **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 - 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 - 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 guideline for additional information and patient assessment/treatment]
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 - remember that external appearance will underestimate the degree of tissue injury

6. Electrical injuries may be associated with significant pain, treat per [Pain Management guideline](#)
7. Electrical injury patients should be taken to a burn center whenever possible since these injuries can involve considerable tissue damage
8. 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**

##### **Associated NEMESIS Protocol(s) (eProtocol.01)**

- 9914095 – Injury-Electrical Injuries

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

- Characteristics of electrical current
- Downtime if found in cardiac arrest
- Positioning of the patient with respect to the electrical source
- Accurate description of external injuries
- Document presence or absence of associated trauma

##### **Performance Measures**

- Confirmation of scene safety
- Documentation of electrical source and voltage if known
- Documentation of cardiac monitoring
- Documentation of appropriate care of associated traumatic injuries



- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMESIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

### **References**

1. Electrical Injuries. Emedicine.medscape.com.  
<http://emedicine.medscape.com/article/433682-overview>. Updated February 8, 2017. Accessed August 29, 2017.
2. Pham TN, Gibran NS. Thermal and electrical injuries. *Surg Clin North Am.* 2007;87(1):185-206.
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September 8, 2017

## Lightning/Lightning Strike Injury

### **Aliases**

Lightning burn

### **Patient Care Goals**

1. Identify patient(s) as lightning strike victim(s)
2. Move to safe area
3. Initiate immediate resuscitation of cardiac arrest victim(s), within limits of mass casualty care, also known as “reverse triage”
4. Cardiac monitoring during transport
5. Treat associated traumatic injuries

### **Patient Presentation**

1. Lightning strikes may happen in a variety of environmental conditions
  - a. Most commonly they occur in outdoor or wilderness circumstances
  - b. 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 recommendations

### **Patient Management**

#### **Assessment**

1. Respiratory
  - a. Apnea
  - b. Agonal respirations
  - c. Respiratory paralysis
2. Cardiovascular
  - a. Dysrhythmias
  - b. Transient hypertension
3. Neurologic
  - a. Seizures
  - b. Confusion
  - c. Paralysis
  - d. Paraplegia
  - e. Vertigo/dizziness
  - f. Parasthesias
  - g. Amnesia
  - h. Memory deficits

- i. Anxiety
- j. Fixed/dilated pupils possible (autonomic dysfunction)
- 4. 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
- 5. Patient may be in full cardiopulmonary arrest or have only respiratory arrest, as injury is a result of DC current
- 6. May have stroke-like findings as a result of neurologic insult
- 7. May have secondary traumatic injury as a result of overpressurization, blast or missile injury
- 8. 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, treat per [Cardiac Arrest 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 from traditional triage practices)
  - a. Patients suffering cardiac arrest from lightning strike initially suffer a combined cardiac and respiratory arrest
  - b. Return of spontaneous circulation may precede resolution of respiratory arrest
  - c. Patients may be successfully resuscitated if provided proper cardiac and respiratory support, highlighting the value of “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

### Associated NEMIS Protocol(s) (eProtocol.01)

- 9914209 – Injury-Lightning/Lightning Strike

### Key Documentation Elements

- Initial airway status
- Initial cardiac rhythm
- Neurologic exam (initial and repeat)
- Associated/secondary injuries
- Pain scale documentation/pain management

### Performance Measures

- Cardiopulmonary issues addressed early and documented appropriately
- Patient transported to closest appropriate facility
- Pain scale documented and treated per guidelines (when appropriate)
- **EMS Compass® Measures** (for additional information, see [www.emscompass.org](http://www.emscompass.org))
  - *Trauma-01: Pain assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-02: Pain re-assessment of injured patients.* Recognizing that pain is undertreated in injured patients, it is important to assess whether a patient is experiencing pain
  - *Trauma-04: Trauma patients transported to trauma center.* Trauma patients meeting Step 1 or 2\* or 3\*\* of the *CDC Guidelines for Field Triage of Injured Patients* are transported to a trauma center
    - \* Any value documented in NEMIS eInjury.03 - Trauma Center Criteria
    - \*\* 8 of 14 values under eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor match Step 3, the remaining 6 value options match Step 4

## References

1. Anderson DR, Gillberg JM, Torrey JW, Koneru JN. Lightning induced inappropriate ICD shock: an unusual case of electromagnetic interference. *Pacing Clin Electrophysiol.* 2012;35(6):e159-62.
2. Arnoldo BD, Purdue GF. The diagnosis and management of electrical injuries. *Hand Clin.* 2009;25(4):469-79.
3. Blumenthal R. Secondary missile injury from lightning strike. *Am J Forensic Med Pathol.* 2012;33(1):83-5.
4. Blumenthal R, Jandrell IR, West NJ. Does a sixth mechanism exist to explain lightning injuries? Investigating a possible new injury mechanism to determine the cause of injuries related to close lightning flashes. *Am J Forensic Med Pathol.* 2012;33(3):222-6.
5. Brunner FX. [Bilateral tympanic membrane perforation caused by a lightning accident]. *HNO.* 1984;32(10):429-30.
6. Centers for Disease Control and Prevention (CDC). Lightning-associated deaths – United States, 1980-1995. *MMWR Morb Mortal Wkly Rep.* 1998 May 22;47(19):391-94.
7. Cherington M, Kurtzman R, Krider EP, Yarnell PR. Mountain medical mystery: unwitnessed death of a healthy young man, caused by lightning. *Am J Forensic Med Pathol.* 2001;22(3):296-8.

8. Cooper MA. Emergent care of lightning and electrical injuries. *Semin Neurol.* 1995;15(3):268-78.
9. Cooper MA. A fifth mechanism of lightning injury. *Acad Emerg Med.* 2002;9(2):172-4.
10. Davis C, Engeln A, Johnson E, et al; Wilderness Medical Society. Wilderness Medical Society practice guidelines for the prevention and treatment of lightning injuries. *Wilderness Environ Med.* 2012;23(3):260-9.
11. Desai BK, Fairclough R. A case of a speech impediment following a near lightning strike. *Int J Emerg Med.* 2011;4:60.
12. Dronacahrya L, Poudel R. Lightning induced atrial fibrillation. *Kathmandu Univ Med J (KUMJ).* 2008;6(24):514-5.
13. Duclos PJ, Sanderson LM, Klontz KC. Lightning-related mortality and morbidity in Florida. *Public Health Rep.* 1990;105(3):276-82.
14. Dundon BK, Puri R, Leong DP, Worthley MI. Takotsubo cardiomyopathy following lightning strike. *BMJ.* 2008;25:460-1.
15. Fontanarosa PB. Electrical shock and lightning strike. *Ann Emerg Med.* 1993;22(2 Pt 2):378-87.
16. Forster SA, Silva IM, Ramos MLC, Gragnani A, Ferreira LM. Lightning burn – review and case report. *Burns.* 2013;39(2):e8–12.
17. Glunčić I, Roje Z, Glunčić V, Poljak K. Ear injuries caused by lightning: report of 18 cases. *J Laryngol Otol.* 2001;115(1):4-8.
18. Guardiola B, Planella M, Ferreruela M, Velasco J, Pérez-Bárcena J, Llopart-Pou JA. [Brain injury secondary to lightning strike]. *Med Intensiva.* 2013;37(5):367-8.
19. Haraldsson PO, Bergstedt M. [Unconsciousness and persistent tinnitus caused by lightning injury to the ear during telephoning]. *Läkartidningen.* 1983;80(19):2024.
20. Hinkelbein J, Spelten O, Wetsch WA. [Lightning strikes and lightning injuries in prehospital emergency medicine. Relevance, results, and practical implications]. *Unfallchirurg.* 2013;116(1):74-9.
21. Jefferiss WR. Three cases of lightning-stroke. *Br Med J.* 1876;1(786):102.
22. Kaliszán M, Karnecki K, Jankowski Z. [A case of fatal lightning stroke at an unusual site – the city center]. *Arch Med Sądowej Kryminol.* 2012;62(3):208-12.
23. Kleinschmidt-DeMasters, BK. Neuropathology of lightning-strike injuries. *Semin Neurol.* 1995;15(4):323-8.
24. Ko SH, Chun W, Kim HC. Delayed spinal cord injury following electrical burns: a 7-year experience. *Burns.* 2004;30(7):691-5.
25. Kubilius D, Rimdeika R. Simultaneous lightning injury in a group of people: case report. *Burns.* 2012;38(3):e9-12.
26. Lane JR. Clinical lecture on injuries from lightning. *Br Med J.* 1872;2(605):114-6.
27. Leiria TLL, Pires LM, Kruse ML, de Lima GG. Struck by lightning: a case of nature-induced pre-excited atrial fibrillation. *Circ Arrhythm Electrophysiol.* 2013;6(2):e20-1.
28. Levy DR, Akiyama T. Lightning-induced ventricular fibrillation. *Cardiology J.* 2007;14(1):91-4.
29. Lichtenberg R, Dries D, Ward K, Marshall W, Scanlon P. Cardiovascular effects of lightning strikes. *J Am Coll Cardiol.* 1993;21(2):531-6.
30. *Lightning Safety Awareness.* Boston, MA: American Meteorological Society; April 29, 2002.
31. Lightning-related Medical Encounters, Active and Reserve Components, U.S. Armed Forces, January 2009-August 2012. *MSMR.* 2012;19(9):18-9.
32. McIntyre WF, Simpson CS, Redfearn DP, Abdollah H, Baranchuk A. The lightning heart: a case report and brief review of the cardiovascular complications of lightning injury. *Indian Pacing Electrophysiol J.* 2010;10(9):429-34.

