National Association of State EMS Officials

National Model EMS Clinical Guidelines

Abstract

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

NASEMSO Medical Directors Council

Contents

Introduction

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

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

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

Carol Cunningham, M.D.
Co-Principal Investigator

Richard Kamin, M.D.
Co-Principal Investigator

Purpose and Notes

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

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

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

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

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

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

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

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

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

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

Target Audience

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

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

Acknowledgements

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

Universal Care

Universal Care Guideline

(9914075 – Universal Patient Care/Initial Patient Contact)

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

Patient Presentation

Inclusion Criteria
All patient encounters with and care delivery by EMS personnel

Exclusion Criteria
None

Patient Management

Assessment

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

iii. Apnea (not breathing): go to **Prehospital Airway Management/Confirmation/ Obstruction/Failed Airway** guideline

c. Circulation:
   i. Assess pulse
      1. If none: go to **Cardiac Arrest (VF/VT/Asystole/PEA**) guideline
      2. Assess rate and quality of carotid and radial pulses
   ii. Evaluate perfusion by assessing skin color and temperature
      1. Evaluate capillary refill
      2. Control any major external bleeding. See also **Extremity Trauma/ External Hemorrhage Management** guideline

d. Disability
   i. Evaluate patient responsiveness: AVPU scale (Alert, Verbal, Pain, Unresponsive; see **6. Obtain baseline vital signs a.**, below)

   ii. Evaluate gross motor and sensory function in all extremities
   iii. Evaluate blood glucose in patients with altered mental status
   iv. If acute stroke suspected, go to **Suspected Stroke/Transient Ischemic Attack** guideline

e. Expose patient as appropriate to complaint
   i. Be considerate of patient modesty
   ii. Keep patient warm

5. Secondary Survey

The performance of the secondary survey should not delay transport in critical patients. See also secondary survey specific to individual complaints in other protocols. Secondary surveys should be tailored to patient presentation and chief complaint. The following are suggested considerations for secondary survey assessment:

a. Head:
   i. Pupils
   ii. Naso-oropharynx
   iii. Skull and scalp

b. Neck
   i. Jugular venous distension
   ii. Tracheal position

c. Chest
   i. Retractions
   ii. Breath sounds
   iii. Chest wall deformity

d. Abdomen/Back
   i. Flank/abdominal tenderness or bruising
   ii. Abdominal distension

e. Extremities
   i. Edema
   ii. Pulses
   iii. Deformity

f. Neurologic
   i. Mental status/orientation
   ii. Motor/sensory

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

<u>Treatment and Interventions</u>:

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

c. Waveform capnography
d. Carbon monoxide assessment

3. Establish vascular access if indicated or in patients who are at risk for clinical deterioration
4. Monitor pain scale if appropriate
5. Reassess patient

Patient safety considerations

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

Notes/Educational Pearls

Key considerations

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

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

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

Pertinent Assessment Findings

This guideline is too broad to list all possible findings

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

Normal Pediatric Vital Signs

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

Glasgow Coma Scale

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

References

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

Revision Date

September 15, 2014

Functional Needs

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

None

Patient Management

Assessment

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

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

iii. Fluency in a different language than that of the EMS professional
iv. Examples of tools to overcome language barriers include:
1. Transport of an individual who is fluent in the patient's language along with the patient to the hospital
2. Medical translation cards
3. Telephone-accessible services with live language interpreters
4. Methods through which the patient augments his/her communication skills (e.g. eye blinking, nodding) should be noted, utilized as able, and communicated to the receiving facility

b. Sensory Barriers:
i. Visual impairment
ii. Auditory impairment
iii. Examples of tools to overcome sensory barriers include:
1. Braille communication card
2. Sign language
3. Lip reading
4. Hearing aids
5. Written communication

2. Physical Barriers:
i. Ambulatory impairment (e.g. limb amputation, bariatric)
ii. Neuromuscular impairment

3. Cognitive Barriers:
i. Mental illness
ii. Developmental challenge or delay

Pertinent assessment findings

1. Assistance Adjuncts

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

a. Extremity prostheses
b. Hearing aids
c. Magnifiers
d. Tracheostomy speaking valves
e. White or sensory canes
f. Wheelchairs or motorized scooters

2. Service Animals

As defined by the American Disabilities Act, "any guide dog, signal dog, or other animal individually trained to do work or perform tasks for the benefit of an individual with a disability, including, but not limited to guiding individuals with impaired vision, alerting individuals with impaired hearing to intruders or sounds, providing minimal protection or rescue work, pulling a wheelchair, or fetching dropped items"

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

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

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

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

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

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

Quality Improvement

Key documentation elements

1. Language barriers:
   a. The patient's primary language of fluency
   b. The identification of the person assisting with the communication
   c. The methods through which the patient augments his/her communication skills should be communicated to the receiving facility

2. Sensory barriers:
   a. The methods through which the patient augments his/her communication skills communicated to the receiving facility
   b. Written communication between the patient and the EMS professional is part of the medical record, even if it is on a scrap sheet of paper, and it should be retained with the same collation, storage, and confidentiality policies and procedures that are applicable to the written or electronic patient care report

3. Assistance adjuncts (devices that facilitate the activities of life for the patient)

Performance measures

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

References

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

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

Revision Date
September 15, 2014

Patient Refusals

(9914189 – Refusal of Care)

Patient Care Goals/Patient Presentation (Overview)

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

Patient Management

Assessment

Decision-Making Capacity

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

Treatment and Interventions

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

Notes/Educational Pearls

Key Considerations

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

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

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

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

References
No specific recommendations

Revision Date
September 15, 2014

Cardiovascular

Adult and Pediatric Syncope and Presyncope

(9914149 – Syncope)

Patient Care Goals

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

Patient Presentation

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

Inclusion criteria

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

Exclusion criteria

Conditions other than the above, including patients:

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

Patient Management

Assessment

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

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

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

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

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

Notes/Educational Pearls

Key Considerations

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

ii. Neurologic - some of the symptoms of seizure may mimic those of syncope with loss of consciousness and collapse. Consider seizure and obtain full history from bystander witnesses

b. Consider high risk 12-lead EKG features including:
   i. Evidence of QT prolongation
   ii. Delta waves
   iii. Brugada syndrome (incomplete RBBB pattern in V1/V2 with ST segment elevation)

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

of North America. 2010 Aug; 28(3):501-16. doi: 10.1016/j.emc.2010.03.009

Revision Date

September 15, 2014

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

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

Patient Care Goals

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

Patient Presentation

Inclusion/Exclusion Criteria

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

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

Patient Management

Assessment, Treatment, and Interventions

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

c. Performance of serial EKGs is suggested
d. All EKGs should be made available to treating personnel at the receiving hospital, whether brought in or transmitted from the field

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

Revision Date

September 15, 2014

Bradycardia

(9914115 – Bradycardia)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment, Treatment, and Interventions

1. Adult Management
   a. Manage airway as necessary
   b. Provide supplemental O_2 as needed to maintain O_2 saturation $\geq$ 94%
   c. Initiate monitoring and perform 12-lead EKG
   d. Establish IV access
   e. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
   f. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
      i. Atropine 0.5 mg IV q 3-5 minute (max 3 mg)
      ii. Chronotropic medications (no order of preference intended)

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

iii. Transcutaneous Pacing
If pacing is performed, consider sedation or pain control

2. Pediatric Management

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

a. Initiate chest compressions
b. Manage airway and assist ventilations as necessary with minimally interrupted chest compressions using a compression to ventilation ratio 15:2 (30:2 if single provider is present)
c. Provide supplemental O_2 as needed to maintain O_2 saturations $\geq$ 94%
d. Initiate monitoring and perform 12-lead EKG
e. Establish IV access
f. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
g. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
    i. Epinephrine (1:10,000) 0.01 mg/kg IV every 3-5 minutes
    ii. Also consider atropine 0.01-0.02 mg/kg IV with minimum dose of 0.1 mg if increased vagal tone or cholinergic drug toxicity
    iii. Transcutaneous pacing. If pacing is performed, consider sedation or pain control

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

Patient Safety Considerations
If pacing is performed, consider sedation or pain control

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

No specific recommendations

Quality Improvement

Key Documentation Elements

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

Performance Measures

1. Response to medication/treatment

References

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

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

Revision Date

September 15, 2014

Tachycardia with a Pulse

(9914147 – Supraventricular Tachycardia (Including Atrial Fibrillation))

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

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

Exclusion Criteria

Sinus tachycardia

Patient Management

Assessment, Treatments, and Interventions

1. Adult Management
   a. Manage airway as necessary
   b. Provide supplemental O_2 as needed to maintain O_2 saturation $\geq$ 94%
   c. Initiate monitoring and perform 12-lead EKG
   d. Establish IV access
   e. Finger stick blood glucose and treat hypoglycemia per the **Diabetic** guideline
   f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
      i. **Regular Narrow Complex Tachycardia – Stable (SVT)**
         1. Perform vagal maneuvers
         2. Adenosine 6 mg IV followed by 10 ml fluid bolus. If tachycardia continues, give adenosine 12 mg IV. A third dose of adenosine,12 mg IV, can be given
         3. Diltiazem 0.25 mg/kg slowly IV over 2 minutes. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed
         4. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses
      ii. **Regular Narrow Complex Tachycardia – Unstable**
         1. Deliver a synchronized shock based on manufacturer's recommendations

2. For responsive patients, consider sedation

iii. **Irregular Narrow Complex Tachycardia – Stable** (atrial fibrillation, atrial flutter, multifocal atrial tachycardia)
   1. Diltiazem 0.25 mg/kg slowly IV over 2 minutes. After 15 minutes, a second dose of diltiazem 0.35 mg/kg IV may be given if needed. For patients older than 65, recommend initial dose of diltiazem 10 mg IV and a second dose of 20mg
   2. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses

iv. **Irregular Narrow Complex Tachycardia – Unstable**
   1. Deliver a synchronized shock based on manufacturer's recommendation
   2. For responsive patients, consider sedation

v. **Regular Wide Complex Tachycardia – Stable** (ventricular tachycardia - VT, supraventricular tachycardia - SVT, atrial fibrillation/flutter with aberrancy, accelerated idioventricular rhythms, pre-excited tachycardias with accessory pathways, torsades de pointes)
   1. Adenosine 6 mg IV followed by 10 ml fluid bolus; if monomorphic tachycardia continues, give adenosine 12 mg IV
   2. Amiodarone 150 mg IV over 10 minute; may repeat
   3. Procainamide drip at 10 mg/minute for a maximum dose of 17 mg/kg
   4. Lidocaine 1-1.5 mg/kg IV; may be repeated at 5 minute intervals for a maximum dose of 3 mg/kg IV

vi. **Irregular Wide Complex Tachycardia – Stable** (atrial fibrillation with aberrancy, pre-excited atrial fibrillation (i.e. atrial fibrillation using an accessory pathway), MAT or polymorphic VT/torsades de pointes.
   1. Amiodarone 150 mg IV over 10 minute; may repeat if needed
   2. Metoprolol 5 mg IV given over 1-2 minutes. May repeat as needed every 5 minutes for a total of 3 doses
   3. If torsades, give magnesium 1-2 grams IV over 15 minutes

2. Pediatric Management
   a. Manage airway as necessary
   b. Provide supplemental O_2 as needed to maintain O_2 saturation $\geq$ 94%
   c. Initiate monitoring and perform 12-lead EKG
   d. Establish IV access
   e. Finger stick blood glucose and treat hypoglycemia per the **Hypoglycemia/Hyperglycemia** guideline
   f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
      i. **Regular Narrow Complex Tachycardia – Stable** (SVT)
         1. Perform vagal maneuvers
         2. Adenosine 0.1 mg/kg; if unsuccessful, may repeat with 0.2 mg/kg
      ii. **Regular Narrow Complex Tachycardia – Unstable**
         1. Deliver a synchronized shock; 0.5-1 J/kg for the first dose
         2. Repeat doses should be 2 J/kg

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

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

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

Synchronized cardioversion 0.5-1.0 J/kg

Notes/Educational Pearls

Key Considerations

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

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

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

Pertinent Assessment Findings

No specific recommendations

Patient Safety Considerations

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

Time to clinical improvement

References

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

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

Revision Date
September 15, 2014

Suspected Stroke / Transient Ischemic Attack

(9914145 – Stroke/TIA)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

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

c. Neurologic status assessment (see Appendix VI)

Treatment and Interventions

1. Determine – Time "last seen normal"
2. Provide oxygen only if O_2 saturation < 94%. Titrate to ≥ 94%
3. If seizure activity present, refer to **Seizures** guideline
4. Obtain blood glucose level. Treat only if glucose < 60
5. Acquire 12-lead EKG if possible

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. www.strokeassociation.org
2. Jauch Edward Z, Cucchiara Brett, Adeoye Opeolu, Meurer William, Brice Jane. Stroke: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*, 2010 122;S818-S828; doi: 10.1161/CIRCULATIONAHA.110.971044

Revision Date

September 15, 2014

General Medical

Abuse and Maltreatment

(9914187 – Neglect or Abuse Suspected)

Patient Care Goals

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

Patient Presentation

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

Inclusion/Exclusion Criteria

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

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

b. Age inappropriate behavior (e.g. adults who are submissive or fearful, children who act in a sexually inappropriate way)
c. Pattern burns, bruises, or scars suggestive of specific weaponry used
d. Evidence of medical neglect for injuries or infections
e. Trauma to genitourinary systems or frequent infections to this system
f. Evidence of malnourishment and/or serious dental problems
g. Inability to communicate due to language and/or cultural barrier

3. Have a high index of suspicion for abuse in children presenting with an Apparent Life Threatening Event (ALTE)

Patient Management

Assessment

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

As noted above

Quality Improvement

Key Documentation Elements

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

Performance Measures

No specific recommendations

References

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

Revision Date

September 15, 2014

Agitated or Violent Patient/Behavioral Emergency

(9914053 – Behavioral/Patient Restraint)

Patient Care Goals

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

Patient Presentation

Inclusion criteria

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

Exclusion criteria

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

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

Patient Management

Assessment

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

Treatment and Interventions

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

2. Chemical Restraints
    a. Notes:
        i. Selection of chemical restraint should be based upon the patient's clinical condition, current medications, and allergies in addition to EMS resources and medical oversight
        ii. The numbering of medications below is not intended to indicate a hierarchy/preference of administration
        iii. Chemical restraints should be a later consideration for pediatric patients
    b. Antipsychotics
        i. Droperidol
            1. Adults:
                a. 2.5 mg IV; 10 minute onset of action, or
                b. 5 mg IM; 20 minute onset of action
            2. Pediatrics: Not routinely recommended
        ii. Haloperidol
            1. Adults:
                a. 5 mg IV; 5-10 minute onset of action, or
                b. 10 mg IM; 10-20 minute onset of action
            2. Pediatrics:
                a. Age 6-12 years: 1-3 mg IM (maximum dose 0.15 mg/kg)
        iii. Olanzapine
            1. Adults: 10 mg IM; 15-30 minute onset of action
            2. Pediatrics:
                a. Age 6-11 years: 5 mg IM (limited data available for pediatric use)
                b. Age 12-18 years: 10 mg IM
        iv. Ziprasidone
            1. Adults: 10 mg IM; 10 minute onset of action
            2. Pediatrics:
                a. Age 6-11 years: 5 mg IM (limited data available for pediatric use)
                b. Age 12-18 years: 10 mg IM
    c. Benzodiazepines
        i. Diazepam
            1. Adults:
                a. 5 mg IV; 2-5 minute onset of action, or
                b. 10 mg IM; 15-30 minute onset of action
            2. Pediatrics:
                a. 0.05-0.1 mg/kg IV, or
                b. 0.1-0.2 mg/kg IM
        ii. Lorazepam
            1. Adults:
                a. 2 mg IV; 2-5 minute onset of action, or

b. 4 mg IM; 15-30 minute onset of action

2. Pediatrics:
    a. 0.05 mg/kg IV, or
    b. 0.05 mg/kg IM

iii. Midazolam

1. Adults:
    a. 5 mg IV; 3-5 minute onset of action, or
    b. 5 mg IM; 10-15 minute onset of action, or
    c. 5 mg IN; 3-5 minute onset of action
2. Pediatrics:
    a. 0.05-0.1 mg/kg IV, or
    b. 0.1-0.15 mg/kg IM, or
    c. 0.3 mg/kg IN

d. Dissociative Agents (Provide Sedation and Anesthesia)

i. Ketamine

1. Adults:
    a. 2 mg/kg IV; 1 minute onset of action, or
    b. 4 mg/kg IM; 3-5 minute onset of action
2. Pediatrics:
    a. 1 mg/kg IV, or
    b. 3 mg/kg IM

e. Antihistamines

i. Diphenhydramine

1. Pediatrics:
    a. 1 mg/kg IM/IV/PO (maximum dose of 25 mg)

3. Physical Restraints

a. Body

i. Stretcher straps should be applied as the standard procedure for all patients during transport
ii. Sheets can be used as additional stretcher straps if necessary
iii. Stretcher straps and sheets should never restrict the patient's chest wall motion
iv. Placement of stretcher straps or sheets (to prevent flexion/extension of torso, hips, legs) around:
    1. the lower lumbar region, below the buttocks, or
    2. the thighs, knees, and legs

b. Extremities

i. Soft or leather restraint devices should not require a key to release them
ii. Restrain all four extremities to maximize safety for patient, staff, and others
iii. Restrain all extremities to the stationary frame of the stretcher
iv. Multiple knots should not be used to secure the restraint device

Patient Safety Considerations

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

Notes/Educational Pearls

Key considerations

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

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

Pertinent assessment findings

Continuous monitoring of:

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

Quality Improvement

Key Documentation Elements

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

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

Performance Measures

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

References

1. ACEP Excited Delirium Task Force, White Paper Report on Excited Delirium Syndrome, American College of Emergency Physician, September 10, 2009
2. Adimando AJ et al. Pharmacological management of the agitated pediatric patient. *Pediatric Emergency Care*, 2010 NOV 26(11): 856-860
3. Drayna PC et al. Ketamine sedation is not associated with clinically meaningful elevation of intraocular pressure. *American Journal of Emergency Medicine,* 2012; 30(7): 1215-1218
4. Halstead SM et al. The effect of ketamine on intraocular pressure in pediatric patients during procedural sedation. *Academic Emergency Medicine,* 2012; 19(10): 1145-1150
5. Ho JD et al. Successful management of excited delirium syndrome with prehospital ketamine: two case examples. *Prehosp Emerg Care,* 2013; 17: 274-279
6. Kupas DF, Wydro GC. Patient restraint in emergency medical services systems. *Prehospital Emergency Care,* July/September 2002 6(3): 340-345
7. Sonnier L, Barzman D. Pharmacologic management of acutely agitated pediatric patients. *Pediatric Drugs,* 2011, 13(1): 1-10
8. Tsze DS et al. Intranasal Ketamine for procedural sedation in pediatric laceration repair: a preliminary report. *Pediatric Emergency Care,* 2012; 28(8): 767-770
9. Kupas DF, Wydro GC. Patient restraint in emergency medical services systems. *Prehospital Emergency Care,* July/September 2002; 6(3): 340-345