33. Modayil PC, Lloyd GW, Mallik A, Bowdler DA. Inner ear damage following electric current and lightning injury: a literature review. *Eur Arch Otorhinolaryngol*. 2014;271(5):855-61.
34. Mora-Magaña I, Collado-Corona MA, Toral-Martiñòn R, Cano A. Acoustic trauma caused by lightning. *Int J Pediatr Otorhinolaryngol*. 1996;35(1):59-69.
35. Myung N-S, Lee I-W, Goh E-K, Kong S-K. Cochlear implantation for severe sensorineural hearing loss caused by lightning. *Am J Otolaryngol*. 2012;33(6):767-9.
36. Navarrete N. Severe rhabdomyolysis without renal injury associated with lightning strike. *J Burn Care Res*. 2013;34(3):e209-12.
37. O'Keefe Gatewood M, Zane RD. Lightning injuries. *Emerg Med Clin N Am*. 2004;22(2):369-403.
38. Parsaik AK, Jahlskog JE, Singer W, et al. Central hyperadrenergic state after lightning strike. *Clin Auton Res*. 2013;23(4):169-173.
39. Pedersen ML, Bülent U, Morten NL, Carl P. [Survival following lightning strike and treatment of sequelae]. *Ugeskr Laeger*. 2011;173(15):1138-9.
40. Pfortmueller CA, Yikun Y, Haberkern M, Wuest E, Zimmermann H, Exadaktylos AK. Injuries, sequelae, and treatment of lightning-induced injuries: 10 years of experience at a Swiss trauma center. *Emerg Med Int*. 2012;2012:167698.
41. Russell KW, Cochran AL, Sagar TM, Morris SE, McDevitt MC. Lightning burns. *J Burn Care Res*. 2013;35(6):e436-8.
42. Slesinger TL, Bank M, Drumheller BC, et al. Immediate cardiac arrest and subsequent development of cardiogenic shock caused by lightning strike. *J Trauma*. 2010;68(1):e5-7.
43. Soomaroo L, Murray V. Weather and environmental hazards at mass gatherings. *PLoS Curr*. 2012;4:e4fca9ee30afc4.
44. Thacker MTF, Lee R, Sabogal RI, Henderson A. Overview of deaths associated with natural events, United States, 1979-2004. *Disasters*. 2008;32(2):303-15.
45. Thomson EM, Thomas MH. Lightning injuries in sports and recreation. *Curr Sports Med Rep*. 2013;12(2):120-4.
46. US Lightning Fatalities. Noaa.gov. <http://www.lightningsafety.noaa.gov/fatalities.shtml>. Accessed August 29, 2017.
47. Walsh KM. Lightning and severe thunderstorms in event management. *Curr Sports Med Rep*. 2012;11(3):131-4.
48. Walsh KM, Cooper MA, Holle R, Rakov VA, Roeder WP, Ryan M; National Athletic Trainers' Association. National Athletic Trainers' Association position statement: lightning safety for athletics and recreation. *J Athl Train*. 2013;48(2):258-70.
49. Wankhede AG, Sariya DR. Damage due to lightning when it strikes the face. *Foren Sci Int*. 2013;224(1-3):e1-3.
50. Ward NJ, Little JH, Higgins GL III. Man with confusion and resolved paralysis. Lightning strike injury. *Ann Emerg Med*. 2012;59(4):335, 340.
51. Wiesenthal L, Jacoby A, Davis KP, Campagne D, Snowden B, Hughes S. Lightning safety awareness of visitors in three California national parks. *Wilderness Environ Med*. 2011;22(3):257-61.
52. Zimmermann C, Cooper MA, Holle RL. Lightning safety guidelines. *Ann Emerg Med*. 2002;39(6):660-4.

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### III. Universal Documentation Guideline

#### **Aliases**

NEMSIS, Documentation

#### **Patient Care Goals**

1. Support continuity of patient care and continuous performance improvement (CPI) of patient care through meeting minimum documentation standards for all EMS events where a patient was encountered
2. This guideline defines minimum standards and inclusions used and referenced throughout this document under the “Quality Improvement” section of each guideline
3. The National EMS Information System (NEMSIS) submission requirements, state and local EMS systems, and EMS billing reimbursement services will have more extensive minimum requirements that exceed this guideline
4. This guideline can be used as a starting point for systems looking to more formally define documentation requirements

#### **Patient Presentation**

##### **Inclusion Criteria**

All EMS events where a patient was encountered and one or more clinical guideline was used to determine patient treatment and/or disposition.

##### **Exclusion Criteria**

None

#### **Toolkit for Key Categories of Data Elements**

##### **Incident Demographics**

1. Incident Demographics include the type of incident, location, time, dispatch information, response resources and patient/incident disposition of the EMS event
  - a. This information will always apply and be available, even if the responding unit never arrives on scene (is cancelled) or never makes patient contact
  - b. Incident demographics are important for filtering incident types and outcomes when doing CPI reviews, providing aggregate descriptive data, and billing for reimbursement
2. Minimum Incident Demographic Fields include:
  - a. Incident Times
    - i. eTimes.03 - Unit Notified by Dispatch Date/Time (*NEMSIS mandatory*)
    - ii. eTimes.05 - Unit En Route Date/Time (*Unit responding*)
    - iii. eTimes.06 - Unit Arrived on Scene Date/Time (*If arrived*)
    - iv. eTimes.07 - Arrived at Patient Date/Time (*If patient contact made*)
    - v. eTimes.09 - Unit Left Scene Date/Time (*Unit Transporting Time, if applicable*)
    - vi. eTimes.11 - Patient Arrived at Destination Date/Time (*If applicable*)
    - vii. eTimes.13 - Unit Back in Service Date/Time (*NEMSIS mandatory*)
  - b. eResponse.05 - Type of Service Requested (*e.g. 911 vs interfacility*)
  - c. eResponse.07 - Primary Role of the Unit (*e.g. Transport or non-transport*)
  - d. eDispatch.01 - Complaint Reported by Dispatch (*Dispatch reason from EMD*)
  - e. Crew Responding:

- i. eCrew.01 - Crew Member ID (*Crew name or license # depending on software*)
  - ii. eCrew.02 - Crew Member Level (*License level for this call*)
  - iii. eCrew.03 - Crew Member Response Role (*e.g. Primary or secondary care giver*)
- f. eScene.09 - Incident Location Type
  - i. Used for multiple purposes, including CARES (Cardiac Arrest Registry to Enhance Survival)
- g. Response Modes (*e.g. lights and sirens*)
  - i. eResponse.23 - Response Mode to Scene
  - ii. eResponse.24 - Additional Response Mode Descriptors
- h. Delays:
  - i. eResponse.09 - Type of Response Delay
  - ii. eResponse.10 - Type of Scene Delay

### **Patient Demographics and Medical History**

Patient demographics in this section include the minimum information required for CPI review and do not include protected health information (PHI) or patient identifiable information. Local systems may require additional PHI to support EMS reimbursement and link local level CPI reviews to specific incidents or outcome data.

#### 1. Minimum Patient Demographic and History Fields include:

- a. ePatient.13 - Gender
- b. ePatient.15 - Age
- c. ePatient.16 - Age Units
- d. eHistory.06 - Medication Allergies
- e. eHistory.07 - Environmental/Food Allergies
- f. eHistory.08 - Medical/Surgical History
- g. eHistory.12 - Current Medications
- h. eHistory.17 - Alcohol/Drug Use Indicators
- i. eHistory.01 - Barriers to Patient Care
- j. eExam.01 - Estimated Body Weight in Kilograms
- k. eExam.02 - Length-based Tape Measure

### **Patient Complaints and Symptoms**

1. Patient and situational history for this EMS event generally addresses issues leading up to EMS being requested and include patient complaints, SAMPLE history, signs or symptoms, barriers and confounders, onset times, and trauma and cardiac arrest historical information

#### 2. Patient Complaints, Signs and Symptoms, and Key Related Times:

- a. eSituation.02 - Possible Injury
- b. Patient Complaint Group
  - i. eSituation.03 - Complaint Type
  - ii. eSituation.04 – Complaint
  - iii. eSituation.05 - Duration of Complaint
  - iv. eSituation.06 - Time Units of Duration of Complaint
- c. eSituation.07 - Chief Complaint Anatomic Location
- d. eSituation.08 - Chief Complaint Organ System
- e. Signs and Symptoms
  - i. eSituation.01 - Date/Time of Symptom Onset
  - ii. eSituation.09 - Primary Symptom [Single Choice]
  - iii. eSituation.10 - Other Associated Symptoms [Choose All that Apply]



- f. eSituation.18 - Date/Time Last Known Well (Stroke/CVA)

**Situational History for this EMS Event**

3. SAMPLE History

*NOTE: Although many assessment guidelines refer to this history mnemonic, many electronic patient care report (ePCR) systems do not collect this information in a tool organized specifically in this group, but rather throughout the EMS record in the appropriate areas to the topics*

a. Symptoms

- i. eSituation.09 - Primary Symptom

**AND**

- ii. eSituation.10 - Other Associated Symptoms

b. Allergies

- i. eHistory.06 - Medication Allergies

**AND**

- ii. eHistory.07 - Environmental/Food Allergies

a. Medications

- i. eHistory.12 - Current Medications

b. Past medical and surgical history

- i. eHistory.08 - Medical/Surgical History

c. Last Oral Intake

- i. eHistory.19 - Last Oral Intake (*if software configured to collect*)  
and/or

- ii. eNarrative.01 - Patient Care Report Narrative

d. Events leading to activation of EMS

- i. eSituation.17 - Patient Activity  
and/or

- ii. eNarrative.01 - Patient Care Report Narrative

4. Barriers and Situational Confounders

- a. eHistory.01 - Barriers to Patient Care

- b. eHistory.17 - Alcohol/Drug Use Indicators

5. Stroke

- a. eSituation.18 - Date/Time Last Known Well (Stroke/CVA)

6. Trauma History and Situation

- a. eSituation.02 - Possible Injury (*Yes/No - based on mechanism, not listing an actual injury*)

- b. eInjury.01 - Cause of Injury

- i. Known to providers as *Mechanism of Injury*; values are from ICD-10

- ii. Intent is included where possible in ICD-10, but is no longer a separate field as it was in NEMSIS v2

- c. eInjury.03 - Trauma Center Criteria (*Combined steps 1 and 2 of CDC's "Guidelines for Field Triage of Injured Patients"*)

- d. eInjury.04 - Vehicular, Pedestrian, or Other Injury Risk Factor (*Combined steps 3 and 4 of CDC's "Guidelines for Field Triage of Injured Patients"*)

- e. eInjury.07 - Use of Occupant Safety Equipment

- f. Destination Pre-Arrival Alerts (e.g. trauma alerts)

- i. eDisposition.24 - Destination Team Pre-Arrival Alert or Activation

- ii. eDisposition.25 - Date/Time of Destination Pre-Arrival Alert or Activation

7. Cardiac Arrest History and Situation

NOTE: The following fields meet the needs of Utstein Criteria reports and many of the fields in CARES. CARES has additional custom fields that may be available from your software vendor.

- a. eArrest.01 - Cardiac Arrest [Yes/No]
- b. eArrest.02 - Cardiac Arrest Etiology
- c. eArrest.03 - Resuscitation Attempted By EMS
- d. eArrest.04 - Arrest Witnessed By
- e. eArrest.05 - CPR Care Provided Prior to EMS Arrival
- f. eArrest.06 - Who Provided CPR Prior to EMS Arrival
- g. eArrest.07 - AED Use Prior to EMS Arrival
- h. eArrest.08 - Who Used AED Prior to EMS Arrival
- i. eArrest.09 - Type of CPR Provided
- j. eArrest.11 - First Monitored Arrest Rhythm of the Patient
- k. eArrest.12 - Any Return of Spontaneous Circulation
- l. eArrest.14 - Date/Time of Cardiac Arrest
- m. eArrest.15 - Date/Time Resuscitation Discontinued
- n. eArrest.16 - Reason CPR/Resuscitation Discontinued
- o. eArrest.17 - Cardiac Rhythm on Arrival at Destination
- p. eArrest.18 - End of EMS Cardiac Arrest Event
- q. eScene.02 - Other EMS or Public Safety Agencies at Scene
- r. eScene.03 - Other EMS or Public Safety Agency ID Number
- s. eScene.04 - Type of Other Service at Scene

**Provider Impressions and Incident/Patient Disposition**

- 1. Provider Impressions (Provider Field Working Diagnosis)
  - a. eSituation.11 - Provider's Primary Impression [Single Choice]
    - i. The word "Primary" causes a great deal of understandable confusion with this field, this should be the diagnosis of the most acute (primary) problem *NOT NECESSARILY THE FIRST* problem that was wrong with the patient, or their initial complaint
  - b. eSituation.12 - Provider's Secondary Impressions [Choose all that Apply]
- 2. Incident/Patient Disposition
  - a. eSituation.13 - Initial Patient Acuity (*Intended to be prior to EMS care*)
  - b. eDisposition.19 - Final Patient Acuity (*Intended to be after EMS care*)
  - c. eDisposition.12 - Incident/Patient Disposition
  - d. eDisposition.16 - EMS Transport Method
  - e. Transport Mode (*e.g. use of lights and sirens*)
    - i. eDisposition.17 - Transport Mode from Scene
    - ii. eDisposition.18 - Additional Transport Mode Descriptors
  - f. eDisposition.01 - Destination/Transferred To, Name
    - i. Intended by NEMSIS to be the destination facility or the Agency transferred to, although many ePCR systems only collect this as the destination facility because of the complexity of mixing facilities and services in the same field

## Assessments and Exams

### 1. Exams

By definition, use of NEMSIS eExam fields is optional; they are, however, available for both state and local EMS system use.

- a. Many systems do not require use of these fields as they can be time-consuming to enter, often too detailed (e.g. there is no value for whole arm, it would need to be entered as shoulder, upper arm, elbow, forearm and wrist with separate exam findings for each component, meaning a single exam finding of paralysis for an arm would take ten steps to enter) and the same information is often reflected in the provider's narrative.
- b. However, there *is* some utility in targeted use of these fields for certain situations such as stroke, spinal exams, and trauma without needing to enter all the fields in each record.