Revision Date

September 15, 2014

Anaphylaxis and Allergic Reaction

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

(9914111 – Allergic Reaction/Anaphylaxis)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients of all ages with suspected allergic reaction

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Evaluate for patent airway and presence of oropharyngeal edema
2. Auscultate for wheezing and assess level of respiratory effort
3. Assess for adequacy of perfusion
4. Assess for presence of signs of anaphylaxis
5. Determine:
   a. Non-anaphylactic Allergic Reaction

      Symptoms involving only **one** organ system (i.e. localized angioedema that does not compromise the airway, or not associated with vomiting)
   b. Anaphylaxis - More severe and is characterized by an acute onset involving:
      i. The skin (urticaria) and/or mucosa with either respiratory compromise or decreased BP or signs of end-organ dysfunction,

         OR
      ii. Hypotension for that patient (systolic BP < 90 for adults; see Normal Vital Signs table, **Appendix VII**, for pediatric cut-offs) after exposure to a known allergen

         OR
      iii. Two or more of the following occurring rapidly after exposure to a likely allergen:
         1. Skin and/or mucosal involvement (urticaria, itchy, swollen tongue/lips)
         2. Respiratory compromise (dyspnea, wheeze, stridor, hypoxemia)
         3. Persistent gastrointestinal symptoms (vomiting, abdominal pain)
         4. Hypotension or associated symptoms (syncope, hypotonia, incontinence)

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Taillac PP, Brown L, Lubogo N, Nichols J, Shah MI. An evidence-based guideline for pediatric prehospital allergic reaction management using GRADE methodology. 2014; *manuscript in preparation*
2. 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), 42-48
3. 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), 1303-1310
4. 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), 653-657
5. Dahlof C, Mellstrand T, Svedmyr N. Systemic absorption of adrenaline after aerosol, eye-drop and subcutaneous administration to healthy volunteers. *Allergy,* 1987 42(3), 215-221
6. Hauswald M. Can paramedics safely decide which patients do not need ambulance transport or emergency department care? *Prehosp Emerg Care,* 2002 6(4), 383-386
7. 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), 1174-1179
8. Hompes S, 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), 568-574
9. 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 e161-163
10. 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), 371-377
11. 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), 341-344
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), 268-277
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), 405-410
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), 237-242
15. Sampson HA, Munoz-Furlong A, Campbell RL, Adkinson NF Jr., Bock SA, Branum A, Decker WW. 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), 391-397
16. 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
17. 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,* (8) 2012 CD008935
18. Sheikh A, ten Broek V, Brown SG, Simons FE. H1-antihistamines for the treatment of anaphylaxis with and without shock. *Cochrane Database Syst Rev,* (1) 2007 CD006160
19. 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), 387-390
20. 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), 1040-1044
21. 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), 1040-1044
22. 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), 33-37
23. Watson NT, Weiss EL, Harter PM. Famotidine in the treatment of acute urticaria. *Clin Exp Dermatol,* 2000 25(3), 186-189
24. Yavuz ST, Sahiner UM, Buyuktiryaki B, Soyer OU, Sackesen C, Sekerel BE, Tuncer A. Clinical features of children with venom allergy and risk factors for severe systemic reactions. *Int Arch Allergy Immunol,* 2013 160(3), 313-321

Revision Date
September 15, 2014

Altered Mental Status

(9914113 – Altered Mental Status)

Patient Care Goals

1. Identify treatable causes
2. Protect patient from harm

Patient Presentation

Inclusion criteria

Impaired decision-making capacity

Exclusion criteria

Traumatic brain injury

Patient Management

Assessment

Look for treatable causes of altered mental status:

1. Airway: make sure airway can remain patent; reposition patient as needed
2. Breathing: look for respiratory depression; check SPO_2 , $ETCO_2$, and CO detector readings
3. Circulation: look for signs of shock
4. Glasgow Coma Score and/or AVPU
5. Pupils
6. Neck rigidity or pain with range of motion
7. Stroke tool
8. Blood glucose level
9. EKG: arrhythmia limiting perfusion
10. Breath odor: possible unusual odors include alcohol, acidosis, ammonia
11. Chest/Abdominal: intra-thoracic hardware, assist devices, abdominal pain or distention
12. Extremities/skin: track marks, hydration, edema, dialysis shunt, temperature to touch (or if able, use a thermometer)
13. Environment: survey for pills, paraphernalia, ambient temperature

Treatment and Interventions

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance measures

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

References

1. 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

2. 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.
3. 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

Revision Date
September 15, 2014

Hypoglycemia/Hyperglycemia

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

Patient Care Goals

Limit morbidity from hypoglycemia and hyperglycemia by:

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

Patient in cardiac arrest

Patient Management

Assessment

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

Treatment and Interventions

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

iii. Pediatric Dosing: 0.5-1 gm/kg

b. Dextrose IV
   i. Adult Dosing: 25 gm of 10-50% dextrose IV
      1. 50 ml of 50% dextrose
      2. 100 ml of 25% dextrose
      3. 250 ml of 10% dextrose
   ii. Pediatric Dosing: 0.5-1 gm/kg of 10-25% dextrose IV
      1. 2 – 4 ml/kg of 25% dextrose
      2. 4 – 8 ml/kg of 12.5% dextrose
      3. 5 – 10 ml/kg of 10% dextrose

c. Glucagon IM/IN
   i. Adult Dosing: 1 mg IM/IN
   ii. Pediatric Dosing: 1 mg IM/IN if ≥ 20 kg (or ≥ 5 yo)
   0.5 mg IM/IN if < 20 kg (or < 5 yo)

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

Patient Safety Considerations

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

Notes/Educational Pearls

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

[50] / [____ % 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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Kitabchi AE, Umpierrez GE, Miles JM, et al. Hyperglycemic crises in adult patients with diabetes. *Diabetes Care*, 2009 32(7):1335–43
2. Corwell et al. Current diagnosis and treatment of hyperglycemic emergencies. *Emerg Med Clin North Am.*, 2014 May; 32(2): 437-52

Revision date

September 15, 2014

Pain Management

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

(9914071 – Pain Control)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients who are experiencing pain

Exclusion Criteria

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

Patient Management

Assessment, Treatment and Interventions

1. Apply a pulse oximeter and administer oxygen as needed to maintain a O_2 saturation $\geq$ 94%
2. Determine patient's pain score assessment using standard pain scale.
   a. < 4 years: Observational scale (e.g. Faces, Legs, Arms, Cry, Consolablity (FLACC) or Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)
   b. 4-12 years: Self-report scale (e.g. Wong Baker Faces, Faces Pain Scale (FPS), Faces Pain Scale Revised (FPS-R)
   c. > 12 years: Self-report scale (Numeric Rating Scale (NRS)
3. Place patient on cardiac monitor per patient assessment
4. If available, consider use of non-pharmaceutical pain management techniques
   a. Placement of the patient in a position of comfort
   b. Application of ice packs and/or splints for pain secondary to trauma
   c. Verbal reassurance to control anxiety
5. If not improved, consider use of analgesics as available and as permitted by direct medical oversight
   a. Acetaminophen 15 mg/kg PO (maximum dose 1 gm)
   b. Ibuprofen 10 mg/kg PO for patients greater than 6 months of age (maximum dose 800 mg)
   c. Fentanyl 1 mcg/kg IN or IM

d. Ketorolac – Adult: 60 mg IM in adults who are not pregnant
   Pediatric: (2-16 years) 1mg/kg IM (maximum dose 30 mg)
   Geriatric/Renal impairment: 1mg/kg IM (maximum dose 30 mg)
e. Morphine sulfate 0.1 mg/kg (maximum dose 15 mg)
f. Nitrous Oxide

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

Universal Pain Assessment Tool

Verbal Descriptor Scale	0 1 2 3 4 5 6 7 8 9 10					
	No pain	Mild pain	Moderate pain	Severe pain	Very severe pain	Excruciating Pain

Wong-Baker Scale

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

---

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

Here are two examples of pediatric-appropriate pain assessment tools

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

FLACC SCALE

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

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

Faces Pain Scale – Revised (FPS-R)

From *Pediatric Pain Sourcebook*, **www.painsourcebook.ca**
Version: 7 Aug 2007 CL von Baeyer

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

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

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

Sources. 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;93:173-183. Bieri D, Reeve R, Champion GD, Addicoat 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.

Fold here

0 2 4 6 8 10

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

Revision Date

September 15, 2014

Seizures

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

(9914141 – Seizure)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

Treatment and Interventions

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

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

Patient safety considerations

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

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. 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
2. Funk DL, Chan L, Lutz N, Verdile VP. Comparison of capillary and venous glucose measurements in healthy volunteers. *Prehosp Emerg Care,* 2001 5(3): 275-277
3. 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): 400-405
4. 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): 690-694
5. Kulkarni A, Saxena M, Price G et al. Analysis of blood glucose measurements using 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): 679-682
6. Kumar G, Sng BL, Kumar S. Correlation of capillary and venous glucometry with laboratory determination. *Prehosp Emerg Care,* 2004 8(4): 378-383
7. Holstein A, Plaschke A, Vogel MY, Egberts EH. Prehospital management of diabetic emergencies – a population-based intervention study. *Acta Anaesthesiol Scand,* 2003 47(5): 610-615
8. 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): 274-276
9. Sporer KA, Johnson NJ. Detailed analysis of prehospital interventions in medical priority dispatch system determinants. *West J Emerg Med,* 2011 12(1): 19-29
10. 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): 650-655

11. Silbergleit R, Durkalski V, Lowenstein D, Conwit R, Pancioli A, Palesch Y, Barsan W; NETT Investigators. Intramuscular versus intravenous therapy for prehospital status epilepticus. *N Engl J Med*, 2012 Feb 16; 366(7): 591-600 doi: 10.1056/NEJMoa1107494
12. 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
13. 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): 329-332
14. 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): 65-68
15. 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
16. 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,* 52(4): 788-793
17. 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): 529-538
18. 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,* 65(1): 12-21
19. Mahmoudian T, Zadeh MM. Comparison of intranasal midazolam with intravenous diazepam for treating acute seizures in children. *Epilepsy Behav,* 2004 5(2): 253-255
20. 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): 744-749
21. 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): 215-217
22. Lahat E, Goldman M, Barr J, Bistritzer 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): 83-86
23. Shah I, Deshmukh CT. Intramuscular midazolam vs. intravenous diazepam for acute seizures. *Indian J Pediatr,* 2005 72(8): 667-670
24. 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): 575-582
25. 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): 975-978
26. 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): 92-94
27. 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
28. 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): 205-210

29. 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
30. Rainbow J, Browne GJ, Lam LT. Controlling seizures in the prehospital setting: diazepam or midazolam? *J Paediatr Child Health,* 2002 38(6): 582-586
31. 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): 123-126
32. Bhattacharyya M, Kalra V, Gulati S. Intranasal midazolam vs rectal diazepam in acute childhood seizures. *Pediatr Neurol,*. 2006 34(5): 355-359
33. 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): 747-753
34. 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,* 19(4); 221-225
35. Alldredge BK, Wall DB, Ferriero DM. Effect of prehospital treatment on the outcome of status epilepticus in children. *Pediatr Neurol,* 12(3): 213-216
36. 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): 682-688
37. 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,* 14(2): 162-168
38. 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): 631-637
39. Leppik IE, Derivan AT, Homan RW, Walker J, Ramsay RE, Patrick B. Double-blind study of lorazepam and diazepam in status epilepticus. *JAMA,* 249(11);1452-1454
40. 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): 202-209
41. Wuerz RC, Swope GW, Holliman J, Vazquez-de Miguel G. On-line medical direction: a prospective study. *Prehosp Disaster Med,* 1995 10(3): 51-54
42. Cain E, Ackroyd-Stolarz S, Alexiadis P, Murray D. Prehospital hypoglycemia: the safety of not transporting treated patients. *Prehosp Emerg Care,* 2003 7(4)458-465

Revision Date

September 15, 2014

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

Shock

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

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Signs of poor perfusion (due to a medical cause) such as one or more of the following:
   a. Altered mental status
   b. Delayed/flash capillary refill
   c. Hypoxia (pulse oximetry < 94%)
   d. Decreased urine output
   e. Respiratory rate > 20 in adults or elevated in children (see normal vital signs table)
   f. Hypotension for age (lowest acceptable systolic blood pressure in mm Hg):
      i. < 1 year: 60
      ii. 1-10 years: (age in years)(2)+70
      iii. > 10 years: 90
   g. Tachycardia for age, out of proportion to temperature (see **Normal Vital Signs** table, **Appendix VII**)
   h. Weak, decreased or bounding pulses
   i. Cool/mottled or flushed/ruddy skin

2. AND potential etiologies of shock:
   a. Hypovolemia (poor fluid intake, excessive fluid loss (e.g. bleeding, SIADH, hyperglycemia excessive diuretics, vomiting, diarrhea)
   b. Sepsis (temperature instability: < 36 C or 96.8 F; > 38.5 C or 101.3 F; and/or tachycardia, warm skin, tachypnea)
   c. Anaphylaxis (urticaria, nausea/vomiting, facial edema, wheezing)
   d. Signs of heart failure (hepatomegaly, rales on pulmonary exam, extremity edema, JVD)

Exclusion Criteria

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

Patient Management

Assessment

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

c. Stroke
d. Fever
e. Nausea/vomiting, diarrhea
f. Frequent or no urination
g. Syncopal episode
h. Allergic reaction
i. Immunocompromise (malignancy, transplant, asplenia)
j. Adrenal insufficiency
k. Presence of a central line
l. Other risk of infection (spina bifida or other genitourinary anatomic abnormality)

2. Exam
   a. Airway/breathing (airway edema, rales, wheezing, pulse oximetry, respiratory rate)
   b. Circulation (heart rate, blood pressure, capillary refill)
   c. Abdomen (hepatomegaly)
   d. Mucous membrane hydration
   e. Skin (turgor, rash)
   f. Neurologic (GCS, sensorimotor deficits)

3. Determination of type of shock
   a. Cardiogenic
   b. Distributive (neurogenic, septic, anaphylactic)
   c. Hypovolemic
   d. Obstructive (e.g. pulmonary embolism, cardiac tamponade, tension pneumothorax)

Treatment and Interventions

1. Check full vital signs
2. Administer oxygen (titrate oxygen to $SPO_2 \geq 94\%$)
3. Cardiac monitor
4. Pulse oximetry
5. Check blood sugar, and correct if < 60 mg/dl
6. EKG
7. Check lactate, if available (> 2.5 mmol/L is abnormal)
8. Antipyretics for fever
   a. Acetaminophen (15 mg/kg; max dose of 1000 mg)
   b. Ibuprofen (10 mg/kg; max dose of 800 mg)
9. Establish IV access; if unable to obtain within 2 attempts or < 90 seconds, place an IO needle
10. IV fluids (20 ml/kg isotonic fluid; max of 1 liter) over < 15 minutes, using a push-pull method of drawing up the fluid in a syringe and pushing it through the IV. May repeat up to 3 times
11. If there is a history of adrenal insufficiency, give:
    a. Hydrocortisone succinate, 2 mg/kg (max 100 mg) IV/IM (preferred) **or**
    b. Methylprednisolone 2 mg/kg IV (max 125 mg)
12. Vasopressors (shock unresponsive to IV fluids)
    a. Cardiogenic shock, hypovolemic shock, obstructive shock:
       - Give dopamine, 2-20 mcg/kg/minute
       - Give epinephrine, 0.05-0.3 mcg/kg/minute

- Norepinephrine - there is recent evidence that supports the use of norepinephrine as the preferred intervention (initial dose: 0.5 – 1 mcg/minute titrated to effect. For patients in refractory shock: 8-30 mcg/minute)

b. Distributive shock (with the exception of anaphylactic shock):
   - Give norepinephrine, 0.05-0.5 mcg/kg/minute
   - Norepinephrine is the first-line drug of choice for neurogenic shock
   - For anaphylactic shock see **Anaphylaxis and Allergic Reaction** guideline

13. Provide advanced notification to the hospital
14. Consider empiric antibiotics for suspected septic shock if transport time is anticipated to be > 1 hour, if blood cultures can be obtained in advance, and/or EMS has coordinated with regional receiving hospitals about choice of antibiotic therapy.