### 2. Capacity Assessment Group

This can be used to support documentation of patient capacity for refusal of care and/or transport, participation in advanced spinal assessments, or support for treatment decisions by EMS providers. *NOTE: The Capacity Assessment Group does not provide a legal definition of capacity and should not be used as such. It is intended only to assist the EMS provider in documenting the most basic exam and history findings in order to determine capacity. Many additional factors must be considered when determining capacity including the situation, patient medical history, medical conditions, and consultation with direct medical oversight.*

- a. Barriers and situational confounders [Both only single entry]
  - i. eHistory.01 - Barriers to Patient Care
  - ii. eHistory.17 - Alcohol/Drug Use Indicators
- b. Glasgow Coma Score (GCS) Vitals Group [see **Vitals** section] [serial entries allowed]
- c. eVitals.26 - Level of Responsiveness (AVPU) [serial entries allowed]
- d. eExam.19 - Mental Status Assessment [serial entries allowed]
- e. eExam.20 - Neurological Assessment [serial entries allowed]

### 3. Stroke Assessments

- a. Initial Vitals
- b. eSituation.18 - Date/Time Last Known Well (Stroke/CVA)
- c. Stroke Score Group
- d. eExam.19 - Mental Status Assessment
- e. eExam.20 - Neurological Assessment (*Speech, facial droop, arm drift, unilateral weakness*)
- f. eVitals.31 - Reperfusion Checklist (*May not apply if service area does not use due to lack of consensus on a standard reperfusion checklist, or acceptance by EMS if used*)

### 4. Spinal Injury/Exam

- a. Capacity Assessment Group
- b. Back and Spine Assessment Group
  - i. eExam.13 - Back and Spine Assessment Finding Location
  - ii. eExam.14 - Back and Spine Assessment
- c. Extremity Assessment Group
  - i. eExam.15 - Extremity Assessment Finding Location
  - ii. eExam.16 - Extremities Assessment

### 5. 12-lead EKG Acquisition

- a. eTimes.06 - Unit Arrived on Scene Date/Time
- b. eTimes.07 - Arrived at Patient Date/Time

- c. EKG Rhythm Group [see **Vitals** section]
- d. Attach 12-lead graphic ePCR (through direct integration linkage with EKG monitor or attachment of scanned printout as allowed/available in software)
- e. 12-lead-EKG Procedure-documented under Procedures Performed Group

6. Trauma/Injury

The exam fields have many useful values for documenting trauma (deformity, bleeding, burns, etc.). Use of targeted documentation of injured areas can be helpful, particularly in cases of more serious trauma. Because of the endless possible variations where this could be used, specific fields will not be defined here. Note, however that the exam fields use a specific and useful Pertinent Negative called "Exam Finding Not Present." This can be used to document that the provider actually performed the assessment, but did not find any injury/abnormality.

Vitals

1. Vitals Date/Time Group
  - a. eVitals.01 - Date/Time Vital Signs Taken
  - b. eVitals.02 - Obtained Prior to this Unit's EMS Care
2. Glasgow Coma Score (GCS) Group
  - a. Vitals Date/Time Group
  - b. eVitals.19 - Glasgow Coma Score-Eye
  - c. eVitals.20 - Glasgow Coma Score-Verbal
  - d. eVitals.21 - Glasgow Coma Score-Motor
  - e. eVitals.22 - Glasgow Coma Score-Qualifier
  - f. eVitals.23 - Total Glasgow Coma Score
3. EKG Rhythm Group
  - a. Vitals Date/Time Group
  - b. eVitals.03 - Cardiac Rhythm/Electrocardiography (EKG)
  - c. eVitals.04 - EKG Type
  - d. eVitals.05 - Method of EKG Interpretation
4. Temperature Group
  - a. Vitals Date/Time Group
  - b. eVitals.24 - Temperature
  - c. eVitals.25 - Temperature Method
5. Pain Scale Group
  - a. Vitals Date/Time Group
  - b. eVitals.27 - Pain Scale Score
  - c. eVitals.28 - Pain Scale Type
6. Stroke Score Group
  - a. Vitals Date/Time Group
  - b. eVitals.29 - Stroke Scale Score
  - c. eVitals.30 - Stroke Scale Type
7. Additional Vitals Options
 

All should have a value in the Vitals Date/Time Group and can be documented individually or as an add-on to basic, standard, or full vitals

  - a. eVitals.09 - Mean Arterial Pressure
  - b. eVitals.13 - Pulse Rhythm
  - c. eVitals.15 - Respiratory Effort
  - d. eVitals.16 - End Tidal Carbon Dioxide (ETCO<sub>2</sub>)

- e. eVitals.17 - Carbon Monoxide (CO)
  - f. eVitals.18 - Blood glucose Level
  - g. eVitals.26 - Level of Responsiveness (AVPU)
  - h. Vitals.32 - APGAR
8. Routine Vitals – Includes the following vital signs:
    - a. Vitals Date/Time Group
    - b. Blood Pressure
    - c. eVitals.06 - SBP (Systolic Blood Pressure)
    - d. eVitals.07 - DBP (Diastolic Blood Pressure)
    - e. eVitals.10 - Heart Rate
    - f. eVitals.12 - Pulse Oximetry
    - g. eVitals.14 - Respiratory Rate
    - h. eVitals.26 - Level of Responsiveness (AVPU)
    - i. Pain Scale Group
  9. Initial Vitals
    - a. Routine Vitals
    - b. eVitals.18 - Blood glucose Level
    - c. Glasgow Coma Score (GCS) Group
    - d. Temperature Group
  10. Full Vitals
    - a. Initial Vitals
    - b. eVitals.13 - Pulse Rhythm
    - c. eVitals.15 - Respiratory Effort
    - d. eVitals.16 - End Tidal Carbon Dioxide (ETCO<sub>2</sub>) (*If available and applicable*)
    - e. EKG Rhythm Group (*If available and applicable*)

### **Medications Given**

1. eMedications.01 - Date/Time Medication Administered
2. eMedications.02 - Medication Administered Prior to this Unit's EMS Care
3. eMedications.03 - Medication Given
  - a. Pertinent Negatives (medication qualifiers) allowed
    - i. Contraindication Noted
    - ii. Medication Already Taken
    - iii. Denied By Order
    - iv. Refused
    - v. Medication Allergy
    - vi. Unable to Complete
4. eMedications.04 - Medication Administered Route
5. eMedications.05 - Medication Dosage
6. eMedications.06 - Medication Dosage Units
7. eMedications.07 - Response to Medication [*see Definitions of Medication Response below*]
8. eMedications.08 - Medication Complication
9. eMedications.09 - Medication Crew (Healthcare Professionals) ID (*Name or license #*)
10. eMedications.10 - Role/Type of Person Administering Medication (*License level*)

### **Procedures Performed**

1. eProcedures.01 - Date/Time Procedure Performed
2. eProcedures.02 - Procedure Performed Prior to this Unit's EMS Care

3. eProcedures.03 – Procedure
  - a. Pertinent Negatives Allowed
    - i. Contraindication Noted
    - ii. Refused
    - iii. Denied By Order
    - iv. Unable to Complete
4. eProcedures.04 - Size of Procedure Equipment
5. eProcedures.05 - Number of Procedure Attempts (*This should always be “1” with each attempt at a procedure documented separately with appropriate date/time stamp*)
6. eProcedures.06 - Procedure Successful
7. eProcedures.07 - Procedure Complication
8. eProcedures.08 - Response to Procedure [*see **Definitions for Response to Procedures** below*]
9. eProcedures.09 - Procedure Crew Members ID
10. eProcedures.10 - Role/Type of Person Performing the Procedure
11. eProcedures.13 - Vascular Access Location (*If applicable*)

### **Narrative**

The use of the narrative is essential to an effective and complete Patient Care Record. It summarizes the incident history and care in a manner that is easily digested between caregivers for continuity of care and provides a place for EMS to document facts that do not fit into fixed data fields [see **Narrative** section under **Notes/Educational Pearls** (below) for more detail]

## **Notes/Educational Pearls**

### **Documenting Signs and Symptoms Versus Provider Impressions**

1. Signs and Symptoms
  - a. Signs and Symptoms should support the provider impressions, treatment guidelines and overall care given. A symptom is something the patient experiences and tells the provider; it is subjective. A sign is something the provider sees; it is objective.
  - b. Symptoms should not be confused with provider impressions. The provider impressions are the EMS working field diagnosis of the patient’s actual medical condition.
2. Provider Impressions
  - a. There is often a great deal of confusion on the part of EMS providers about the difference between symptoms and provider impressions. Provider impressions should be *supported* by symptoms but not *be* the symptoms except on *rare* occasions where they may be the same (e.g. weakness when no etiology for the weakness can be determined by the EMS provider).
  - b. Correctly documenting impressions is essential to many aspects of EMS data use, such as EMS reimbursement, reports of incident types, specialty registries (e.g. CARES) and CPI reviews. EMS agencies could *literally lose money or equipment and staffing resources* if the providers are incorrectly entering provider impressions. Addressing this issue should be an essential part of the record Quality Assurance and CPI process and documentation training.
  - c. Example of documenting symptoms versus impressions:
    - i. An opiate overdose patient who received naloxone and had a positive response. This patient would have possible Symptoms of altered mental status, unconscious, respiratory distress, and respiratory failure/apnea. All 4 of these symptoms are available as provider impressions, however the correct impression for this patient would be whatever variation of “Drug Overdose

Opiates or Heroin” impression(s) are setup in the local ePCR system being used. This impression will specifically define the call as an overdose with opiates, rather than a case where one of the symptoms was also used as an impression when the use of naloxone and other assessments and diagnostic tools could not determine an etiology for the symptom(s).

### **Narrative**

The various data fields within the ePCR are important as they provide a means of uniformly entering incident data that can be used for importing into billing software or hospital records, transmitting between EMS systems or creating descriptive reports, or conducting research. In most cases, at a local, state, or national level, if something wasn't documented in the appropriate data field, it didn't happen or exist. However, the Narrative plays several essential roles in the PCR.

#### **1. Role of the Narrative**

- a. Provides an efficient and effective means to share patient information for continuity of care between EMS services and EMS and hospital staff. The narrative summarizes the incident history and care in a manner that is easily digested between caregivers.
- b. Provides a place for EMS to document facts that do not fit into fixed data fields. Specifically, this would include the detailed history of the scene, what the patient may have done or said or other aspects of the call that only the provider saw, heard, or did. The Narrative is the place for the EMS provider to “paint the picture” for all others to more fully understand the incident.
- c. Provides a standard means to add essential details about medical history, exams, treatments, patient response, and changes in patient condition that can't otherwise be effectively or clearly communicated.

#### **2. Narrative Formats**

Documentation by EMS providers demonstrates a wide variation of training and practice reinforcement. Most training programs provide limited instruction on how to properly document operational and clinical processes, and almost no practice. Most providers learn this skill on the job, and often proficient mentors are sparse. Therefore, it is essential that the EMS provider uses a standard format to ensure they are consistent and complete in their documentation. There are three standard formats for EMS documentation. EMS providers should choose the best match for them, master the format, and be consistent in its use.

- a. **Medical Narrative**: This format is the one most new EMS providers use as it is intuitive and easy to learn. Some more experienced providers use it as they find telling the story from start to finish works best to organize their thoughts. A drawback to this method is that it is easy to forget to include facts because of the lack of structure.
- b. **SOAP**: This format stands for **S**ubjective, **O**bjective, **A**ssessment, **P**lan. This is a format that is very common in the medical field.
- c. **CHART**: This format stands for **C**omplaint, **H**istory, **A**ssessment, **R**x (Treatment) and **T**ransport. Each section's content is clearly defined and consistent in format. It minimizes the likelihood of forgetting information and ensures documentation is consistent between records and providers. CHART is the format most recommended as best practice by EMS legal authorities and is considered the standard in many EMS systems. A variation is DCHART, where the “D” stands for **D**ispatch (reason).

### **Medications Given Showing Positive Action Using Pertinent Negatives**

For medications that are required by protocol (e.g. aspirin for cardiac chest pain), *pertinent negatives* should be used to show that a medication protocol was considered but was satisfied by other than provider action.

Example: *EMS is called to a patient for cardiac chest pain. The patient has already taken 324 mg of aspirin by the time EMS arrives per 9-1-1 pre-arrival instructions. EMS providers should document this as a medication given, prior-to-arrival, with the best estimated time, and qualify the medication as "Medication Already Taken" using the pertinent negative.*

### **Definitions for Response to Medications**

1. **Improved:**
  - a. The medication had its intended therapeutic effect and the patient's symptoms decreased or clinical condition improved or resolved (the word "effective" could be generally be substituted for "improved").
  - b. If a patient had the intended therapeutic response to the medication, but a side effect that caused a clinical deterioration in another body system, then "Improved" should be chosen and the side effects documented as a complication (e.g. nitroglycerin improved chest pain but dropped the blood pressure).
2. **Unchanged:**
  - a. The medication was ineffective and had no intended therapeutic effect or had a sub-therapeutic and unnoticeable effect,  
AND
  - b. The patient condition did not deteriorate.
3. **Worse:**
  - a. The patient condition deteriorated or continued to deteriorate because either the medication:
    - i. Was ineffective and had no intended therapeutic effect;  
**OR**
    - ii. Had a sub-therapeutic effect that was unable to stop or reverse the decline in patient condition;  
**OR**
    - iii. Was the wrong medication for the clinical situation and the therapeutic effect caused the condition to worsen (e.g. giving glucose to a patient with hyperglycemia/diabetic ketoacidosis).

### **Definitions for Response to Procedures**

1. **Not Applicable:**

The nature of the procedure has no direct expected clinical response (e.g. patient assessment, 12-lead EKG acquisition).
2. **Improved:**
  - a. The procedure performed had the intended effective outcome and/or the patient's symptoms decreased or clinical condition improved or resolved (e.g. defibrillation resolved VF into a perfusing rhythm; intubation controlled the airway and allowed effective management of breathing).
  - b. An effective procedure that caused an improvement in the patient condition may also have resulted in a procedure complication and the complication should be documented



(e.g. intubation caused minor airway trauma, but the intubation successfully secured the airway).

3. Unchanged:

a. The procedure performed did not have the clinical effect intended, but did not directly worsen the patient's symptoms or clinical condition (e.g. attempted defibrillation and the person remained in VF);

**or**

b. Had a sub-therapeutic effect and the symptoms continued (e.g. a bandage applied to a bleeding wound failed to stop the bleeding);

**or**

c. The nature of the procedure has no direct expected clinical response (e.g. patient assessment).

*NOTE: "Not Applicable" would also be appropriate to choose for these cases*

4. Worse:

a. The results of the procedure performed lead to a worsening of the patient's symptoms or condition (e.g. defibrillation converted VF into asystole, application of a splint caused significant increase in pain or loss of sensation and pulses).

b. In the case of worsening condition, documentation of the procedure complications may also be appropriate.

c. NOTE: Just because a patient got worse, doesn't necessarily mean the provider performed the procedure incorrectly.

**NEMSIS Data Standards and Limitations**

1. NEMSIS is a national dataset and standard used by all EMS software systems. Currently there are three versions of the data standard available for documentation and in which data is stored:

a. NEMSIS Version 2.2.1 (v2.2.1)

i. Adopted in 2006, there have been no changes since release

ii. Most states or systems have used this standard since its release, and the majority of most states' data available since approximately 2016 is in this format.

iii. NEMSIS accepted v2.2.1 data through 12/31/2016, and some states may continue to collect data in this standard until they transition to NEMSIS v3 standards.

b. NEMSIS Version 3 (v3)

i. NEMSIS v3 was created and finalized in 2011 to replace v2.2.1 in order to allow the dataset to become more flexible for updates and adopt technical standards making linkage to other health records possible.

a. NEMSIS v3.3.4 was released in March 2014 and was the first version in production where live data was collected by services and states and subsequently submitted to NEMSIS. NEMSIS will continue to accept v3.3.4 data until 12/31/2017.

b. NEMSIS v3.4, released in March 2015, included both changed elements and many added values to existing elements. NEMSIS has been accepting data from this version concurrently with V3.3.4 data. As of 01/01/2018, v3.4 will be the only standard and V3.3.4 will be phased out. All documentation guidelines found in this document are based on the NEMSIS v3.4 dataset and standard.