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

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 of Systematic Reviews*, 2010(1)
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), 934-940
3. Bernardin, G., Pradier, C., Tiger, F., Deloffre, P., & Mattei, M. (1996). Blood pressure and arterial lactate level are early indicators of short-term survival in human septic shock. Intensive Care Med, 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 Medicine*, 2006 32(7), 995-1003
5. Carcillo J, Fields A, American College of Critical Care Medicine Task Force Committee, M. Clinical practice parameters for hemodynamic support of pediatric and neonatal patients in septic shock. *Crit Care Med*, 2002 30(6), 1365-1378
6. Carcillo JA, Davis AL, Zaritsky A. Role of Early Fluid Resuscitation in Pediatric Septic Shock. *JAMA,* 1991 266(9), 1242-1245
7. Choong K, Bohn D, Fraser DD, Gaboury I, Hutchison JS, Joffe AR, Ward RE. Vasopressin in pediatric vasodilatory shock: A multicenter randomized controlled trial. *Am J Respir Crit Care Med*, 2009 180(7), 632-639
8. Chopra A, Kumar V, Dutta A. Hypertonic versus normal saline as initial fluid bolus in pediatric septic shock. *Indian Journal of Pediatrics*, 2011 78(7), 833-837
9. Cronin L, Cook DJ, Carlet J, Heyland DK, King D, Lansang MA, Fisher CJ Jr. Corticosteroid treatment for sepsis: a critical appraisal and meta-analysis of the literature. *Crit Care Med*, 1995 23(8), 1430-1439
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), e758-766
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, Madl C, Chochrad D, Aldecoa C, Vincent JL. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*, 2010 362(9), 779-789
13. De Backer D et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med,* 2010 Mar 4; 362:779
14. 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), 782-786
15. Guyette FX, Gomez H, Suffoletto B, Quintero J, Mesquida J, Kim HK, Pinsky, MR. Prehospital dynamic tissue oxygen saturation response predicts in-hospital lifesaving interventions in trauma patients. *J Trauma Acute Care Surg*, 2012 72(4), 930-935
16. Han, YY, Carcillo JA, Dragotta MA, Bills DM, Watson RS, Westerman ME, Orr RA. Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome. Pediatrics, 2013 112(4), 793-799
17. 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
18. 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
19. Kumar A, Roberts D, Wood KE, Light B, Parrillo JE, Sharma S, Cheang M. 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), 1589-1596
20. Larsen GY, Mecham N, Greenberg R. An emergency department septic shock protocol and care guideline for children initiated at triage. *Pediatrics,* 2011 127(6), e1585-1592
21. Lillis KA, Jaffe DM. Prehospital intravenous access in children. *Ann Emerg Med*, 1992 21(12), 1430-1434
22. Martin C, Papazian L, Perrin G, Saux P, Gouin F. Norepinephrine or dopamine for the treatment of hyperdynamic septic shock? *Chest*, 1993 103(6), 1826-1831
23. Martin C, Viviand X, Leone M, Thirion X. Effect of norepinephrine on the outcome of septic shock. *Crit Care Med*, 2000 28(8), 2758-2765
24. Mikkelsen ME, Miltiades AN, Gaieski DF, Goyal M, Fuchs BD, Shah CV, Christie JD. Serum lactate is associated with mortality in severe sepsis independent of organ failure and shock. *Crit Care Med*, 2009 37(5), 1670-1677
25. Morimatsu H, Singh K, Uchino S, Bellomo R, Hart G. Early and exclusive use of norepinephrine in septic shock. *Resuscitation*, 2004 62(2), 249-254
26. Oliveira CF, 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), 810-815
27. Patel GP, Grahe JS, Sperry M, Singla S, Elpern E, Lateef O, Balk RA. Efficacy and safety of dopamine versus norepinephrine in the management of septic shock. *Shock*, 2010 33(4), 375-380
28. Santhanam I, Sangareddi S, Venkataraman S, Kissoon 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), 647-655
29. Sebat F, Johnson D, Musthafa AA, Watnik M, Moore S, Henry K, Saari, M. A multidisciplinary community hospital program for early and rapid resuscitation of shock in nontrauma patients. *Chest*, 2005 127(5), 1729-1743
30. Seymour CW, et al. Out-of-hospital characteristics and care of patients with severe sepsis: A cohort study. *J Crit Care*, 2010 25(4), 553-562
31. Shapiro NI, Howell MD, Talmor D, Lahey D, Ngo L, Buras J, Lisbon A. Implementation and outcomes of the Multiple Urgent Sepsis Therapies (MUST) protocol. *Crit Care Med*, 2006 34(4), 1025-1032

32. Sholl JM, Chung S, Prentiss S, Smith JM, Shah MI. An evidence-based guideline for pediatric prehospital shock management using GRADE methodology. 2014; *manuscript in preparation.*
33. 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), 51-56
34. Trzeciak S, et al. Serum lactate as a predictor of mortality in patients with infection. *Intensive Care Med*, 2007 33(6), 970-977
35. 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), 318-322

Revision Date
September 15, 2014

Resuscitation

Cardiac Arrest (VF/VT/Asystole/PEA)

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

Patient Care Goals

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

Inclusion Criteria

Patients with cardiac arrest

Exclusion Criteria

Include the following:

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

Patient Management

Assessment

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

Treatment and Interventions

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

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

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

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

Sodium bicarbonate 1 mEq/kg IV

d. Hypovolemia - Additions to care include the following:
   Normal saline 2 L IV (or 20 ml/kg, repeated up to 3 times for pediatrics)
e. If the patient is intubated at the time of arrest, assess for tension pneumothorax and misplaced ETT. If tension pneumothorax suspected, perform needle decompression. Assess ETT, if misplaced, replace ETT

10. If at any time during this period of resuscitation the patient regains return of spontaneous circulation, proceed to the **Adult Post-ROSC Care** guideline
11. If resuscitation remains ineffective, consider termination of resuscitation (see **Termination of Resuscitative Efforts** guideline)

Patient Safety Considerations

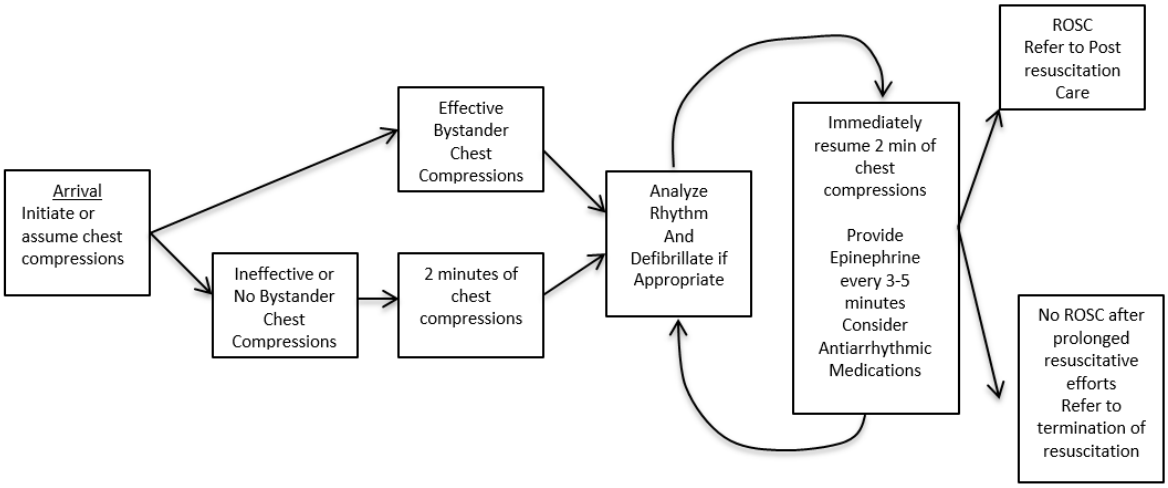
It is not safe for the patient or providers to perform chest compressions during transport. Chest compressions during patient movement are less effective in regards to hands on time, depth, recoil and rate and providers performing chest compressions in a moving vehicle are at risk for injury. Therefore,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

Notes/Educational Pearls

Key Considerations

1. Effective chest compressions and defibrillation are the most important therapies to the patient in cardiac arrest. Effective chest compressions are defined as:
   a. A rate of greater than 100 and less than 120 compressions/minute
   b. Depth of at least 2 inches (5 cm) for adults and children or 1.5 inches (4 cm) for infants
   c. Allow for complete chest recoil
   d. Minimize interruptions in compressions
   e. Avoid rescuer fatigue by rotating rescuers every 1-2 minutes
   f. Avoid excessive ventilation. If no advanced airway, consider either a 15:1 or 30:2 ventilation to compression ratio for adults, and 15:2 for children when 2 rescuers are present. Once advanced airway is applied, ventilations should not exceed 8-10 breaths/minute
   g. Quantitative end-tidal CO_2 should be used to monitor effectiveness of chest compressions. If $ETCO_2 < 10$ mmHg, attempt to improve chest compression quality. Consider additional monitoring with biometric feedback which may improve compliance with suggested resuscitation guidelines

General Cardiac Arrest Process



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

2. Consider IV access during first round of chest compressions

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

include teamwork simulations integrating first responders, BLS, and ALS crewmembers who regularly work together. High-performance systems should practice teamwork using "pit crew" techniques with predefined roles and crew resource management principles. For example (the Pennsylvania State EMS Model for Pit Crew):

i. Rescuer 1 and 2 set up on opposite sides of patient's chest and perform continuous chest compressions, alternating after every 100 compressions to avoid fatigue
ii. Consider use of a metronome or CPR feedback device to ensure that compression rate is 100-120/minute
iii. Chest compressions are only interrupted during rhythm check (AED analysis or manual) and defibrillation shocks. Continue compressions when AED/ defibrillator is charging
iv. Additional rescuer obtains IO (or IV) access and gives Epinephrine. Consider tibial IO as first attempt at vascular access
v. During the first four cycles of compressions/defibrillation (approximately 10 minutes) avoid any attempt at intubation
vi. One responding provider assumes code leader position overseeing the entire response
vii. Use a CPR checklist to ensure that all best practices are followed during CPR

b. For efficient "pit crew" style care, the EMS agency medical director should establish the options that will be used by providers functioning within the EMS agency. Options include establishing:
   i. The airway/ventilation management, if any, that will be used
   ii. The initial route of vascular access
c. The EMS agency must, overseen by the agency medical director, perform a QI review of care and outcome for every patient that receives CPR
   i. The QI should be coordinated with local receiving hospitals to include hospital admission, discharge, and condition information. This EMS agency QI can be accomplished by participation an organized cardiac arrest registry
   ii. The QI should be coordinated with local PSAP/dispatch centers to review opportunities to assure optimal recognition of possible cardiac arrest cases and provision of dispatch-assisted CPR (including hands-only CPR when appropriate)

Quality Improvement

Key Documentation Elements

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

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

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

Performance Measures

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

References

1. Berg et al. Part 5: Adult Basic Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
2. Link et al. Part 6: Electrical therapies: automated external defibrillators, defibrillators, cardioversion and pacing. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
3. Cave et al. Part 7: CPR techniques and devices: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
4. Neumar et al. Part 8: Adult Advanced Cardiovascular Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
5. Vanden Hoek et al. Part 12: cardiac arrest in special situations: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
6. Kleinman et al. Part 14: pediatric Advanced Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
7. Berg et al. Part 13: pediatric Basic Life Support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010
8. Hostler et al. Effect of real-time feedback during CPR. *BMJ,* 2011
9. Jacobs et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. C*irculation,* 2004

Revision Date

September 15, 2014

Adult Post-ROSC (Return of Spontaneous Circulation) Care

(9914019 – Post Resuscitation Care)

Patient Care Goals

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

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

Patient Presentation

Inclusion Criteria

Patient returned to spontaneous circulation following cardiac arrest resuscitation

Exclusion Criteria

None

Patient Management

Assessment, Treatment, and Interventions

1. Perform general patient management
2. Support life-threatening problems associated with airway, breathing, and circulation. Monitor closely for reoccurrence of cardiac arrest
3. Titrate oxygen to keep O_2 saturation $\geq$ 94%. Do NOT hyper-oxygenate
4. For hypotension (SBP less than 90 mmHg) associated with cardiogenic shock, give a Dopamine infusion at 5–20 mcg/kg/minute IV. Titrate to SBP greater than 90 mmHg in adults. Consider norepinephrine: there is recent evidence that supports the use of norepinephrine as the preferred intervention (initial dose: 0.5 – 1 mcg/minute titrated to effect. For patients in refractory shock: 8-30 mcg/minute)
5. Check blood glucose. If hypoglycemic, see appropriate guideline. If hyperglycemic, notify hospital on arrival
6. If patient seizes, refer to seizure guideline
7. Perform 12-lead EKG
8. Post cardiac arrest patients with evidence or interpretation consistent with ST elevation myocardial infarction (STEMI/Acute MI) may be transported to any hospitals which offer percutaneous coronary intervention in their cardiac catheterization laboratory
9. Consider transport patients to facility which offers specialized post-resuscitative care
10. Do not allow patient to become hyperthermic
11. Mild therapeutic hypothermia may be beneficial in unresponsive patients with ROSC. Only if a coordinated system of care exists to maintain therapy, ***may*** consider:
    a. Start an IV of ice-cold normal saline

b. Infuse a 20 to 30 ml/kg bolus (Goal: 2 liters of ice cold saline in adult patients)
c. While administering fluid boluses, frequently reassess perfusion for improvement and/or fluid overload respiratory distress. If perfusion improves, slow the IV to KVO and monitor closely. If patient develops fluid overload respiratory distress (dyspnea, rales, crackles, decreasing SpO_2), slow the IV to KVO
d. If patient unresponsive and patient begins shivering, sedate further with benzodiazepines

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

CONTRAINDICATIONS FOR ICE SALINE:

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

Patient Safety Considerations

None

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Neumar R, Nolan J et al. ILCOR Consensus Statement. Post–cardiac arrest syndrome
2. Epidemiology, Pathophysiology, Treatment, and Prognostication. A consensus statement from the International Liaison Committee on Resuscitation (American Heart Association, Australian and New Zealand Council on Resuscitation, European Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Asia, and the Resuscitation Council of Southern Africa); the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; and the Stroke Council. *Circulation* 2008; 118: 2452-2483
3. Bernard SA, Gray TW, Buist MD, Jones BM, Silvester W, Gutteridge G, Smith K. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med,* 2002; 346: 557–563
4. De Backer D et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med,* 2010 Mar 4; 362:779
5. 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: 1865–1873
6. Kim F, Olsufka M, Longstreth WT Jr., Maynard C, Carlbom D, Deem S, Kudenchuk P, Copass MK, Cobb LA. 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: 3064–3070
7. 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: 299–302
8. Kliegel A, Janata A, Wandaller C, Uray T, Spiel A, Losert H, Kliegel M, Holzer M, Haugk M, Sterz F, Laggner AN. Cold infusions alone are effective for induction of therapeutic hypothermia but do not keep patients cool after cardiac arrest. *Resuscitation,* 2007; 73: 46–53
9. 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*
10. Aufderheide TP, Lurie KG. Death by hyperventilation: a common and life-threatening problem during cardiopulmonary resuscitation. *Crit Care Med,* 2004; 32 (suppl): S345–S351
11. Quintero-Moran B, Moreno R, Villarreal S, Perez-Vizcayno MJ, Hernandez R, Conde C, Vazquez P, Alfonso F, Bañuelos C, Escaned J, Fernandez-Ortiz A, Azcona L, Macaya C. Percutaneous coronary intervention for cardiac arrest secondary to ST-elevation acute myocardial infarction: influence of immediate paramedical/medical assistance on clinical outcome. *J Invasive Cardiol*, 2006; 18: 269–272
12. Garot P, Lefevre T, Eltchaninoff H, Morice MC, Tamion F, Abry B, Lesault PF, Le Tarnec JY, Pouges C, Margenet A, Monchi M, Laurent I, Dumas P, Garot J, Louvard Y. Six-month outcome of emergency percutaneous coronary intervention in resuscitated patients after cardiac arrest complicating ST-elevation myocardial infarction. *Circulation*, 2007; 115: 1354–1362

Revision Date
September 15, 2014

Determination of Death / Withholding Resuscitative Efforts

(No NEMSIS category)

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

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

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

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

OR

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

Patient Management

Assessment

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

No specific recommendations

Quality improvement

Key Documentation Elements

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

Performance Measures

Compliance with guideline

References

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

Revision Date

September 15, 2014

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

(9914169 – Cardiac Arrest – Do Not Resuscitate)

Patient Care Goals

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

Patient Presentation

Inclusion/Exclusion Criteria

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

Patient Management

Assessment

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

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

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

No specific recommendations

Quality Improvement

Key Documentation Elements

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

Performance Measures

Compliance with guideline

References

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

Revision Date

September 15, 2014

Termination of Resuscitative Efforts

(No NEMSIS category)

Patient Care Goals

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

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

Patient Presentation

Patient in cardiac arrest

Inclusion Criteria

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

Exclusion Criteria

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

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

1. Hypothermia
2. Near-drowning

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

Patient Management

Resuscitation may/should be terminated under the following circumstance:

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

Assessment

1. Pulse
2. Respirations

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

Treatment and Interventions

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

Patient Safety Considerations:

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

Notes / Educational Pearls:

Key Considerations and Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

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 Apr; 133(4):e1104-16. doi: 10.1542/peds.2014-0176. Epub 2014 Mar 31
2. Eckstein M, Hatch L, Malleck J, McClung C, Henderson SO. End-tidal CO2 as a predictor of survival in out-of-hospital cardiac arrest. *Prehosp Disaster Med*, 2011 Jun; 26(3): 148-50. doi: 10.1017/S1049023X11006376
3. Millin MG, Khandker SR, Malki A. Prehosp Emerg Care. Termination of resuscitation of nontraumatic cardiopulmonary arrest: resource document for the National Association of EMS Physicians position statement. 2011 Oct-Dec; 15(4): 547-54. doi: 10.3109/10903127.2011.608872. Epub 2011 Aug 15
4. Morrison LJ1, 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
5. Resuscitation. 2009 Mar; 80(3): 324-8. doi: 10.1016/j.resuscitation.2008.11.014. Epub 2009 Jan 15
6. 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 Oct-Dec; 14(4): 537-42. doi: 10.3109/10903127.2010.497899
7. American College of Emergency Physicians. Discontinuing resuscitation in the out-of-hospital setting. *Ann Emerg Med,* 2008 Nov; 52(5): 592. doi: 10.1016/j.annemergmed.2008.07.033

Revision Date

September 15, 2014

Pediatric Specific Guidelines

Apparent Life Threatening Event (ALTE)

(9914197 – Apparent Life Threatening Event (ALTE))

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

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

Exclusion Criteria

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

Patient Management

Assessment

1. History
   a. History and circumstances associated with event of symptoms
   b. History of color change (including cyanosis and/or pallor), irregular breathing or change in muscle tone
   c. Concurrent symptoms (fever, cough, rhinorrhea, vomiting, diarrhea, rash, labored breathing)
   d. Prior history of ALTE, prior ALTE event in last 24 hours
   e. Family history of SIDS
   f. Treatment and Interventions performed (resuscitation attempts at home)
   g. History of premature birth before 37 weeks gestation
   h. Past medical history (cardiac, neurologic, respiratory, or chromosomal anomalies)
   i. History of gastroesophageal reflux

2. Exam
   a. Full set of vital signs (per **Universal Care** guideline)
   b. Signs of respiratory distress (grunting, nasal flaring, retracting)
   c. Color (pallor, cyanosis, normal)

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Tieder J, Altman R, MD, Bonkowsky J, Brand DA, Claudius I, Cunningham DJ, DeWolfe C, Percelay JM, Pitetti RD, Smith MB. Management of Apparent Life-Threatening Events in Infants: A Systematic Review. *J Pediatr, 2013* 163: 94-99
2. 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 Vol 28: 599-605
3. Kaji A, Claudius I, Santillanes G, Mittal M, Hayes K, Lee J Gausche-Hill M. Apparent Life-Threatening Event: Multicenter Prospective Cohort Study to Develop a Clinical Decision Rule for Admission to the Hospital. *Ann Emerg Med*, 2013 Apr; 61(4): 379-387
4. Guenther E, Powers A, Srivastava R, Bonkowsky J. Abusive Head Trauma in Children Presenting with an Apparent Life-Threatening Event. *Journal of Pediatrics*, 2010 Vol 157 (5), 821-825
5. Parker K, Pitetti R. Mortality and Child Abuse in Children Presenting with Apparent Life-Threatening Events. *Pediatric Emergency Care,* 2011 Vol 27(7), 591-595
6. Al-Kindy H, Gelinas J, Hatzakis G, Cote A. Risk Factors for Extreme Events in Infant Hospitalized for Apparent Life-Threatening Events. *Journal of Pediatrics*, 2009 154(3): 332-7
7. Bonkowsky J. Guenther E, Filloux F, Srivastatva R. Death, Child Abuse, and Adverse Neurologic Outcome of Infants after an Apparent Life-Threatening Event. *Pediatrics,* 2008 Vol 122 (1): 125-131
8. 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 Vol 43: 711-717

9. Meislin AHW, Hinsberg P. A prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Annals of Emergency Medicine*, 1994 24(2), 209-214
10. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J et al. Advanced life support for out-of-hospital respiratory distress. *New England Journal of Medicine*, 2007 356(21), 2156-2164
11. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *Journal of Emergency Medicine*, 2009 36(4), 357-362
12. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *Journal of Pediatric Surgery*, 2004 39(9), 1376-1380
13. Gausche 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: The Journal of the American Medical Association*, 2000 283(6), 783-790
14. Group DMAS. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehospital Emergency Care,* 2009 *13(3), 304-310*
15. 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? *Annals of Emergency Medicine*, 1995 25(4), 507-511
16. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: Are they being misused? *Annals of Emergency Medicine*, 1997 29(2), 223-227
17. 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. *Annals of Emergency Medicine*, 1997 32(5), 585-588
18. Kaji A, Claudius I, Santillanes G, Mittal M, Hayes K, Lee J Gausche-Hill M. Do infants less than 12 months of age with an apparent life-threatening event need transport to a pediatric critical care center? *Prehospital Emerg Care*. 2013 Vol 17(3): 304-311
19. Gausche-Hill et al. Pediatric Preparedness of US Emergency Departments: A 2003 Survey**.** *Pediatrics*. Dec 2007 120(6): 1229-37
20. Middleton KR and Burt CW. Availability of Pediatric Services and Equipment in Emergency Departments: United States, 2002-03. *Adv Data*. 2006; 367: 1-16
21. 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 Oct; 124(4): 1233-43
22. 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 Oct; 54(4): 543-52

Revision Date

September 15, 2014

Pediatric Respiratory Distress (Bronchiolitis)

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

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Child < age 2 with wheezing or diffuse rhonchi

Exclusion Criteria

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

Patient Management

Assessment

1. History
    a. Onset of symptoms
    b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
    c. Sick contacts
    d. History of wheezing
    e. Treatments given
    f. Number of emergency department visits in the past year
    g. Number of admissions in the past year
    h. Number of ICU admissions ever
    i. History of prematurity
    j. Family history of asthma, eczema, or allergies
2. Exam
    a. Full set of vital signs (T, BP, RR, P, O_2 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_2 ($ETCO_2$) should be routinely used as an adjunct to other forms of respiratory monitoring
2. Perform EKG only if there are no signs of clinical improvement after treating respiratory distress
3. Airway
   a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-breather mask as needed, in order to maintain normal oxygenation
   b. Suction the nose and/or mouth (via bulb, Yankauer®, or suction catheter) if excessive secretions are present
4. Inhaled Medications
   Nebulized epinephrine should be administered to children in severe respiratory distress with bronchiolitis (e.g. coarse breath sounds) in the prehospital setting if other treatments (e.g., suctioning, oxygen) fail to result in clinical improvement
5. Utility of IV Placement and Fluids
   IVs should only be placed in children with respiratory distress for clinical concerns of dehydration, or when administering IV medications
6. Steroids
   Are generally not efficacious, and not given in the prehospital setting
7. Improvement of Oxygenation and/or Respiratory Distress with Non-invasive Airway Adjuncts
   a. Continuous positive airway pressure (CPAP) or high flow nasal cannula (HFNC) should be administered, when available, for severe respiratory distress
   b. Bag-Valve-Mask Ventilation should be utilized in children with respiratory failure
8. Supraglottic Devices and Intubation
   a. Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails
   b. The airway should be managed in the least invasive way possible

Patient Safety Considerations

Routine use of lights and sirens is not recommended during transport

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

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

Performance Measures

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

References

1. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatric Emergency Care*, 1996 12(4), 252-254
2. Moses JM, Alexander JL, Agus MS. The correlation and level of agreement between end-tidal and blood gas PCO2 in children with respiratory distress: a retrospective analysis. *BMC Pediatr*, 2009 Mar 12; 9: 20. doi: 10.1186/1471-2431-9-20
3. Lashkeri T, Howell JM, Place R. Capnometry as a predictor of admission in bronchiolitis. *Pediatric Emergency Care*. 28(9): 895-7, 2012 Sep
4. 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), 1278-1285
5. 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. *Pediatrics*, 2003 111(1)

6. Mussman GM, Parker MW, Statile A, Sucharew H, Brady PW. Suctioning and length of stay in infants hospitalized with bronchiolitis. *JAMA Pediatr*, 2013 May 1; 167(5): 414-21. doi: 10.1001/jamapediatrics.2013.36
7. Umoren R, Odey F, Meremikwu MM. Steam inhalation or humidified oxygen for acute bronchiolitis in children up to three years of age. *Cochrane Database of Systematic Reviews,* 2011 Issue 1. Art. No.: CD006435. doi: 10.1002/14651858.CD006435.pub2
8. Chavasse RJPG, Seddon P, Bara A, McKean MC. Short acting beta2-agonists for recurrent wheeze in children under two years of age. *Cochrane Database of Systematic Reviews*
9. 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 of Systematic Reviews,* 2005 Issue 3. Art. No.: CD001279. doi: 10.1002/14651858.CD001279.pub2
10. 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. *Archives of Pediatrics & Adolescent Medicine*, 2009 163(11), 1007-1012
11. 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. *The Journal of Pediatrics*, 2010 157(4), 630-634
12. Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP. Nebulized hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database of Systematic Reviews*, 2008 Issue 4
13. Hartling L, Russell KF, Patel H, Klassen TP, Liang Y. Epinephrine for bronchiolitis. *Cochrane Database of Systematic Reviews,* 2004 Issue 1. Art. No.: CD003123. doi: 10.1002/14651858.CD003123.pub2
14. Skjerven HO, Hunderi JO, Brügmann-Pieper SK, Brun AC, Engen H, Eskedal L, Haavaldsen M, Kvenshagen B, Lunde J, Rolfsjord LB, Siva C, Vikin T, Mowinckel P, Carlsen KH, Lødrup Carlsen KC. Racemic adrenaline and inhalation strategies in acute bronchiolitis. *N Engl J Med*, 2013 Jun 13; 368(24): 2286-93
15. 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. *Annals of Emergency Medicine*, 1994 24(2), 209-214
16. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J et al. Advanced life support for out-of-hospital respiratory distress. *The New England Journal of Medicine*, 2007 356(21), 2156-2164
17. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *Journal of Emergency Medicine*, 2009 36(4), 357-362
18. Corneli HM, Zorc JJ, Mahajan P, Shaw KN, Holubkov R, Reeves SD et al. A multicenter, randomized, controlled trial of dexamethasone for bronchiolitis. *New England Journal of Medicine*, 2007 357(4), 331-339
19. Martinon-Torres F, Rodriguez-Nunez A, Martinon-Sanchez JM. Heliox therapy in infants with acute bronchiolitis. *Pediatrics*, 2002 109(1), 68-73

20. Liet JM, Ducruet T, Gupta V, Cambonie G. Heliox inhalation therapy for bronchiolitis in infants. *Cochrane Database of Systematic Reviews,* 2010 Issue 4. Art. No.: CD006915. doi: 10.1002/14651858.CD006915.pub2
21. Chowdhury MM, McKenzie SA, Pearson CC, Carr S, Pao C, Shah AR, Reus E, Eliahoo J, Gordon F, Bland H, Habibi P. Heliox therapy in bronchiolitis: phase III multicenter double-blind randomized controlled trial. *Pediatrics*, 2013 Apr; 131(4): 661-9. doi: 10.1542/peds.2012-1317. Epub 2013 Mar 18
22. Cambonie G, Milési C, Jaber S, Amsallem F, Barbotte E, Picaud JC et al. Nasal continuous positive airway pressure decreases respiratory muscles overload in young infants with severe acute viral bronchiolitis. *Intensive Care Medicine*, 2008 34(10),1865-1872
23. Thia LP, McKenzie SA, Blyth TP, Minasian CC, Kozlowska WJ, Carr SB. Randomized controlled trial of nasal continuous positive airways pressure (CPAP) in bronchiolitis. *Archives of Disease in Childhood*, 2008 93(1), 45-47
24. 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 Sep; 34(9):1608-14. doi: 10.1007/s00134-008-1150-4. Epub 2008 May 24
25. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *Journal of Pediatric Surgery*, 2004 39(9), 1376-1380
26. Gausche 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: The Journal of the American Medical Association*, 2000 283(6), 783-790
27. Wang HE, Mann NC, Mears G, Jacobson K, Yealy DM. Out-of-hospital airway management in the United States. *Resuscitation*, 2011 Apr; 82(4): 378-85. doi: 10.1016/ *J. Resuscitation*. 2010.12.014. Epub 2011 Feb 1
28. Group DMAS. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehospital Emergency Care*, 2009 13(3), 304-310
29. 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? *Annals of Emergency Medicine*, 1995 25(4), 507-511
30. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: Are they being misused? *Annals of Emergency Medicine*, 1997 29(2), 223-227
31. 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. *Annals of Emergency Medicine*, 1998 32(5), 585-588
32. 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 Emergency Care*, 2001 Apr-Jun; 5(2): 159-62

Revision Date
September 15, 2014

Pediatric Respiratory Distress (Croup)

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

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

Presumed underlying cause that includes one of the following:

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

Patient Management

Assessment

1. History
   a. Onset of symptoms (history of choking)
   b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
   c. Sick contacts
   d. Treatments given
   e. Personal history of asthma, wheezing, or croup in past
2. Exam
   a. Full set of vital signs (T, BP, RR, P, O_2 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_2 ($ETCO_2$) should be routinely used as an adjunct to other forms of respiratory monitoring

b. Perform EKG only if there are no signs of clinical improvement after treating respiratory distress

2. Airway
   a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-breather mask as needed, in order to maintain normal oxygenation
   b. Suction the nose and/or mouth (via bulb, Yankauer®, or suction catheter) if excessive secretions are present
3. Inhaled Medications
   a. Epinephrine 5 ml of 1:10,000 (0.5 mg) nebulized, should be administered by advanced life support (ALS) providers to all children in respiratory distress with signs of stridor at rest. This medication should be repeated at this dose with unlimited frequency for ongoing distress
   b. Humidified oxygen or mist therapy is **not** indicated
4. Medications
   Dexamethasone 0.6 mg/kg oral, IV, or IM to max dose of 16 mg should be administered to patients with suspected croup
5. Utility of IV Placement and Fluids
   IVs should only be placed in children with respiratory distress for clinical concerns of dehydration, or when administering IV medications
6. Improvement of Oxygenation and/or Respiratory Distress with Non-invasive Airway Adjuncts
   a. Heliox for the treatment of croup can be considered for severe distress not responsive to more than 2 doses of epinephrine
   b. Continuous positive airway pressure (CPAP) should be administered for severe respiratory distress
   c. Bag-valve-mask ventilation should be utilized in children with respiratory failure
7. Supraglottic Devices and Intubation
   Supraglottic devices and intubation should be utilized only if bag-valve-mask ventilation fails. The airway should be managed in the least invasive way possible

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

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

Performance Measures

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

References

1. 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. *Annals of Emergency Medicine*, 2002 40(3), 300- 307
2. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatric Emergency Care,* 1996 12(4), 252-254
3. Moses JM, Alexander JL, Agus MSD. The correlation and level of agreement between end-tidal and blood gas PCO_2 in children with respiratory distress: A retrospective analysis. *BMC Pediatrics*, 2009 9, 20
4. Guideline for the diagnosis and management of croup. Alberta, ON, Canada: Alberta Medical Association, 2008. (Accessed July 15, 2013, at http://www.topalbertadoctors.org/uploads/croup_guideline.pdf)
5. Stoney PJ, Chakrabarti MK. Experience of pulse oximetry in children with croup. *Journal of Laryngology & Otology*, 105(4): 295-8, 1991 Apr
6. 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), 1278-1285
7. Westley CR, Cotton EK, Brooks JG. Nebulized racemic epinephrine by IPPB for the treatment of croup: A double-blind study. 1978 *132, 5*(484-487)
8. Bjornson C, Russell KF, Vandermeer B, Durec T, Klassen TP, Johnson DW. Nebulized epinephrine for croup in children. *Cochrane Database of Systematic Reviews*, 2011 Issue 2. Art. No.: CD006619. doi: 10.1002/14651858.CD006619.pub2
9. 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*. 295(11):1274-80, 2006 Mar 15
10. Neto GM, Kentab O, Klassen TP, Osmond MH. A randomized controlled trial of mist in the acute treatment of moderate croup. *Academic Emergency Medicine*, 9(9):873-9, 2002 Sep
11. Russell KF, Liang Y, O'Gorman K, Johnson DW, Klassen TP. Glucocorticoids for croup. *Cochrane Database Syst Rev,* 2011 Jan 19; (1):CD001955. doi: 10.1002/14651858.CD001955.pub3. Review. PMID: 21249651
12. Ausejo M, Saenz A, Pham B, Moher D, Chalmers TC, Kellner JD, Johnson DW, Klassen TP. The effectiveness of glucocorticoids in treating croup: meta-analysis. *West J Med*, 1999 Oct; 171(4):227-32
13. Bjornson CL, Klassen TP, Williamson J, Brant R, Mitton C, Plint A, Bulloch B, Evered L, Johnson DW. A randomized trial of a single dose of oral dexamethasone for mild croup. Pediatric Emergency Research Canada Network. *N Engl J Med*, 2004 Sep 23; 351(13): 1306-13
14. 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. *Annals of Emergency Medicine*, 1994 24(2), 209-214
15. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J et al. Advanced life support for out-of-hospital respiratory distress. *The New England Journal of Medicine*, 2007 356(21), 2156-2164
16. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *Journal of Emergency Medicine*, 2009 36(4), 357-362
17. Kline-Krammes S, Reed C, Giuliano JS Jr., Schwartz HP, Forbes M, Pope J, Besunder J, Gothard MD, Russell K, Bigham MT. Heliox in children with croup: a strategy to hasten improvement. *Air Medical Journal*. 31(3) :131-7, 2012 May-Jun
18. Vorwerk C, Coats T. Heliox for croup in children. [Review] [47 refs][Update in Cochrane Database Syst Rev. 2012; 10: CD006822; PMID: 23076928]
19. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehospital and Disaster Medicine*, 2010 25(1), 87-91
20. Gausche 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: The Journal of the American Medical Association*, 2000 283(6), 783-790
21. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *Journal of Pediatric Surgery*, 2004 39(9), 1376-1380
22. Group DMAS. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehospital Emergency Care*, 2009 13(3), 304-310
23. 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? *Annals of Emergency Medicine*, 1995 25(4), 507-511
24. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: Are they being misused? *Annals of Emergency Medicine*, 1997 29(2), 223-227
25. 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. *Annals of Emergency Medicine,* 1998 32(5), 585-588

26. Kunkel NC, Baker MD. Use of racemic epinephrine, dexamethasone, and mist in the outpatient management of croup. *Pediatric Emergency Care*. 12(3):156-9, 1996 Jun.

Revision Date

September 15, 2014

Neonatal Resuscitation

(9914133 – Newborn/Neonatal Resuscitation)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Newly born infants

Exclusion Criteria

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

Patient Management

Assessment

1. History
   a. Date and time of birth
   b. Onset of symptoms
   c. Prenatal history (prenatal care, substance abuse, multiple gestation, maternal illness)
   d. Birth history (maternal fever, presence of meconium, prolapsed or nuchal cord, maternal bleeding)
   e. Estimated gestational age (may be based on last menstrual period)
2. Exam
   a. Respiratory rate and effort (strong, weak, or absent; regular or irregular)
   b. Signs of respiratory distress (grunting, nasal flaring, retractions, gasping, apnea)
   c. Heart rate (fast, slow, or absent)
      i. Precordium, umbilical stump or brachial pulse may be used
      ii. Auscultation of chest is preferred since palpation of umbilical stump is less accurate
   d. Muscle tone (poor or strong)
   e. Color/Appearance (central cyanosis, acrocyanosis, pallor, normal)
   f. APGAR score (appearance, pulse, grimace, activity, respiratory effort)
      May be calculated for documentation, but not necessary to guide resuscitative efforts
   g. Estimated gestational age (term, late preterm, premature)
   h. Pulse oximetry should be considered if prolonged resuscitative efforts or if supplemental oxygen is administered
      Goal: oxygen saturation at 10 minutes is 85-95%

Treatment and Interventions

1. Clamp cord in two places and cut cord between the clamps if still attached to mother
2. Warm, dry, and stimulate
   a. Wrap infant in dry towel or thermal blanket to keep infant as warm as possible during resuscitation; keep head covered if possible
   b. If strong cry, regular respiratory effort, good tone, and term gestation, infant should be placed skin-to-skin with mother and covered with dry linen
3. If weak cry, signs of respiratory distress, poor tone, or preterm gestation then position airway (sniffing position) and clear airway as needed
   If thick meconium or secretions present ***and*** signs of respiratory distress, suction mouth then nose
4. If heart rate > 100 beats per minute
   a. Monitor for central cyanosis
      Provide blow-by oxygen as needed
   b. Monitor for signs of respiratory distress. If apneic or in significant respiratory distress:
      i. Initiate bag-valve-mask ventilation with room air at 40-60 breaths per minute
      ii. Consider endotracheal intubation as per local guidelines
5. If heart rate < 100 beats per minute
   a. Initiate bag-valve-mask ventilation with room air at 40-60 breaths per minute
      i. Primary indicator of effective ventilation is improvement in heart rate
      ii. Rates and volumes of ventilation required can be variable, only use the minimum necessary rate and volume to achieve chest rise and a change in heart rate
   b. If no improvement after 90 seconds, change oxygen delivery to 30% FiO_2 if blender available, otherwise 100% FiO_2 until heart rate normalizes
   c. Consider endotracheal intubation per local guidelines if bag-valve-mask ventilation is ineffective
6. If heart rate < 60 beats per minute
   a. Ensure effective ventilations with supplementary oxygen and adequate chest rise
   b. If no improvement after 30 seconds, initiate chest compressions
      i. Two-thumb-encircling-hands technique is preferred
   c. Coordinate chest compressions with positive pressure ventilation (3:1 ratio, 90 compressions and 30 breaths per minute)
   d. Consider endotracheal intubation per local guidelines