2. Mandatory and Required Elements
  - b. *Mandatory*: NEMSIS makes certain elements or fields mandatory so, if not included, the record cannot be properly stored or moved electronically. These fields require real data and do not accept Nil (Blank) values, Not Values, or Pertinent Negatives.
  - c. *Required*: NEMSIS requires these elements or fields to be completed or the record cannot be properly stored or moved electronically. However, required fields allow Nil (blank) values, Not Values, or Pertinent Negatives to be entered and submitted.
  - d. State and local systems may have Mandatory or Required fields that are not Mandatory or Required by NEMSIS. The manager for these systems should be contacted for a list of these fields.
3. Not Values, Nil, and Pertinent Negatives
  - b. Not Values (NV), Nil, and Pertinent Negatives (PN) are values that are attributes of certain NEMSIS elements designed to clarify a null data entry or qualify data entry into the element with which the NV, Nil, or PN is associated.
  - c. Not Values available are “Not Applicable” and “Not Recorded”
    - i. Some NEMSIS rules require one of these values to be entered when data is imported/exported if there is no other data in a field (e.g. at least one medications given must have a value, if no medications are given, then the software system must insert “Not Applicable” in the medications field when exporting)
    - ii. At times the EMS provider use of “Not Applicable” is appropriate documentation (e.g. using “Not Applicable” under *eInjury.03 - Trauma Center Criteria*, which combines step 1 and 2 of CDC’s Guidelines for Field Triage of Injured Patients, when transporting a patient with a simple sprained ankle)
  - d. Nil Values are blank values
    - i. Values can be left blank, which can either be an accidental or purposeful omission of data.
    - ii. Value fields can appropriately and purposefully be left blank if there was nothing to enter (e.g. a procedure field left blank if no patient was encountered).
  - e. Pertinent Negatives are attributes or qualifiers for both elements and fields. There are 11 possible Pertinent Negative values and the available list for each field varies as appropriate to the field. Two examples of the use of Pertinent Negatives are:
    - i. Documenting non-administration of aspirin for chest pain by the EMS provider with the Pertinent Negative of “Medication Already Taken” to show evidence that this treatment requirement was met.
    - ii. Documenting assessment of, and lack of a gunshot wound to the chest with the qualifier of “Chest --> gunshot wound --> Exam Finding Not Present” in the examination section (previously you could only document a positive finding of a gunshot wound with was no way to document that you looked and did not find one).
4. NEMSIS Element and Value Name Formats
  - b. NEMSIS Elements/Fields are organized into groups with other related elements/fields
    - i. There are two parent datasets: Demographic (designated by a “d”) and EMS (designated by an “e”). The majority of the documentation in any ePCR falls in the “e” section. The Demographic dataset is intended to be descriptive of the EMS agencies and system characteristics for correlation at a larger research level, rather than for use in operational CPI reviews.

- ii. The element numbering structure reflects the dataset and the text group name of the element
- 5. Example: “eVitals.06 - SBP (Systolic Blood Pressure)” where “e” is the EMS dataset and “Vitals” is the dataset grouping for all elements related to Vitals and the number is the number assigned to a specific element.
  - b. “eVitals.06” is used to store the data in the background and “SBP (Systolic Blood Pressure)” is what providers and reviewers see.
  - c. Values are designated by a code and text name.
    - i. The codes are generally derived from various sources such as ICD-10, SNOMED, or RxNorm and are used to store and move the data in the system’s background.
    - ii. Codes are not seen by the EMS provider in the ePCR, but rather the provider will see text names.
      - Some software systems allow the visible text name to be modified or relabeled to meet local standards or nomenclature; This feature can help improve data quality by making documentation easier for the provider.
    - iii. An example of a value code and name for cardiac chest pain, found under the element “eProtocols.01 - Protocols Used” is “9914117 – Medical-Cardiac Chest Pain”.
  - d. All minimum general documentation guideline requirements are identified using the NEMESIS element, values codes, and names to allow application across a variety of ePCR software labels for these fields.
- 6. Custom Elements/Fields and Values
  - b. The NEMESIS Standard provides a data format for software vendors to create custom elements or values requested by states or local systems.
  - c. States or local systems may create new elements or value extensions for existing NEMESIS elements to meet regional needs (e.g. adding additional protocol name values not on the NEMESIS list).

### **Airway Confirmation Fields**

Specific use of the NEMESIS airway confirmation fields in documentation will not be detailed at this time due to current operational and technical challenges all states, local systems, and ePCR software vendors are experiencing.

The NEMESIS airway confirmation fields were closely modeled on the “Recommended Guidelines for Uniform Reporting of Data from Out-of-Hospital Airway Management: Position Statement of the National Association of EMS Physicians” and the fields and values could provide excellent and appropriately useful data to evaluate airway management. However, the technical structure of the fields has made their practical use limited as all the data is collected as a separate, self-contained group, rather than as part of the procedures group. This means EMS providers would need to enter much of the same information twice in the ePCR, in both the procedures area and airway confirmation section (when, who did it, what device was used, and complications).

Furthermore, the airway group can only be entered once per ePCR, so the fields cannot be used again if more than one airway was required (e.g. one airway became ineffective and needed to be replaced with a different type of airway). Many states and ePCR software vendors have been struggling with how to make these fields functional for use by only using a portion of them or

looking to add mirrored custom values that are directly linked to procedures performed. However, solutions are currently far from practical, functional, effective, or uniform in how they are being implemented or used across various systems.

### **References**

1. National Association of EMS Officials, Data Managers Council. Extended data definitions, NEMSIS Version 3.4.0.  
[https://www.nasemso.org/Councils/DataManagers/documents/Extended-Data-Definitions\\_v3\\_Final.pdf](https://www.nasemso.org/Councils/DataManagers/documents/Extended-Data-Definitions_v3_Final.pdf). Published May 2016.
2. National EMS Information System Technical Assistance Center. NEMSIS data dictionary, NHTSA v3.4.0, Build 160713 Critical Patch 2, EMS Data Standard.  
[https://nemsis.org/media/nemsis\\_v3/release-3.4.0/DataDictionary/PDFHTML/DEMEMS/NEMSISDataDictionary.pdf](https://nemsis.org/media/nemsis_v3/release-3.4.0/DataDictionary/PDFHTML/DEMEMS/NEMSISDataDictionary.pdf). Updated July 13, 2016.
3. Wang HE, Domeier RM, Kupas DF, Greenwood MJ, O'Connor RE. Recommended guidelines for uniform reporting of data from out-of-hospital airway management: position statement of the national association of EMS physicians. *Prehosp Emerg Care* 2004;8(1):58-72.

### **Revision Date**

September 8, 2017

## IV. 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, July 15, 2014, July 2017 and August 2017. Additional references include the 2015 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, position statements from the American Academy of Clinical Toxicology and the European Association of Poison Control Centers (<http://clintox.org/documents/positionpapers/Cathartics.pdf>), and the article: Rodrigo GJ, Pollack CV, Rodrigo C, Rowe BH. Heliox for non-intubated acute asthma patients. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD002884.

**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.

### Medication List

#### **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 > 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

### **Helium Gas Mixture**

**Name** – Heliox®

**Class** - Optional method of oxygen delivery

**Pharmacology** - Less resistant than atmospheric air which may reduce the patient's work of breathing by increasing tendency to laminar flow and reducing resistance to turbulent flow

**Indications** – Persistent or severe bronchospasm in non-intubated patients with obstructive airway disease or pediatric patients with croup that is unresponsive to all other evidence-based medical interventions.