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

4. If pulse oximetry is used as an adjunct, the preferred placement place of the probe is the right arm, preferably wrist or medial surface of the palm. Normalization of blood oxygen levels (SaO_2 85-95%) will not be achieved until approximately 10 minutes following birth
5. Both hypoxia and excess oxygen administration can result in harm to the infant. If prolonged oxygen use is required, titrate to maintain an oxygen saturation of 85-95%
6. While not ideal, a larger facemask than indicated for patient size may be used to provide bag-valve-mask ventilation if an appropriately sized mask is not available. Avoid pressure over the eyes as this may result in bradycardia
7. Increase in heart rate is the most reliable indicator of effective resuscitative efforts
8. A multiple gestation delivery may require additional resources and/or providers

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Kattwinkel J, Perlman JM et al. Part 15: Neonatal Resuscitation: 2010 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010; 122: S909 –S919

Revision Date

September 15, 2014

GI/GU/Gyn

Childbirth

(9914155 – Childbirth/Labor/Delivery)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Imminent delivery with crowning

Exclusion Criteria

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

Patient Management

Assessment:

Signs of imminent delivery:

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

Treatment and Interventions

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

ii. Consider placing mother in prone knee-chest position
iii. Apply high-flow oxygen to mother
iv. Transport as soon as possible
v. Contact and/or closest appropriate receiving facility for direct medical oversight and to prepare team

c. Maternal Cardiac Arrest
i. Apply manual pressure to displace uterus from right to left
ii. See **Cardiac Arrest (VF/VT/Asystole/PEA)** guideline for resuscitation care (defibrillation and medications should be given for same indications and doses as if non-pregnant patient)
iii. Transport as soon as possible if infant is estimated to be over 24 weeks gestation (perimortem Cesarean section at receiving facility is most successful if done within 5 minutes of maternal cardiac arrest)
iv. Contact direct medical oversight and/or closest appropriate receiving facility for direct medical oversight and to prepare team

d. Breech Birth
i. If head fails to deliver, place gloved hand into vagina with fingers between infant's face and uterine wall to create an open airway
ii. Apply high-flow oxygen to mother
iii. Transport as soon as possible
iv. Contact direct medical oversight and/or closest appropriate receiving facility for direct medical oversight and to prepare team

4. Support the infant's head as needed
5. Check the umbilical cord surrounding the neck. If present, slip it over the head. If unable to free the cord from the neck, double clamp the cord and cut between the clamps
6. Do NOT routinely suction the infant's airway (even with a bulb syringe) during delivery
7. Grasping the head with hand over the ears, gently pull down to allow delivery of the anterior shoulder
8. Gently pull up on the head to allow delivery of the posterior shoulder
9. Slowly deliver the remainder of the infant
10. Clamp cord 2 inches from the abdomen with 2 clamps and cut the cord between the clamps
11. Record APGAR scores at 1 and 5 minutes. After delivery of infant, suctioning (including suctioning with a bulb syringe) should be reserved for infants who have obvious obstruction to the airway or require positive pressure ventilation (follow **Neonatal Resuscitation** guideline for further care of the infant)
12. The placenta will deliver spontaneously, often within 5-15 minutes of the infant. Do not force the placenta to deliver. Contain all tissue in plastic bag and transport
13. After delivery, massaging the uterus and allowing the infant to nurse will promote uterine contraction and help control bleeding

Patient Safety Considerations

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

Notes/Educational Pearls

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

Quality Improvement

Key Documentation Elements

Document all times (delivery, contraction frequency and length)

Performance Measures

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

References

Consensus process based. No specific recommendations

Revision Date

September 15, 2014

Nausea/Vomiting

(9914131 – Nausea/Vomiting)

Patient Care Goals
Decrease discomfort secondary to nausea and vomiting

Patient Presentation

Inclusion criteria
Currently nauseated and/or vomiting

Exclusion Criteria
No specific recommendations

Patient Management

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

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

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

Notes/Educational Pearls

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

No specific recommendations

References

1. Warden CR, Moreno R, Daya M. Prospective evaluation of ondansetron for undifferentiated nausea and vomiting in the prehospital setting. *Prehosp Emerg Care,* 2008 Jan-Mar;12(1):87-91
2. 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 Jan-Mar;15(1):34-8

Revision Date

September 15, 2014

Obstetrical/Gynecological Conditions

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

1. Obtain history
   a. Abdominal pain – onset, duration, quality, radiation, provoking or relieving factors
   b. Vaginal bleeding – onset, duration, quantity (pads saturated)
   c. Syncope/lightheadedness
   d. Nausea/vomiting
   e. Fever

2. Monitoring
   a. Monitor EKG if history of syncope or lightheadedness
   b. Monitor pulse oximetry if signs of hypotension or respiratory symptoms
3. Secondary survey pertinent to obstetric issues:
   a. Constitutional: vital signs, orthostatic vital signs, skin color
   b. Abdomen: distention, tenderness
   c. Genitourinary: visible bleeding
   d. Neurologic: mental status

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

Document full vital signs and physical exam findings

Performance Measures

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

References

General consensus process based. No specific recommendations

Revision Date

September 15, 2014

Respiratory

Airway Management

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

(9914003 – Airway Failed; 9914001 – Airway)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

1. History: Assess for
    a. Time of onset of symptoms
    b. Associated symptoms
    c. History of asthma or other breathing disorders
    d. Choking or other evidence of upper airway obstruction
    e. History of trauma

2. Physical Examination: Assess for
    a. Shortness of breath
    b. Abnormal respiratory rate and/or effort
    c. Use of accessory muscles
    d. Quality of air exchange, including depth and equality of breath sounds
    e. Wheezing, rhonchi, rales, or stridor
    f. Cough
    g. Abnormal color (cyanosis or pallor)
    h. Abnormal mental status

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

Treatment and Interventions

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

Patient safety considerations

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

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

Notes/Educational Pearls

Key Considerations

1. When compared to the management of adults with cardiac arrest, paramedics are less likely to attempt endotracheal intubation in children with cardiac arrest. Further, paramedics are more likely to be unsuccessful when intubating children in cardiac arrest and complications such as malposition of the ET tube or aspiration can be nearly three times as common in children as compared to adults
2. Use continuous waveform capnography to detect end-tidal carbon dioxide ($ETCO_2$). This is an important adjunct in the monitoring of patients with respiratory distress, respiratory failure, and those treated with positive pressure ventilation. It should be used as the standard to confirm extraglottic device and endotracheal tube placement
3. CPAP, BiPAP, IBBP, HFNC
   Contraindications to these non-invasive ventilator techniques include intolerance of the device, increased secretions inhibiting a proper seal, or recent gastrointestinal and/or airway surgery
4. Bag-Valve Mask:
   a. Appropriately-sized masks should completely cover the nose and mouth and maintain an effective seal around the cheeks and chin
   b. Ventilation should be delivered with only sufficient volume to achieve chest rise
   c. Ventilating breaths should be delivered over one second, with a two second pause between breaths (20 breaths/minute)
5. 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. Confirm successful placement with waveform capnography. Less optimal methods of confirmation include bilateral chest rise, bilateral breath sounds, maintenance of adequate oxygenation, and color change on end-tidal CO_2 colorimetric device. Misting observed in the tube is not a reliable method of confirmation

d. Ongoing education and hands-on practice is essential to maintain skills. This is especially true for children since pediatric intubation is an infrequently utilized skill for many prehospital providers
e. Video laryngoscopy may be helpful, if available, to assist with endotracheal intubation

6. Consideration should be made to dispatch the highest level provider for an EMS system given the potential need for advanced airway placement for patients with severe respiratory distress or failure

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Aguilar SA, Lee J, Castillo E, Lam B, Choy J, Patel E, Serra, J. 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), 210-219
2. 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), 403-407
3. 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), 508-512
4. 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), 217-221
5. 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

6. 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), 750-752
7. 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), 495-499
8. 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), 860-863
9. Chen L, Hsiao AL. Randomized trial of endotracheal tube versus laryngeal mask airway in simulated prehospital pediatric arrest. *Pediatrics*, 2008 122(2), e294-e297
10. 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), 435-441
11. 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), 459-466
12. Davis DP, Hoyt DB, Ochs M, Fortlage D, Holbrook T, Marshall LK, Rosen P. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. *J Trauma*, 2003 54(3), 444-453
13. 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), 64-67
14. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*, 2004 39(9), 1376-1380
15. 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 J,* 1996 15(4), 163-167
16. Fleisher GR, Ludwig S, ed. Textbook of Pediatric Emergency Medicine, 6th ed., 2010 p. 1782.
17. 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), 225-229
18. Grmec S. Comparison of three different methods to confirm tracheal tube placement in emergency intubation. *Intensive Care Med*, 2002 28(6), 701-704
19. 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), 245-249
20. 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), 515-530
21. 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), 546-550
22. 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), 417-421
23. Knapp S et al. The assessment of four different methods to verify tracheal tube placement in the critical care setting. *Anesth Analg*, 1999 88(4), 766-770
24. Kupas DF, Kauffman KF, Wang HE. Effect of airway-securing method on prehospital

endotracheal tube dislodgment. *Prehosp Emerg Care*, 2010 14(1), 26-30
25. Langhan ML, Ching K, Northrup V, Alletag M, Kadia P, Santucci K, Chen L. A randomized controlled trial of capnography in the correction of simulated endotracheal tube dislodgement. *Acad Emerg Med*, 2011 18(6), 590-596
26. Lecky F, Bryden D, Little R, Tong N, Moulton C. Emergency intubation for acutely ill and injured patients. *Cochrane Database Syst Rev*(2), 2008 CD001429
27. 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), 141-143
28. 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), 429-432
29. 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), 101-104
30. 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), 125-127
31. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiberger D, Liu PL. A clinical sign to predict difficult tracheal intubation: A prospective study. *Can Anaesth Soc J*, 1985 32(4), 429-434
32. Mick N, Dyer S, Ostermayer D, Pedro, N, Jackson A, Shah MI. An evidence-based guideline for pediatric prehospital airway management using GRADE methodology. 2014; *manuscript in preparation.*
33. 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), 284-288
34. 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), 866-871
35. Rabitsch W et al. Evaluation of an end-tidal portable ETCO2 colorimetric breath indicator (COLIBRI). *Am J Emerg Med*, 2004 22(1), 4-9
36. 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
37. 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), 46-49
38. 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
39. 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), 475-478
40. 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
41. 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
42. Silvestri S 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
43. Stiell IG et al. The OPALS Major Trauma Study: Impact of advanced life-support on survival and morbidity. *CMAJ*, 2008 178(9), 1141-1152

44. Stiell IG et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med*, 2007 356(21), 2156-2164
45. Stockinger ZT, McSwain NE, Jr. Prehospital endotracheal intubation for trauma does not improve survival over bag-valve-mask ventilation. *J Trauma,* 2004 56(3), 531-536
46. Swanson ER, Fosnocht DE. Effect of an airway education program on prehospital intubation. *Air Med J*, 2002 21(4), 28-31
47. 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), 153-157
48. 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), 175-181
49. 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), 1317-1320
50. 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), 134-141
51. 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
52. Warner KJ, Sharar SR, Copass MK, Bulger EM. Prehospital management of the difficult airway: A prospective cohort study. *J Emerg Med*, 2009 36(3), 257-265
53. Wayne MA, McDonnell M. Comparison of traditional versus video laryngoscopy in out-of-hospital tracheal intubation. *Prehosp Emerg Care*, 2010 14(2), 278-282
54. 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):74-78; discussion 78-80
55. Bankole S, Asuncion A, Ross S, Aghai Z, Nollah L, Echols H et al. First responder performance in pediatric trauma: a comparison with an adult cohort. *Pediatr Crit Care Med*. 2011 12(4):e166-170
56. Bhende MS, LaCovey DC. End-tidal carbon dioxide monitoring in the prehospital setting. *Prehosp Emerg Care*. 2001 5(2):208-213
57. Bochicchio GV, Scalea TM. Is field intubation useful? *Curr Opin Crit Care*, 2003 9(6):524-529
58. Boswell WC, McElveen N, Sharp M, Boyd CR, Frantz EI. Analysis of prehospital pediatric and adult intubation. *Air Med J*. 1995 14(3):125-127; discussion 127-128
59. 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): 352-356
60. 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):43-46
61. Carrey Z, Gottfried SB, Levy RD. Ventilatory muscle support in respiratory failure with nasal positive pressure ventilation. *Chest*, 1990 97(1): 150-158
62. 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
63. 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

64. Deis JN, Abramo TJ, Crawley L. Noninvasive respiratory support. *Pediatr Emerg Care,* 2008 24(5): 331-338; quiz 339
65. Edil BH, Tuggle DW, Jones S, Albrecht R, Kuhn A, Mantor PC et al. Pediatric major resuscitation--respiratory compromise as a criterion for mandatory surgeon presence. *J Pediatr Surg*, 2005 40(6): 926-928; discussion 928
66. 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): 243-251; discussion 251-243
67. 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): 163-166
68. Gausche 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: a controlled clinical trial. *JAMA*, 2000 283(6): 783-790
69. Gemes G, Heydar-Fadai J, Boessner T, Wildner G, Prause G. Prehospital fiberoptic intubation. *Resuscitation*, 2008 76(3): 468-470
70. George S, Macnab AJ. Evaluation of a semi-quantitative CO2 monitor with pulse oximetry for prehospital endotracheal tube placement and management. *Prehosp Disaster Med*, 2002 17(1): 38-41
71. Group DMAS. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*, 2009 13(3): 304-310
72. 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): 349-368
73. 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): 131-136
74. O'Connor, RE, Swor, RA. Verification of endotracheal tube placement following intubation, *Prehosp Emerg Care,* 1999 3(3): 248-250
75. Pointer JE. Clinical characteristics of paramedics' performance of pediatric endotracheal intubation. *Am J Emerg Med*, 1989 7(4): 364-366
76. Ritter SC, Guyette FX. Prehospital pediatric King LT-D use: a pilot study. *Prehosp Emerg Care*, 2011 15(3): 401-404
77. 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): 302-307
78. Stratton SJ. Prehospital pediatric endotracheal intubation. *Prehosp Disaster Med*, 2012 27(1): 1-2
79. Stratton SJ, Underwood LA, Whalen SM, Gunter CS. Prehospital pediatric endotracheal intubation: a survey of the United States. *Prehosp Disaster Med*, 1993 8(4): 323-326
80. Tam RK, Maloney J, Gaboury I, Verdon JM, Trickett J, Leduc SD, et al. Review of endotracheal intubations by Ottawa advanced care paramedics in Canada. *Prehosp Emerg Care*, 2009 13(3): 311-315
81. Teague WG. Noninvasive ventilation in the pediatric intensive care unit for children with acute respiratory failure. *Pediatr Pulmonol*, 2003 35(6): 418-426
82. 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): 71-74
83. 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
84. 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): 505-509

Revision Date
September 15, 2014

Bronchospasm (due to Asthma and Obstructive Lung Disease)

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

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

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

Exclusion Criteria

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

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

Patient Management

Assessment

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

c. Usual triggers of symptoms (cigarette smoke, change in weather, upper respiratory infections)
d. Sick contacts
e. Treatments given
f. Previously intubated
g. Number of emergency department visits in the past year
h. Number of admissions in the past year
i. Number of ICU admissions
j. Family history of asthma, eczema, or allergies

2. Exam
   a. Full set of vital signs (T, BP, RR, P, O_2 sat); waveform capnography is a useful adjunct and will show a "sharkfin" waveform in the setting of obstructive physiology
   b. Air entry (normal vs. diminished; prolonged expiratory phase)
   c. Breath sounds (wheezes, crackles, rales, rhonchi, diminished, clear)
   d. Signs of distress (grunting, nasal flaring, retracting, stridor)
   e. Inability to speak full sentences (sign of shortness of breath)
   f. Color (pallor, cyanosis, normal)
   g. Mental status (alert, tired, lethargic, unresponsive)
   h. Signs of distress include:
      i. Apprehension, anxiety, combativeness
      ii. Hypoxia (< 90% oxygen saturation)
      iii. Intercostal/subcostal/supraclavicular retractions
      iv. Nasal flaring
      v. Cyanosis

Treatment and Interventions

1. Monitoring
   a. Pulse oximetry and end-tidal CO_2 ($ETCO_2$) should be routinely used as an adjunct to other forms of respiratory monitoring
   b. Check an EKG only if there are no signs of clinical improvement after treating respiratory distress
2. Airway
   a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a non-rebreather mask as needed, in order to maintain normal oxygenation
   b. Suction the nose and/or mouth (via bulb, Yankauer, suction catheter) if excessive secretions are present
3. Inhaled Medications
   a. Albuterol 5 mg nebulized (or 6 puffs metered dose inhaler) should be administered to all patients in respiratory distress with signs of bronchospasm (e.g. known asthmatics, quiet wheezers) either by basic life support (BLS) or advanced life support (ALS) providers. This medication should be repeated at this dose with unlimited frequency for ongoing distress
   b. Ipratropium 0.5 mg nebulized should be given up to 3 doses, in conjunction with albuterol
4. Utility of IV Placement and Fluids
   IVs should be placed when there are clinical concerns of dehydration in order to administer fluids, or when administering IV medications

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

1. Respiratory rate
2. Oxygen saturation

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

Performance Measures

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

References

1. Birken CS, Parkin PC, Macarthur C. Asthma severity scores for preschoolers displayed weaknesses in reliability, validity, and responsiveness. *Journal of Clinical Epidemiology*, 2004 57(11), 1177-1181
2. 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. *Academic Emergency Medicine*, 2004 11(1), 10-18
3. Chalut DS, Ducharme FM, Davis GM. The Preschool Respiratory Assessment Measure (PRAM): A responsive index of acute asthma severity. *The Journal of Pediatrics*, 2000 137(6), 762-768
4. Mehta SV, Parkin PC, Stephens D, Schuh S. Oxygen saturation as a predictor of prolonged, frequent bronchodilator therapy in children with acute asthma. *The Journal of Pediatrics*, 2004 145(5), 641-645
5. 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. *Annals of Emergency Medicine*, 2002 40(3), 300- 307
6. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatric Emergency Care*, 1996 12(4), 252-254
7. Guthrie BD, Adler MD, Powell EC. End-tidal carbon dioxide measurements in children with acute asthma. *Academic Emergency Medicine*, 2007 14, 1135-1140
8. Kunkov S, Pinedo V, Johnson Silver E, Crain EF. Predicting the need for hospitalization in acute childhood asthma using end-tidal capnography. *Pediatric Emergency Care*, 2005 21(9), 574-577
9. Moses JM, Alexander JL, Agus MSD. The correlation and level of agreement between end-tidal and blood gas PCO_2 in children with respiratory distress: A retrospective analysis. *BMC Pediatrics*, 2009 9, 20
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),

1278-1285
11. 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. *Pediatrics*, 2003 111(1), e45-e51
12. 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. *The Journal of Emergency Medicine*, 2009 37(2S), S6-S17
13. Markenson D, Foltin G, Tunik M, Cooper A, Treiber M, Caravaglia K. Albuterol sulfate administration by EMT-basics: Results of a demonstration project. *Prehospital Emergency Care*, 2004 8(1), 34-40
14. Richmond NJ, Silverman R, Kusick M, Matallana L, Winokur J. Out-of-hospital administration of albuterol for asthma by basic life support providers. *Academic Emergency Medicine*, 2005 12(5), 396-403
15. Rodenberg H. Effect of levalbuterol on prehospital patient parameters. *American Journal of Emergency Medicine*, 2002 20(5), 481- 483
16. Thompson M, Wise S, Rodenberg H. A preliminary comparison of levalbuterol and albuterol in prehospital care. *The Journal of Emergency Medicine*, 2004 26(3), 271-277
17. 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. *Prehospital Emergency Care*, 2005 9(4), 386-390
18. 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 of Systematic Reviews* 2005, Issue 3. Art. No.: CD001279. doi: 10.1002/14651858.CD001279.pub2
19. 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), 971-977
20. 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. *Annals of Emergency Medicine*, 1994 24(2), 209-214
21. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J et al. Advanced life support for out-of-hospital respiratory distress. *The New England Journal of Medicine*, 2007 356(21), 2156-2164
22. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *Journal of Emergency Medicine*, 2009 36(4), 357-362
23. Rowe BH, Keller JL, Oxman AD. Effectiveness of steroid therapy in acute exacerbations of asthma: A meta-analysis. *The American Journal of Emergency Medicine*, 1992 10(4), 301-31
24. 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 of Systematic Reviews* 2010, Issue 5. Art. No.: CD005535. doi: 10.1002/14651858.CD005535.pub2
25. 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. *The Journal of Pediatrics*, 2008 152(4), 476-480.e471
26. Edmonds M, Camargo CA, Pollack CV, Rowe BH. Early use of inhaled corticosteroids in the emergency department treatment of acute asthma. *Cochrane Database of Systematic*

Reviews 2003, Issue 3. Art. No.: CD002308. doi: 10.1002/14651858.CD002308
27. Gordon S, Tompkins T, Dayan PS. Randomized trial of single-dose intramuscular dexamethasone compared with prednisolone for children with acute asthma. *Pediatric Emergency Care*, 2007 23(8), 521-527
28. Manser R, Reid D, Abramson MJ. Corticosteroids for acute severe asthma in hospitalized patients. *Cochrane Database of Systematic Reviews* 2001, Issue 1. Art. No.: CD001740. doi: 10.1002/14651858.CD001740
29. Rowe BH, Spooner C, Ducharme F, Bretzlaff J, Bota G. Early emergency department treatment of acute asthma with systemic corticosteroids. *Cochrane Database of Systematic Reviews* 2001, Issue 1. Art. No.: CD002178. doi: 10.1002/14651858.CD002178
30. Smith M*,* Rowe BH, N'Diaye T. Corticosteroids for hospitalized children with acute asthma. *Cochrane Database of Systematic Reviews* 2003, Issue 1. Art. No.: CD002886. doi: 10.1002/14651858.CD002886
31. Panickar J, Lakhanpaul M, Lambert PC, Kenia P, Stephenson T, Smyth A et al. Oral prednisolone for preschool children with acute virus-induced wheezing. *New England Journal of Medicine*, 2009 360(4), 329-338
32. Barnett PLJ, Caputo GL, Baskin M, Kuppermann N. Intravenous versus oral corticosteroids in the management of acute asthma in children. *Annals of Emergency Medicine*, 1997 29(2), 212-217
33. 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. *Annals of Emergency Medicine*, 1995 26(4), 480-486
34. Blitz M, Blitz S, Beasely R, Diner B, Hughes R, Knopp JA, Rowe BH. Inhaled magnesium sulfate in the treatment of acute asthma. *Cochrane Database of Systematic Reviews* 2005, Issue 4. Art. No.: CD003898. doi: 10.1002/14651858.CD003898.pub4
35. Alter HJ, Koepsell TD, Hilty WM. Intravenous magnesium as an adjuvant in acute bronchospasm: A meta-analysis. *Annals of Emergency Medicine,* 2000 36(3), 191-197
36. 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 of Systematic Reviews* 2000, Issue 1. Art. No.: CD001490. doi:10.1002/14651858.CD001490
37. Becker AB, Nelson NA, Simons FER. Inhaled salbutamol (albuterol) vs injected epinephrine in the treatment of acute asthma in children. *The Journal of Pediatrics,* 1983 102(3), 465-469
38. 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. *Pediatric Emergency Care*, 1991 7(1), 1-3
39. 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. *Annals of Emergency Medicine*, 1995 26(4), 469-473
40. Uden DL, Goetz DR, Kohen DP, Fifield GC. Comparison of nebulized terbutaline and subcutaneous epinephrine in the treatment of acute asthma. *Annals of Emergency Medicine*, 1985 14(3), 229-232
41. Beers SL, Abramo TJ, Bracken A, Wiebe RA. Bilevel positive airway pressure in the treatment of status asthmaticus in pediatrics. *The American Journal of Emergency Medicine*, 2007 25(1), 6-9
42. Carroll CL, Schramm CM. Noninvasive positive pressure ventilation for the treatment of status asthmaticus in children. *Annals of Allergy, Asthma & Immunology,* 2006 96(3), 454-459

43. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehospital and Disaster Medicine*, 2010 25(1), 87-91
44. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *Journal of Pediatric Surgery*, 2004 39(9), 1376-1380
45. Gausche, M., Lewis, R. J., Stratton, S. J., Haynes, B. E., Gunter, C. S., Goodrich, S. M., et al. (2000). Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA: The Journal of the American Medical Association*, 283(6), 783-790
46. Group, DMAS. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehospital Emergency Care*, 2009 13(3), 304-310
47. 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? *Annals of Emergency Medicine*, 1995 25(4), 507-511
48. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: Are they being misused? *Annals of Emergency Medicine*, 1997 29(2), 223-227
49. 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. 1998 *Annals of Emergency Medicine,* 32(5), 585-588
50. 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. doi: 10.1002/14651858.CD002884.pub2
51. Fergusson RJ, Stewart CM, Wathen CG et al. Effectiveness of nebulized salbutamol administered in ambulances to patients with severe acute asthma. *Thorax,* 1995 50:80-82
52. Bryant DH, Rogers P. Effects of ipratropium bromide nebulizer solution with and without preservatives in the treatment of acute and stable asthma. *Chest,* 1992 102:742-747
53. 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):365-37
54. 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 of Systematic Reviews,* 2005, Issue 3
55. 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* 32, 2004 2516 - 23
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 Emer Med*, article in press, 2008
57. Abroug F et al. A controlled trial of nebulized salbutamol and adrenaline in acute severe asthma. *Intensive Care Med,* 1995 21; 18-23
58. Smith D et al. IV Epinephrine in life-threatening asthma. *Ann Emerg Med, 2003* 41; 706-11
59. Silverman R. et al. IV Magnesium Sulfate in the Treatment of Acute Severe Asthma; A multicenter Randomized Controlled Trial. *Chest,* 2002 122(2):489-497

Revision Date
September 15, 2014

Pulmonary Edema

(9914137 – Pulmonary Edema/CHF)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

Treatment and Interventions

1. Manage airway as necessary
2. Provide supplemental O_2 as needed to maintain O_2 saturation $\geq$ 94%
3. Initiate monitoring and perform 12-lead EKG
4. Establish IV access
5. Nitroglycerin 0.4 mg SL, can repeat q 3-5 minutes as long as SBP > 100 (if range not desired use q 3 minutes)

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

Patient Safety Considerations

No specific recommendations

Notes/Educational Pearls

Key Considerations

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

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

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

References

1. Gheorghiade M, Zannad F, Sopko G, et al. Acute heart failure syndromes: current state and framework for future research. *Circulation,* 2005; 112:3958. (ACEI)
2. Heart Failure Society of America, Lindenfeld J, Albert NM, et al. HFSA 2010 Comprehensive Heart Failure Practice Guideline. *J Card Fail,* 2010 16:e1
3. 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:e391
4. 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 Oct-Dec;10(4):430-9
5. Mosesso VN, Dunford J et al. Prehospital Therapy for Acute Congestive Heart Failure: State of the Art. *Prehospital Emergency Care*, 2003 (7) 13-23
6. 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
7. 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 Sep; 52(3):232?241
8. Williams TA, Finn J, Celenza A et al. Paramedic identification of acute pulmonary edema in a metropolitan ambulance service. *Prehosp Emerg Care*, 2013 March 13

Revision Date

September 15, 2014

Trauma

General Trauma Management

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

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

ii. Signs of hemorrhagic shock include: tachycardia, pale, cool clammy skin, capillary refill > 2 seconds

e. Disability
   i. Perform neurologic status assessment (see **Appendix VI**)
   ii. Assess gross motor movement of extremities
   iii. Evaluate for clinical signs of traumatic brain injury with herniation including: unequal pupils, lateralizing motor signs or posturing

f. Exposure
   i. Rapid evaluation of entire body to identify sites of penetrating wounds or other blunt injuries. Be sure to roll patient and view back
   ii. Prevent hypothermia

Treatment and Interventions

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

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

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

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

Secondary Assessment, Treatment and Interventions

1. Assessment
   a. Obtain medical history from patient or family including:
      i. Allergies
      ii. Medications
      iii. Past medical and surgical history
      iv. Events leading up to the injury
   b. Secondary Survey: Head to toe physical exam
      i. Head
         1. Palpate head and scalp and face and evaluate for soft tissue injury or bony crepitus
         2. Assess pupils
      ii. Neck
         1. Check for:
            a. Contusions
            b. Abrasions
            c. Hematomas
            d. JVD
         2. Palpate for crepitus
         3. Evaluate for spinal tenderness
      iii. Chest
         1. Palpate for instability/crepitus
         2. Listen to breath sounds
         3. Inspect for penetrating or soft tissue injuries
      iv. Abdomen
         1. Palpate for tenderness
         2. Inspect for penetrating or soft tissue injuries
      v. Pelvis
         1. Inspect for penetrating or soft tissue injuries
         2. Palpate once for instability by gentle AP pressure with the heels of the hands on the symphysis pubis and then medial pressure at the iliac crests bilaterally
      vi. Back
         1. Log roll patient to maintain spinal alignment
         2. Inspect for penetrating or soft tissue injuries
         3. Palpate for spinal tenderness

vii. Neurologic status assessment (see **Appendix VI**)
    1. Serial assessment of mental status
    2. Gross exam of motor strength all four extremities
viii. Extremities
    1. Assess for fracture/deformity
    2. Assess peripheral pulses/capillary refill

c. Additional treatment considerations
    i. Maintain spine precautions per **Spinal Care** guideline
    ii. Splint obvious extremity fractures per **Extremity Trauma/External Hemorrhage Management** guideline
    iii. Provide pain medication per **Pain Management** guideline

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

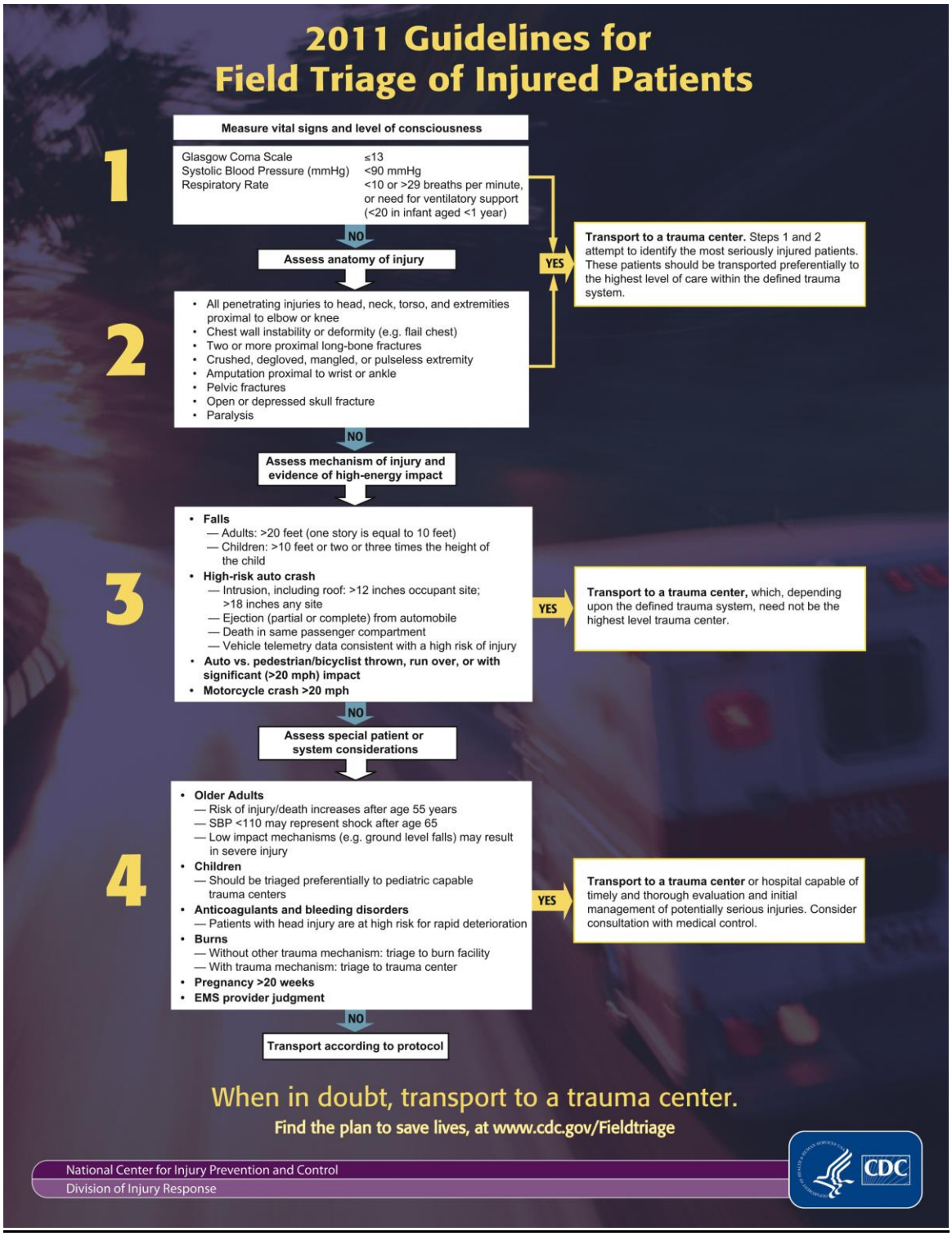
1. Monitor scene time for unstable patients
2. Monitor appropriateness of procedures
3. Monitor appropriate airway management

References

1. 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 D et al. Eastern Association for the Surgery of Trauma Practice Management Guidelines for Hemorrhage in Pelvic Fracture—Update and Systematic Review. *Journal of Trauma-Injury Infection & Critical Care*: December 2011 - Volume 71 - Issue 6 - pp 1850-1868
3. Fallat M et al. Withholding or termination of resuscitation in pediatric out-of-hospital traumatic cardiopulmonary arrest. *Pediatrics*, 2014 133(4):e1104-16
4. Guidelines for the Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage, 2011, MMWR 2012; 61(1):1
5. Millin M 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):459-467
6. Prehospital Trauma Life Support, 6th Ed

Revision Date

September 15, 2014



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

Blast Injuries

(9914045 – Exposure – Explosive/Blast Injury)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

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

Treatment and Interventions

1. Airway: Secure airway, utilizing airway maneuvers, airway adjuncts, supraglottic device, or endotracheal tube (see **Airway Management** guideline)
   If thermal or chemical burn to airway is suspected, early airway control is vital
2. Breathing:
   a. Provide supplemental oxygen to maintain O_2 saturation $\geq$ 94%
   b. Assist respirations as needed
   c. Cover any open chest wounds with semi-occlusive dressing
   d. If patient has evidence of tension pneumothorax (decreased or absent breath sounds and signs of shock), perform needle decompression

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

Revision Date

September 15, 2014

Burns

(9914085 – Burns – Thermal)

Patient Care Goals
Minimize tissue damage and patient morbidity from burns

Patient Presentation
Observe and document:

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

Inclusion Criteria
Patients sustaining thermal burns

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

Special transport considerations:

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

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

Patient Management

Assessment

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

Treatments and interventions

1. Stop the burning:
   a. Soak clothing and skin with water if burning or smoldering, then remove clothing if not stuck to the patient
   b. Remove jewelry. It may be hot
   c. Leave blisters intact
2. Minimize burn wound contamination. Cover burns with dry dressing or clean sheet.
3. Vital signs including SPO_2, consider SPCO and $ETCO_2$ if available
   a. $ETCO_2$ monitoring may be particularly useful to monitor respiratory status in patients receiving significant doses of narcotic pain medication
   b. Cardiac monitor is important in chemical inhalations and electrical burns.
4. Supplement oxygen titrated to SPO_2, if available. Give to all burn patients rescued from a confined space
5. Establish IV access, avoid placement through burned skin
6. Evaluate distal circulation in circumferentially burned extremities
7. Consider early management of pain and nausea/vomiting.
8. Initiate fluid resuscitation: Use lactated ringers or normal saline
   a. If patient in shock, give fluid per shock protocol
   b. If patient not in shock: Begin fluids based on estimated TBSA (see Initial Fluid Rate Chart for Burns in **Appendix V**). For children, use length-based tape for weight estimate
   c. Initial fluid rate can also be calculated as: body weight (kg) X TBSA = cc of fluid to be given in first 2 hours
9. Prevent systemic heat loss – keep patient warm