**Contraindications** - None

### **Hydralazine**

**Name** – No listed brand name

**Class** – Vasodilator

**Pharmacology** – Direct vasodilator at the level of arterioles, with little effect on veins. Decreases systemic resistance.

**Indications** – Severe hypertension with pre-eclampsia symptoms

**Contraindications** – Hypersensitivity, coronary artery disease, mitral valve rheumatic heart disease. Use with caution in CVA, known renal disease, hypotension

### **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

### **Hydromorphone**

**Name** - Dilaudid®

**Class** – Synthetic opiate, opioid analgesic

**Pharmacology** - 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

### **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 cyclooxygenase (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.

### **Isopropyl Alcohol**

**Name** – No brand name available

**Class** – Secondary alcohol

**Pharmacology** – In addition to traditional role as antiseptic, may be used as antiemetic

**Indications** – Nausea and vomiting

**Contraindications** - None

### **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

### **Ketoralac**

**Name** - Toradol®

**Class** – Non-steroidal anti-inflammatory drug (NSAID)

**Pharmacologic Action** - Inhibits synthesis of prostaglandins in body tissues by inhibiting at least 2 cyclooxygenase (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

### **Labetalol**

**Name** - Trandate®

**Class** – Beta blockers, alpha activity

**Pharmacology** - Nonselective beta blocker with intrinsic sympathomimetic activity; also alpha blocker

**Indications** - severe hypertension with pre-eclampsia symptoms

**Contraindications** - Asthma or obstructive airway disease, severe bradycardia, second-degree or third-degree heart block (without pacemaker), cardiogenic shock, bronchial asthma, uncompensated cardiac failure, hypersensitivity, sinus bradycardia, sick sinus syndrome without permanent pacemaker; conditions associated with prolonged and severe hypotension. Use with caution in patients taking calcium channel blockers. Hypotension with or without syncope may occur; monitor. Consider pre-existing conditions, such as, sick sinus syndrome before initiating therapy. Use caution in patients with history of severe anaphylaxis to allergens; patients taking beta-blockers may become more sensitive to repeated challenges; treatment with epinephrine in patients taking beta-blockers may be ineffective or promote undesirable effects. Use with caution in patients with myasthenia gravis, psoriasis, or psychiatric illness (may cause or exacerbate CNS depression)

### **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 1st, 2nd, or 3rd 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®, MSO4

**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.[6] 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

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**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-HT<sub>3</sub> antagonist

**Pharmacologic Action** - Mechanism not fully characterized; selective 5-HT<sub>3</sub> receptor antagonist; binds to 5-HT<sub>3</sub> 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®, Sinares 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

## V. Approved Abbreviations

The following is the Project’s list of approved medical abbreviations used in this document. The Drug.com article “Medical Abbreviations on Pharmacy Prescriptions” at <https://www.drugs.com/article/prescription-abbreviations.html> is considered the reference of authority.

Abbreviation	Description
ACS	acute coronary syndrome
AED	automatic external defibrillator
A-FIB	atrial fibrillation
ALS	advanced life support
AMS	altered mental status
ASA	aspirin
AV	atrioventricular
AVPU	neurological status measure: alert, verbal, pain, unresponsive
BiPAP	bi-level positive airway pressure
BLS	basic life support
BP	blood pressure
BPM	beats per minute
BSA	body surface area
BSI	body substance isolation
BVM	bag-valve-mask
CABG	coronary artery bypass graft
CAD	coronary artery disease
CARES	Cardiac Arrest Registry to Enhance Survival
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
CPI	continuous performance improvement
CPR	cardiopulmonary resuscitation

Abbreviation	Description
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
ECPR	extracorporeal cardiopulmonary resuscitation
EEG	electroencephalogram
EENT	eye, ear, nose, and throat
EGD	extraglottic device
EKG	electrocardiogram
EMS	emergency medical services
EMT	emergency medical technician
ePCR	electronic patient call/care record/report
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)
HFNC	high flow nasal cannula
HR	heart rate (hour)
ICU	intensive care unit
IM	intramuscular
IO	intraosseous

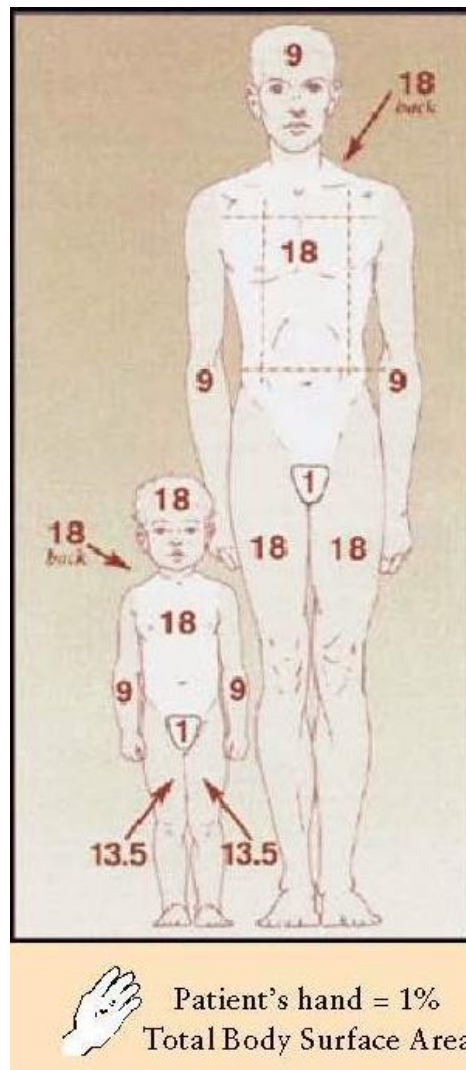
Abbreviation	Description
IPPB	intermittent positive pressure breathing
IV	Intravenous
IVP	intravenous push
J	joules
JVD	jugular vein distension
kg	kilogram
KVO	keep vein open
L	liter
LMA	laryngeal mask airway
LPM	liters per minutes
LR	lactated Ringer's
MAT	multifocal atrial tachycardia
mcg	microgram(s)
MED	medicine
mg	milligram(s)
mg/dL	milligrams per deciliter
MI	myocardial infarction (heart attack)
mL	milliliter
mmHg	millimeters of mercury
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
PCR	Patient call/care record/report
PE	pulmonary embolus



Abbreviation	Description
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
RSI	rapid sequence intubation
Rx	medicine
sat	saturation
SBP	systolic blood pressure
SC	subcutaneous
SCBA	self-contained breathing apparatus
SCUBA	self-contained under-water breathing apparatus
SGD	supraglottic device
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)