Special treatment considerations

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

Notes/Educational Pearls

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

Quality Improvement

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

Key Documentation Elements

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

Performance Measures

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

References

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

Revision Date

September 15, 2014

Extremity Trauma / External Hemorrhage Management

(9914097 – Extremity)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

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

Treatments and Interventions

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

iii. Consider hemostatic adjuncts

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

Patient Safety Considerations

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

Notes/Educational pearls

Key Considerations

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

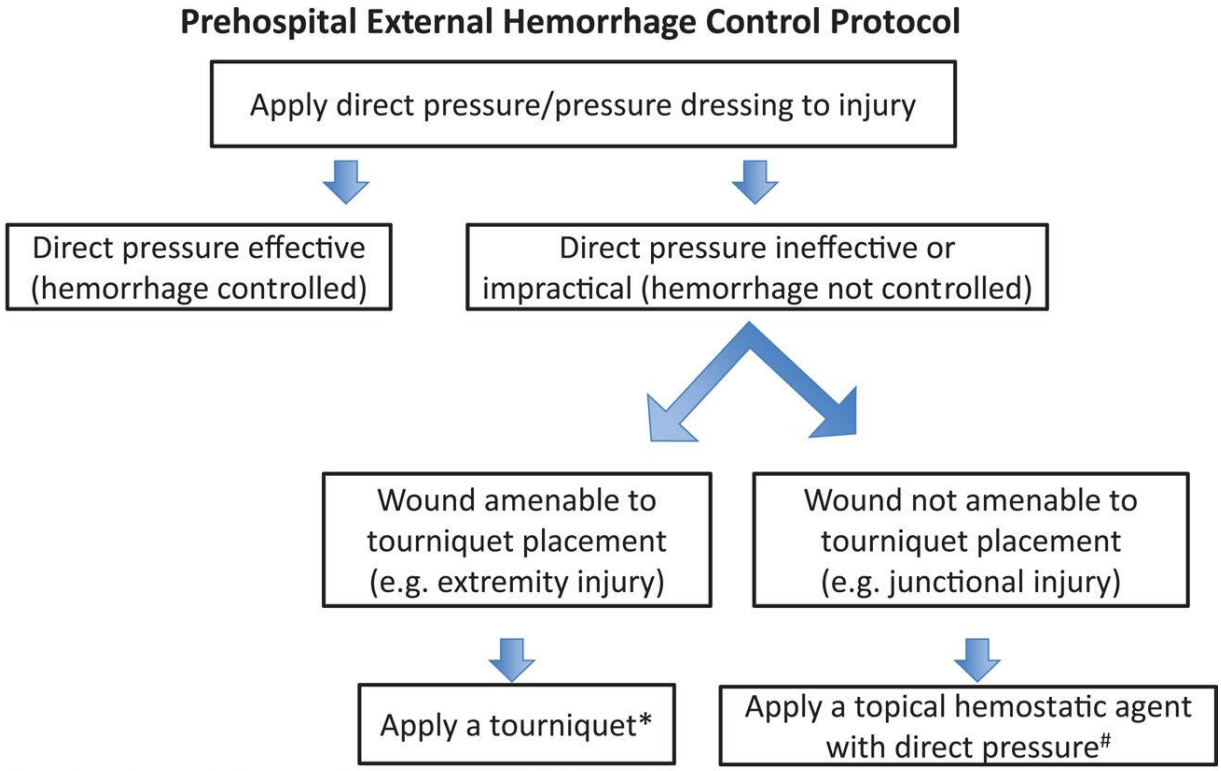
Quality Improvement

Key Documentation Elements

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

Performance Measures

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



From: Bulger, et al. 2014

References

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

Revision Date

September 15, 2014

Facial Trauma

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

Treatment and Interventions

1. Oxygen supplementation based on hypoxia to maintain O_2 saturation $\geq$ 94%; use $ETCO_2$ to help monitor for hypoventilation and apnea
2. IV access, as needed for fluid or pain and anti-emetic medication (more likely) administration
3. Pain medication as per **Pain Management** guideline
4. Avulsed tooth:
   a. Avoid touching the root of the avulsed tooth. Do not wipe off tooth
   b. Pick up at crown end. If dirty, rinse off under cold water for 10 seconds
   c. Place in milk or saline as the storage medium. Alternatively patient can hold tooth in mouth using own saliva as storage medium
5. Eye trauma:
   a. Consider eye shield for any significant eye trauma

b. If globe is avulsed do not put back into socket: cover with moist saline dressings and then place cup over it

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

5. Eye trauma was properly addressed

References
No specific recommendations

Revision Date
September 15, 2014

Head Injury

(9914101 – Head)

Patient Care Goals

Limit disability and mortality from head injury by:

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Maintain cervical stabilization (see **Spinal Care** guideline)
2. Primary survey: Use "Approach to Injured Patient"
3. Monitoring:
   a. Continuous pulse oximetry
   b. Frequent systolic and diastolic blood pressure measurement
   c. Initial neurologic status assessment (see Neurologic Status Assessment in Appendix VI) , and reassessment with any change in mentation
   d. Moderate/severe head injury : apply continuous waveform $ETCO_2$ if available
4. Secondary survey pertinent to isolated head injury:
   a. Head:
      Gently palpate skull to evaluate for depressed or open skull fracture
   b. Eyes:
      i. Evaluate pupil size and reaction to light to establish baseline
      ii. Reassess if decrease in mentation
   c. Nose/mouth/ears:
      Evaluate for blood/fluid drainage
   d. Face:
      Evaluate for bony stability
   e. Neck:
      Palpate for cervical spine step-off
   f. Neurologic:
      i. Perform neurologic status assessment (as above)
      ii. Evaluate for focal neurologic deficit: motor and sensory

Treatment and Interventions

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

1. Airway:
    a. Oxygen: prevent any desaturation < 90%; use supplemental O_2 as needed to maintain O_2 saturation ≥ 94%
    b. If patient unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basal skull fracture)
    c. Oral endotracheal intubation: use only if BVM ventilation ineffective in maintaining oxygenation or if airway is continually compromised. Nasal intubation should not be used in patients with head injury
2. Breathing:
    a. Moderate / severe head injury: Continuous waveform capnography and $EtCO_2$ measurement if available
    b. Supraglottic airway / endotracheal intubation only if BVM ventilation inadequate to maintain adequate oxygenation. Target $EtCO_2$ 35-40 mmHg
    c. Severe head injury with signs of herniation: Hyperventilation to target $EtCO_2$ 30-35 mmHg. This is a short-term option, and is ONLY for severe head injury (GCS ≤ 8 or U (unresponsive) on AVPU scale) with signs of herniation
3. Circulation:
    a. Wound care:
        i. Control bleeding with direct pressure if no suspected open skull injury
        ii. Moist sterile dressing to any potential open skull wound
    b. Moderate / severe closed head injury:
        i. Blood pressure: avoid hypotension
            1. Adult (age > 10 years): maintain SBP ≥ 110 mmHg
            2. Pediatric: maintain SBP:
                a. < 1 month: > 60 mmHg
                b. 1-12 months: > 70 mmHg
                c. 1-10 years: > 70 + 2x age in years
    c. Closed head injury: Consider administering NS/LR fluid bolus to maintain blood pressure to above numbers and maintain cerebral perfusion
    d. Do not delay transport to initiate IV access
4. Disability:
    a. Evaluate for other causes of altered mental status:
        i. Evaluate blood glucose if indicated
    b. Spinal stabilization
    c. Perform and trend neurologic status assessment (moderate / severe: GCS ≤13, P (pain) or U (unresponsive) on AVPU scale)
        i. Early signs of deterioration:
            1. Confusion
            2. Agitation
            3. Drowsiness
            4. Vomiting
            5. Severe headache
        ii. Monitor for signs of herniation
    d. Severe head injury: Elevate head of bed 30 degrees

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

1. Mechanism of injury documented
2. At least one full set of vital signs documented: SBP/DBP, P, R, SaO_2, GCS
3. Pupil exam documented for moderate severe head injury
4. $EtCO_2$ monitored and documented for moderate/severe head injury

Performance Measures

1. No oxygen desaturation < 90%
2. No hypotension < 90 mmHg
3. No $EtCO_2$ lower than 35 for mild head injury, 30 if severe head injury with signs of herniation
4. Appropriate triage to trauma center

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 Jul;35(3):429-35; discussion 435-6. doi: 10.1007/s10143-012-0377-2. Epub 2012 Mar 14. PMID: 22415660
2. Badjatia N, Carney N, Crocco TJ, Fallat ME, Hennes HM, Jagoda AS, Jernigan S, Letarte PB, Lerner EB, Moriarty TM, Pons PT, Sasser S, Scalea T, Schleien CL, Wright DW; Brain Trauma Foundation; BTF Center for Guidelines Management. Guidelines for prehospital management of traumatic brain injury second edition. *Prehosp Emerg Care*, 2008 12Suppl 1:S1-52
3. Berlot G, La Fata C, Bacer B, Biancardi B, Viviani M, Lucangelo U, Gobbato P, Torelli L, Carchietti E, Trillò G, Daniele M, Rinaldi A. Influence of prehospital treatment on the outcome of patients with severe blunt traumatic brain injury: a single-centre study. *Eur J Emerg Med*, 2009 Dec; 16(6): 312-7
4. Davis DP, Koprowicz KM, Newgard CD, Daya M, Bulger EM, Stiell I, Nichol G, Stephens S, Dreyer J, Minei J, Kerby JD. 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 Apr-Jun; 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): 1233-41
6. Franschman G, Peerdeman SM, Andriessen TM, Greuters S, Toor AE, Vos PE, Bakker FC, Loer SA, Boer C; Amsterdam Lifeliner: 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 Oct; 71(4): 826-32
7. Haut ER, Kalish BT, Cotton BA, Efron DT, Haider AH, Stevens KA, Kieninger AN, Cornwell EE third, Chang DC. Prehospital intravenous fluid administration is associated with higher mortality in trauma patients: a National Trauma Data Bank analysis. *Ann Surg,* 2011 Feb;253(2):371-7

8. Jagoda AS, Bazarian JJ, Bruns JJ Jr, Cantrill SV, Gean AD, Howard PK, Ghajar J, Riggio S, Wright DW, Wears RL, Bakshy A, Burgess P, Wald MM, Whitson RR. 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 Dec; 52(6): 714-48. PMID: 19027497
9. Kleinman ME, Chameides L, Schexnayder SM, Samson RA, Hazinski MF, Atkins DL, Berg MD, deCaen AR, Fink EL, Freid EB, Hickey RW, Marino BS, Nadkarni VM, Proctor LT, Qureshi FA, Sartorelli K, Topjian A, van der Jagt EW, Zaritsky AL. Part 14: Pediatric Advanced Life Support. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010 122: S876-S908
10. Reed D. Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults: second Edition. 2011. New South Wales Institute of Trauma and Injury Management. www.health.nsw.gov.au
11. Roberts I, Schierhout G. Hyperventilation therapy for acute traumatic brain injury. Cochrane Database of Systematic Reviews 1997, Issue 4. Art. No.: CD000566. doi: 10.1002/14651858.CD000566
12. Stocchetti N, Maas AIR, Chieregato A, van der Plas AA. Hyperventilation in Head Injury A Review. *Chest,* 2005 127(5): 1812-1827
13. Wakai A, Roberts IG, Schierhout G. Mannitol for acute traumatic brain injury. Cochrane Database of Systematic Reviews 2007, Issue 1. Art. No.: CD001049. doi: 10.1002/14651858.CD001049.pub4
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 Jul; 124(1): 56-64

Revision Date

September 15, 2014

Spinal Care

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

(9914107 – Spinal Cord Injury)

Patient Care Goals

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

Patient Presentation

Inclusion criteria

Traumatic mechanism of injury

Exclusion criteria

No specific recommendations

Patient Management

Assessment

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

Treatment and Interventions

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

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

discomfort and anxiety

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Anders JF, Adelgais 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), 501-503
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), 305-309
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), 447-450
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), 165-169
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), 774-778
7. Bureau of Emergency Medical Services. (2013) New Hampshire Department of Safety. http://www.nh.gov/safety/divisions/fstems/ems/advlifesup/documents/ptprotocols.pdf
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), 161-167
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), 303-309
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), 501-502
12. Cirak B, Ziegfeld S, Knight VM, Chang D, Avellino AM, Paidas, CN. Spinal injuries in children. *J Pediatr Surg,* 2004 *39*(4), 607-612
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), 31-36
14. Davies G, Deakin C, Wilson A. The effect of a rigid collar on intracranial pressure. *Injury,* 1996 *27*(9), 647-649
15. Decoster LC, Burns MF, Swartz EE, Murthi DS, Hernandez AE, Vailas JC, Isham LL. Maintaining neutral sagittal cervical alignment after football helmet removal during emergency spine injury management. *Spine (Phila Pa 1976),* 2012 *37*(8), 654-659
16. Del Rossi G, Heffernan TP, Horodyski M, Rechtine GR. The effectiveness of extrication collars tested during the execution of spine-board transfer techniques. *Spine J,* 2004 *4*(6), 619-623
17. Del Rossi G, Horodyski MH, Conrad BP, Di Paola CP, Di Paola MJ, Rechtine 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, Rechtine GR. Transferring patients with thoracolumbar spinal instability: Are there alternatives to the log roll maneuver? *Spine* 2008 *(Phila Pa 1976), 33*(14), 1611-1615
19. Del Rossi G, Rechtine 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.,* 2013
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), 123-131
22. Domeier RM etal. Multicenter prospective validation of prehospital clinical spinal clearance criteria. *J Trauma,* 2002 *53*(4), 744-750
23. Edlich RF et al. Revolutionary advances in enhancing patient comfort on patients transported on a backboard. *Am J Emerg Med,* 2011 *29*(2), 181-186
24. Engsberg JR, Standeven JW, Shurtleff TL, Eggars JL, Shafer JS, Naunheim RS. Cervical spine motion during extrication. *J Emerg Med,* 2013 *44*(1), 122-127
25. Hasler RM, Kehl C, Exadaktylos AK, Albrecht R, Dubler S, Greif R, Urwyler N. Accuracy of prehospital diagnosis and triage of a Swiss helicopter emergency medical service. *J Trauma Acute Care Surg,* 2012 *73*(3), 709-715
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), 250-252
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), 214-219
28. Haut ER, et al. Spine immobilization in penetrating trauma: More harm than good? *J Trauma,* 2010 *68*(1), 115-120; discussion 120-111
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), 593-598
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), 94-99
31. Hostler D, Colburn D, Seitz SR. A comparison of three cervical immobilization devices. *Prehosp Emerg Care,* 2009 *13*(2), 256-260
32. Huerta C, Griffith R, Joyce SM. Cervical spine stabilization in pediatric patients: Evaluation of current techniques. *Ann Emerg Med,* 1987 *16*(10), 1121-1126
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), 413-418
34. Kolb JC, Summers RL, Galli RL. Cervical collar-induced changes in intracranial pressure. *Am J Emerg Med,* 1999 *17*(2), 135-137
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): 513-18
37. Leonard, JC, Kuppermann N, Olsen C, Babcock-Cimpello L, Brown K, Mahajan P, Jaffe DM. Factors associated with cervical spine injury in children after blunt trauma. *Ann Emerg Med,* 2011 *58*(2), 145-155
38. Lin HL, et al. Neck collar used in treatment of victims of urban motorcycle accidents: Over- or underprotection? *Am J Emerg Med,* 2011 *29*(9), 1028-1033.
39. Lovell ME, Evans JH. A comparison of the spinal board and the vacuum stretcher, spinal stability and interface pressure. *Injury,* 1994 *25*(3), 179-180
40. Luscombe MD, Williams, JL. Comparison of a long spinal board and vacuum mattress for spinal immobilisation. *Emerg Med J,* 2003 *20*(5), 476-478
41. March JA, Ausband SC, Brown, LH. Changes in physical examination caused by use of spinal

immobilization. *Prehosp Emerg Care, 2002 6*(4), 421-424
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), 1064-1067
43. Mohseni S, Talving P, Branco BC, Chan LS, Lustenberger T, Inaba K, Demetriades D. Effect of age on cervical spine injury in pediatric population: A National Trauma Data Bank review. *J Pediatr Surg,* 2011 *46*(9), 1771-1776
44. National Association of EMS Physicians/American College of Surgeons. Position statement: EMS spinal precautions and the use of the long backboard. Prehospital Emergency Care 2013 Early Online: 1 -2
45. Nypaver M, Treloar D. Neutral cervical spine positioning in children. *Ann Emerg Med,* 1994 *23*(2), 208-211
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), 1515-1524
47. Peery CA, Brice J, White WD. Prehospital spinal immobilization and the backboard quality assessment study. *Prehosp Emerg Care,* 2007 *11*(3), 293-297
48. Pieretti-Vanmarcke R, Velmahos GC, Nance ML, Islam S, Falcone RA Jr., Wales PW, Masiakos PT. 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), 543-549; discussion 549-550
49. Podolsky S, Baraff LJ, Simon RR, Hoffman JR, Larmon B, Ablon W. Efficacy of cervical spine immobilization methods. *J Trauma,* 1983 *23*(6), 461-465
50. Prasarn ML, Zhou H, Dubose D, Rossi GD, Conrad BP, Horodyski M, Rechtine GR. 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), 504-508
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), 1342-1345
52. Rhee P, Kuncir EJ, Johnson L, Brown C, Velmahos G, Martin M, Demetriades D. Cervical spine injury is highly dependent on the mechanism of injury following blunt and penetrating assault. *J Trauma,* 2006 *61*(5), 1166-1170
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), 1017-1019
54. Shafer JS, Naunheim RS. Cervical spine motion during extrication: A pilot study. *West J Emerg Med,* 2009 *10*(2), 74-78
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. 2014 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), 631-636 e631
57. Spinal Motion Restriction Guideline. 2013 State of Connecticut
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), 609-615
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), 166-174

60. Theodore N, Hadley MN, Aarabi B, Dhall SS, Gelb DE, Hurlbert RJ, Walters BC. Prehospital cervical spinal immobilization after trauma. *Neurosurgery,* 2013 *72* Suppl 2, 22-34
61. Vaillancourt C, Stiell IG, Beaudoin T, Maloney J, Anton AR, Bradford P, Wells GA. The out-of-hospital validation of the Canadian C-Spine Rule by paramedics. *Ann Emerg Med,* 2009 *54*(5), 663-671 e661
62. Vanderlan WB, Tew BE, McSwain NE Jr. Increased risk of death with cervical spine immobilisation in penetrating cervical trauma. *Injury, 2*009 *40*(8), 880-883
63. Vanderlan WB, Tew BE, Seguin CY, Mata MM, Yang JJ, Horst HM, McSwain NE. Neurologic sequelae of penetrating cervical trauma. *Spine* 2009 *(Phila Pa 1976), 34*(24), 2646-2653
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, Deppe S, Love L, Betz S, Santanello S. Clinical clearance of spinal immobilization in the air medical environment: A feasibility study. *J Trauma,* 2008 *64*(6), 1539-1542
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,* 2014