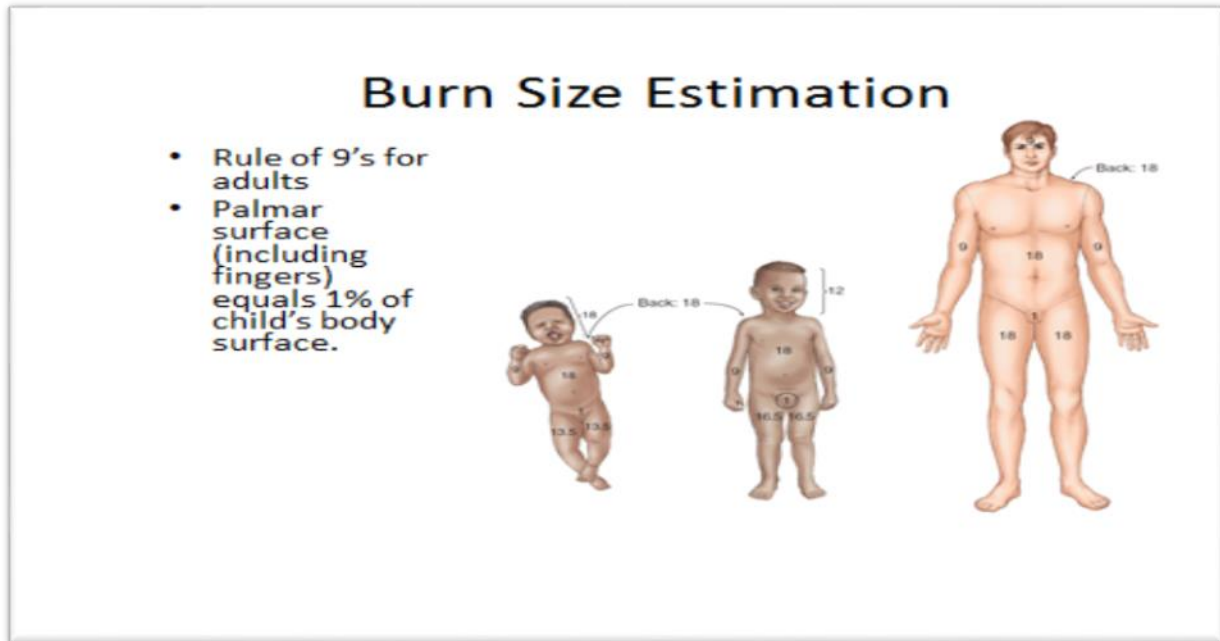
VI. Burn and Burn Fluid Charts

**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**

<i>Adult</i>	
<b>Anatomic Structure</b>	<b>Surface Area</b>
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%

<i>Child</i>	
<b>Anatomic Structure</b>	<b>Surface Area</b>
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%

<i>Adult – Obese 80 kg</i>	
<b>Anatomic Structure</b>	<b>Surface Area</b>
Head and neck	2%
Anterior torso	25%
Posterior torso	25%
Leg, each	20%
Arm, each	5%
Genitalia/perineum	0%

<i>Infant 10 kg</i>	
<b>Anatomic Structure</b>	<b>Surface Area</b>
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 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	125.0	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	275.0	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	275.0
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	300.0

Patients with traumatic injuries may require additional fluids.

## 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

Source: Used with permission, University of Utah Burn Center (<https://crisisstandardsofcare.utah.edu>).

## VII. 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
Eyes	1	No eye opening	
	2	Eye opening to pain	
	3	Eye opening to verbal	
	4	Eyes open spontaneously	
Verbal	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
Motor	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



### VIII. Abnormal 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

## IX. 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:

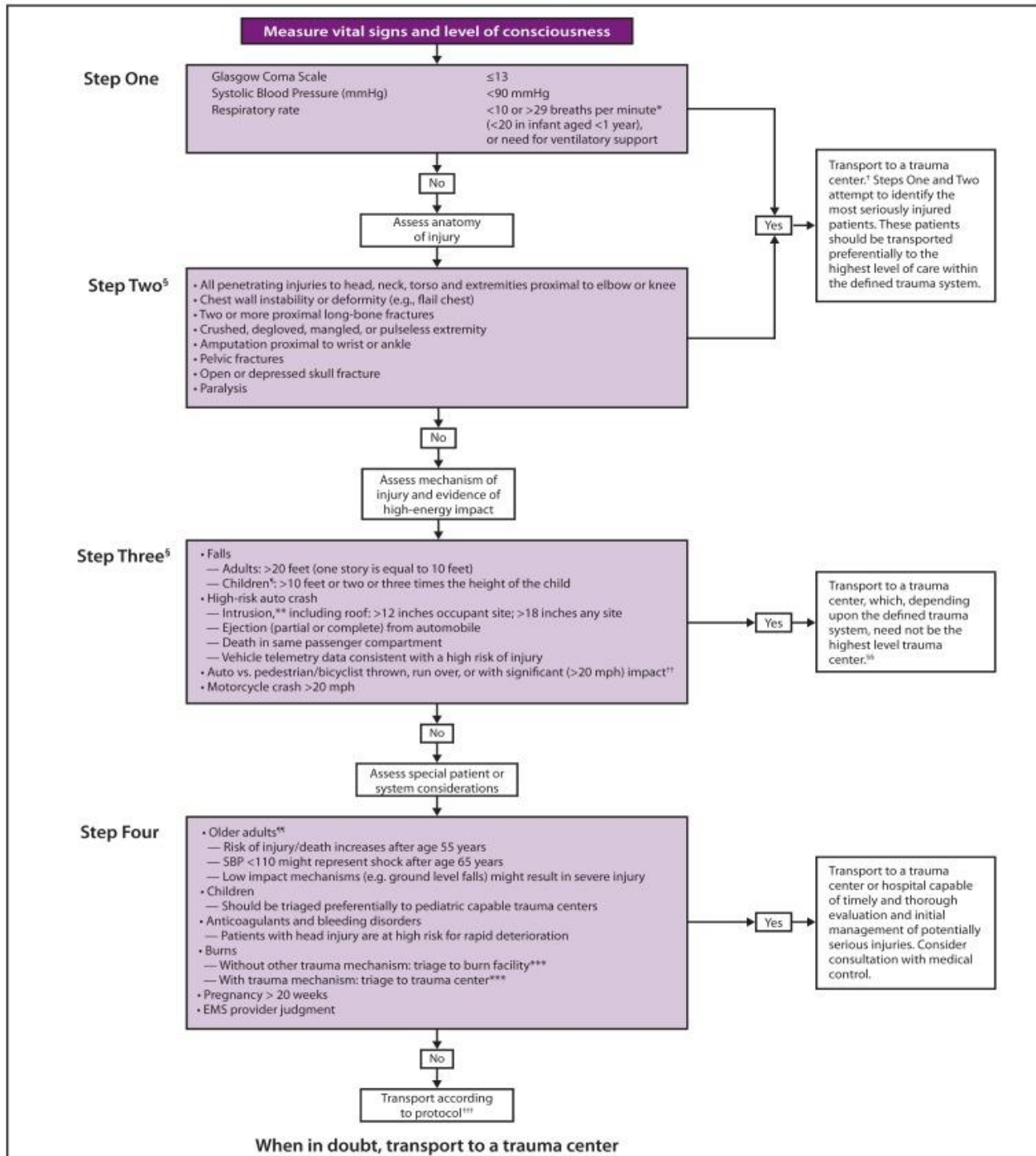
- Assemble the expert panel and provide GRADE training
- Define the EBG content area and establish the specific clinical questions to address in patient, intervention, comparison, and outcome (PICO) format
- Prioritize outcomes to facilitate systematic literature searches
- Create GRADE tables (or evidence 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

## X. 2011 Guidelines for Field Triage of Injured Patients



**Source:** Adapted from American College of Surgeons. Resources for the optimal care of the injured patient. Chicago, IL: American College of Surgeons; 2006. Footnotes (see following page) have been added to enhance understanding of field triage by persons outside the acute injury care field.

<https://www.cdc.gov/mmwr/preview/mmwrhtml/rr6101a1.htm>

- \* The upper limit of respiratory rate in infants is greater than 29 breaths per minute to maintain a higher level of overtriage for infants
- † Trauma centers are designated Level I–IV, with Level I representing the highest level of trauma care available.
- § Any injury noted in Steps Two and Three triggers a "yes" response.
- ¶ Age less than 15 years.
- \*\* Intrusion refers to interior compartment intrusion, as opposed to deformation which refers to exterior damage.
- †† Includes pedestrians or bicyclists thrown or run over by a motor vehicle or those with estimated impact greater than 20 mph with a motor vehicle.
- §§ Local or regional protocols should be used to determine the most appropriate level of trauma center; appropriate center need not be Level I.
- ¶¶ Age greater than 55 years.
- \*\*\* Patients with both burns and concomitant trauma for whom the burn injury poses the greatest risk for morbidity and mortality should be transferred to a burn center. If the nonburn trauma presents a greater immediate risk, the patient may be stabilized in a trauma center and then transferred to a burn center.
- ††† Injuries such as an open fracture or fracture with neurovascular compromise.
- §§§ Emergency medical services.
- ¶¶¶ Patients who do not meet any of the triage criteria in Steps One through Four should be transported to the most appropriate medical facility as outlined in local EMS protocols.