Revision Date
September 15, 2014

Toxins and Environmental

Poisoning/Overdose Universal Care

(9914135 – Overdose/Poisoning/Toxic Ingestion)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

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

2. Ingestion:
    a. Nausea
    b. Vomiting
    c. Diarrhea
    d. Altered mental status
    e. Abdominal pain
    f. Rapid or slow heart rate
    g. Dyspnea
    h. Seizures

i. Arrhythmias
j. Respiratory depression
k. Chemical burns around or inside the mouth
l. Abnormal breath odors

3. Inhalation:
   a. Nausea
   b. Vomiting
   c. Diarrhea
   d. Altered mental status
   e. Abnormal skin color
   f. Dyspnea
   g. Seizures
   h. Burns to the respiratory tract
   i. Stridor
   j. Sooty sputum
   k. Known exposure to toxic or irritating gas
   l. Respiratory depression
   m. Sweating
   n. Tearing
   o. Constricted/dilated pupils
   p. Dizziness

4. Injection:
   a. Local pain
   b. Puncture wounds
   c. Reddening skin
   d. Local edema
   e. Numbness
   f. Tingling
   g. Nausea
   h. Vomiting
   i. Diarrhea
   j. Altered mental status
   k. Abdominal pain
   l. Seizures
   m. Muscle twitching
   n. Hypoperfusion
   o. Respiratory depression
   p. Metallic or rubbery taste

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Make sure the scene is safe

2. Consider Body Substance Isolation (BSI) or appropriate personal protective equipment (PPE)
3. Assess ABCD and if indicated expose and then cover to assure retention of body heat
4. Vital signs which include temperature
5. Place cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
6. Check blood glucose Level
7. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation
8. Identify specific medication taken (including immediate release vs sustain release) time of ingestion, dose, and quantity
9. Pertinent cardiovascular history or other prescribed medications for underlying disease
10. Check for needle marks, paraphernalia, bites, bottles or evidence of agent involved, self-inflicted injury, or trauma
11. Law enforcement should have checked for weapons and drugs but you may decide to re-check
12. Patient pertinent history
13. Patient physical examination

Treatment and Interventions

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

i. Consider administration of midazolam (benzodiazepine of choice) for temperature control
ii. Adult and Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)

e. Oral ingestion poisoning:
i. Consider administration of activated charcoal without sorbitol (1 gm/kg) PO particularly if it is within the first 2 hour after ingestion (including acetaminophen)
ii. Patients who have ingested medications with extended release or delayed absorption should also be administered activated charcoal
iii. If there is a risk of rapidly decreasing mental status or for petroleum-based ingestions, do not administer oral agents

Patient Safety Considerations

1. Scene/environmental safety patient and provider
2. Monitor patient airway, breathing, pulse oximetry, $ETCO_2$ for adequate ventilation as they will change over time
3. Repeat vital signs
4. Monitor level of consciousness
5. Monitor EKG with special attention to rate, rhythm, QRS and QT duration
6. Maintain or normalize patient temperature
7. Accurate ingestion history (as patient may become unconscious before arrival at ED):
   a. Time of ingestion
   b. Route of exposure
   c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
   d. Alcohol or other intoxicant taken
8. Poison center should be engaged as early as reasonably possible to add in appropriate therapy and to track patient outcomes to improve knowledge of toxic effects. The national 24-hour toll-free telephone number to poison control centers is (800) 222-1222, and it is a resource for free, confidential expert advice from anywhere in the United States

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 514
2. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 490
3. Spiller H. A prospective evaluation of the effect of activated charcoal before N-Acetyl cysteine in acetaminophen overdose. *Ann of Emerg Med*, 1994 23; 519-523
4. 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; 292-313
5. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 108-113 and 490

Revision Date

September 15, 2014

Acetylcholinesterase Inhibitors (Carbamates, Nerve Agents, Organophosphates) Exposure

(9914047 – Nerve Agents)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

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

Exclusion Criteria

No specific recommendations

Patient Management

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

Assessment

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

b. Bronchospasm
c. Vomiting
d. Excessive secretions in the form of:
    i. Tearing
    ii. Salivation
    iii. Rhinorrhea
    iv. Diarrhea
    v. Urination

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

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

Treatment and Interventions

Medications:

1. Atropine
   Atropine is the primary antidote for organophosphate, carbamate, or nerve agent exposures, and repeated doses should be administered liberally to patients who exhibit signs and symptoms of exposure or toxicity
   a. Atropine may be provided in multi-dose vials, pre-filled syringes, or auto-injectors
   b. Commercially available atropine auto-injectors include:
      i. Atro-Pen® 1 mg of atropine (dark red container)
      ii. Atro-Pen® 2 mg of atropine (green container)
      iii. Pediatric Atro-Pen® 0.25 mg of atropine (yellow container)
      iv. Pediatric Atro-Pen® 0.5 mg of atropine (blue container)
2. Pralidoxime Chloride (2-PAM)
   Pralidoxime chloride is a secondary treatment and should be given concurrently in an effort to reactivate the acetylcholinesterase
   a. Pralidoxime chloride may be provided in a single dose vial, pre-filled syringes, or auto-injectors
   b. Auto-injectors contain 600 mg of pralidoxime chloride
   c. In order to be beneficial to the victim, a dose of pralidoxime chloride should be administered shortly after the nerve agent or organophosphate poisoning as it has minimal clinical effect if administration is delayed
3. Benzodiazepines
   Benzodiazepines are administered as an anticonvulsant for those patients who exhibit seizure activity (see the **Seizures** guideline for doses and routes of administration)
   a. Lorazepam, diazepam, and midazolam are the most frequently used benzodiazepines in the prehospital setting
   b. In the scenario of an AChEI agent exposure, the administration of diazepam or midazolam is preferable due to their more rapid onset of action
   c. Benzodiazepines may be provided in multi-dose or single-dose vials, pre-filled syringes, or auto-injectors
   d. Cana® is a commercially available auto-injector of diazepam
4. Mark I® Kits
   a. A commercially available kit of nerve agent/organophosphate antidote auto-injectors
   b. A Mark I® kit consists of one auto-injector containing 2 milligrams of atropine and a second auto-injector containing 600 milligrams of pralidoxime chloride
5. Duodote®
   a. A commercially available auto-injector of nerve agent/organophosphate antidote
   b. Duodote® is one auto-injector that contains 2.1 milligrams of atropine and 600 milligrams of pralidoxime chloride

Medication Administration:

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

Recommended Doses

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

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

Mild AChEI Agent Exposure

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

Mild to Moderate AChEI Agent Exposure

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

Severe AChEI Agent Exposure

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

Guideline for the Treatment of Seizures Secondary to AChEI Agent Exposure

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Barkin RM et al. *Pediatric Emergency Medicine: Concepts and Clinical Practice*, 1992 490-491
2. Eddelston M, Buckley NA, Eyer P, Dawson AH. Management of acute organophosphorus poisoning. *Lancet,* 2008 371: 597-607
3. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 2052-2054
4. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill Toxicologic Emergencies, 2010 1450-1466
5. Tintinalli JE et al. *Tintinalli's Emergency Medicine*, 2011 1298-1300
6. 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

Revision Date

September 15, 2014

Radiation Exposure

(9914049 – Radiologic Agent)

Patient Care Goals

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

Patient Presentation

Inclusion criteria

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

Exclusion criteria

No specific recommendations

Patient Management

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

Assessment

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

Treatment and Interventions

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. Sources of radiation
    a. Legal
        i. Industrial plants
        ii. Healthcare facilities that provide radiologic services
        iii. Nuclear power plants
        iv. Mobile engineering sources (e.g. construction sites that are installing cement)

    b. Illegal
        i. Weapons of mass destruction
        ii. “Dirty bomb” design to contaminate widespread areas
2. Physiology of Radiation Poisoning
    a. Contamination – Poisoning from direct exposure to a radioactive source, contaminated debris, liquids, or clothing where radiation continues to be emitted from particles on surface
    b. Exposure – Poisoning from radioactivity, in the form of ionizing rays, penetrating through the bodily tissues of the patient
3. Common types of radioactivity that cause poisoning
    a. Gamma rays
        i. Highest frequency of ionizing rays
        ii. Penetrates the skin deeply
        iii. Causes the most severe radiation toxicity
    b. Beta rays
    Can penetrate up to 1 cm of the skin’s thickness
    c. Alpha rays
        i. Lowest frequency of ionizing rays

ii. Short range of absorption
iii. Dangerous only if ingested or inhaled

d. Radioactive daughters
i. Products of decay of the original radioactive substance
ii. Can produce gamma and beta rays (e.g. uranium decays into a series of radon daughters)

4. In general, trauma patients who have been exposed to or contaminated by radiation should be triaged and treated on the basis of the severity of their conventional injuries
5. A patient who is contaminated with radioactive material (e.g. flecks of radioactive material embedded in their clothing and skin) generally poses a minimal exposure risk to medical personnel.

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Center for Disease Control and Prevention, Emergency Preparedness and Response, Specific Hazards: *Radiation*, 2013
2. Cone D, Koenig. Mass casualty triage in the chemical, biological, radiological, or nuclear environment. *European Journal of Emergency Medicine*, 12:287–302
3. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 1937-1939

Revision Date
September 15, 2014

Topical Chemical Burn

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion criteria

None

Patient Management

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

Assessment

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

Treatment and Interventions

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

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

Hydrofluoric acid

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

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

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

Patient safety considerations

1. Don PPE
2. Take measures to prevent the patient from further contamination through decontamination
3. Take measures to protect the EMS provider and others from contamination
4. Do not attempt to neutralize an acid with an alkali or an alkali with an acid as a serious exothermic reaction will occur and cause serious harm to the patient
5. 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

Key Considerations

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

Pertinent Assessment Findings

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

.

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. American Heart Association, *Advanced Pediatric Life Support*, 2013
2. Ferng M. Hazardous Brick Cleaning. *J Emergency Medicine*, 2009 Vol 37 305-307
3. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 769-770
4. Nelson LR et al. *Goldfrank's Toxicologic Emergencies*, 2010 1450-1466
5. O'Sullivan SB, Schmitz TJ. *Physical Rehabilitation*, 5th ed., 2007 1098
6. Tintinalli JE et al. *Tintinalli's Emergency Medicine*, 2011 1297, 1351, 1381-1382

Revision Date
September 15, 2014

Stimulant Poisoning/Overdose

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

No specific recommendations

Patient Management

Begin with the ABCDs:

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

Assessment

1. Vital signs including temperature
2. Apply a cardiac monitor and examine rhythm strip for arrhythmias
3. Check blood glucose level
4. Monitor $ETCO_2$ for respiratory decompensation
5. Check for trauma, self-inflicted injury
6. Law enforcement should have checked for weapons and drugs, but you may decide to repeat the inspection

Treatment and Interventions

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. If law enforcement has placed the patient in handcuffs, this patient needs ongoing physical restraint for safe transport. Have law enforcement in back of ambulance for the handcuffed patient or make sure proper physical restraints are in place before law enforcement leaves and ambulance departs from scene
2. If patient has signs and symptoms of ACS, strive to give nitroglycerin SL q 3-5 minutes as long as SBP > 100 and until pain resolves (if range not desired, use q 3 minutes). Vasospasm is often the problem in this case as opposed to a fixed coronary artery lesion
3. Maintaining IV access, cardiac monitor, and SPO_2/$ETCO_2$ monitors are key to being able to catch and intervene decompensations in a timely manner. Restrain the patient to facilitate patient assessment and lessen likelihood of vascular access or monitor displacements

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

Revision Date

September 15, 2014

Cyanide Exposure

(9914043 – Cyanide)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

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

High concentrations of cyanide will produce:

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

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose and then cover the patient to assure retention of body heat
3. Vital signs which include temperature
4. Put on cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
5. Check blood glucose Level
6. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation.
7. Identify specific agent taken, time of ingestion/ inhalation, and quantity
8. Pertinent cardiovascular history or other prescribed medications for underlying disease

9. Patient pertinent history
10. Patient physical exam

Treatment and Interventions

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

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

Early and repeated assessment is essential

Quality Improvement

Key documentation elements

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

Performance measures

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

References

1. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 1689-1691
2. Marraffa JM et al. Antidotes for Toxicological Emergencies, *Am J Health Syst Pharm,* 2012 69(3):199-212
3. Bebarta VS et al. 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 Apr; 55(4): 345-51
4. Shepherd G, Velez LI. Role of hydroxocobalamin in acute cyanide poisoning. *Ann Pharmacotherapy,* 2008 42(5): 661-9
5. 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

6. Thompson JP, Marrs TC. 2012 Hydroxocobalamin in cyanide poisoning. *Clin Toxicol,* (Phila); 50: 875

Revision Date
September 15, 2014

Beta Blocker Poisoning/Overdose

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

Patients present with:

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Assess ABCDs and if indicated expose and then cover to assure retention of body heat
2. Vital signs which include temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose level
5. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation
6. Identify specific medication taken (noting immediate release vs. sustained release formulations), time of ingestion, and quantity
7. Pertinent cardiovascular history or other prescribed medications for underlying disease
8. Patient pertinent history
9. Patient physical

Treatment and Interventions

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

b. Pediatric: 0:02 mg/kg (0.5 mg max) q 5 minutes, max total dose 1 mg
4. Consider fluid challenge (20 ml/kg) for hypotension with associated bradycardia
5. Consider glucagon for symptomatic patient
   a. Adult: 1 mg every 5 minutes IVP (may require 6 mg to see clinical effects)
   b. Pediatric:
      i. 1 mg IVP (25-40 kg); every 5 minutes as necessary
      ii. 0.5 mg IVP (less than 25 kg); every 5 minutes as necessary
6. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient
   a. Norepinephrine (start 2 mcg/minute and titrate)
   b. Dopamine (start 2 mcg/kg/minute and titrate)
7. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
8. If seizure, consider midazolam (benzodiazepine of choice)
   a. Adult : 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg (Reduce by 50% for patients 69 years or older)
   b. Pediatric: 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg or 0.2 mg/kg IN to max dose of 4 mg

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key documentation elements

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

Performance Measures

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

References

1. Wax PM. b-Blocker ingestion: An evidence-based consensus guideline for out-of-hospital management, *Clinical Toxicology,* 2005 43: 131–146 ISSN: 0731-3810 print/1097-9875 online doi: 10.1081/CLT-200062475
2. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill 2006 902, 903
3. Kerns W II. Management of b-adrenergic blocker and calcium channel antagonist toxicity, *Emerg Med Clin N Am,* 25 (2007) 309–331
4. Hepherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm*, 2006 Oct 1; 63(19): 1828-35
5. Review. Erratum in: *Am J Health Syst Pharm*, 2008 Sep 1; 65(17): 1592
6. Boyd R, Ghosh A. Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. Glucagon for the treatment of symptomatic beta blocker overdose. *Emerg Med J*, 2003 May; 20(3):266-7
7. Marraffa JM, Cohen V, Howland MA. Antidotes for Toxicological Emergencies. *Am J Health Syst Pharm*, 2012 69(3): 199-212

Revision Date

September 15, 2014

Bites and Envenomation

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

Patient Care Goals

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

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

Patient Presentation

Inclusion Criteria

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

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

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

Exclusion Criteria

None

Patient Management

Assessment

1. Assess ABCDs and if indicated expose and then cover to assure retention of body heat
2. Vital signs which include temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose Level
5. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation
6. Patient pertinent history

7. Patient physical

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

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

Performance Measures

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

References

1. American College of Medical Toxicology; American Academy of Clinical Toxicology; American Association of Poison Control Centers; European Association of Poison Control Centres and Clinical Toxicologists; International Society on Toxinology; Asia Pacific Association of Medical Toxicology. Pressure immobilization after North American Crotalinae snake envenomation. *Clin Toxicol,* (Phila). 2011 Dec; 49(10): 881-2
2. Ward N. Evidence-based treatment of jellyfish stings in North America and Hawaii. *Ann Emerg,* 2012 60; 399-414
3. Prestwich H, Jenner R. Best evidence topic report. Treatment of jellyfish stings in UK coastal waters: vinegar or sodium bicarbonate? *Emerg Med J*, 2007 Sep 24(9): 664
4. Weinstein SA, Dart RC, Stables A. Envenomations: An Overview of Clinical Toxinology for the Primary Care Physician. *Am Fam Physician,* 2009 Oct 15; 80(8): 793-802 http://www.aafp.org/afp/2009/1015/p793.html
5. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 1590-1591

Revision Date

September 15, 2014

Calcium Channel Blocker Poisoning/Overdose

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

Patients present with:

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

Exclusion criteria

No specific recommendations

Patient Management

Assessment

1. Assess ABCDs and, if indicated, expose and then cover to assure retention of body heat
2. Vital signs including temperature
3. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
4. Check blood glucose Level
5. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation
6. Identify specific medication taken (noting immediate release vs. sustained release formulations), time of ingestion, and quantity
7. Pertinent cardiovascular history or other prescribed medications for underlying disease
8. Patient pertinent history
9. Patient physical

Treatment and Interventions

1. Consider activated charcoal without sorbitol (1 gm/kg) PO. If risk of rapid decreasing mental status, do not administer oral agent without adequately protecting the airway
2. Consider atropine sulfate for symptomatic bradycardia
   a. Adult: 1 mg IV q 5 minutes to max of 3 mg
   b. Pediatric: 0:02 mg/kg (0.5 mg max) q 5 minutes, max total dose 1 mg
3. Consider calcium chloride or calcium gluconate

a. Calcium Chloride
    i. Adult: 0.5 - 1 gm slow IVP (50 mg/minute)
    ii. Pediatric: 20 mg/kg (0.2 ml/kg) slow IVP/IO (50 mg/ml) Maximum dose 1 gm or 10 ml
b. Calcium gluconate
    i. Adult: 2-6 gm slow IVP over 10 minutes
    ii. Pediatric: 60 mg/kg IV over 10 minutes

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Shepherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. Am J Health Syst Pharm. 2006 Oct 1; 63(19): 1828-35. Review. Erratum in: *Am J Health Syst Pharm*, 2008 Sep 1; 65(17): 1592
2. 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 Dec; 310(6): 258-63
3. Marraffa JM, Cohen J, Howland MA. Antidotes for Toxicological Emergencies, *Am J Health Syst Pharm,* 2012 69(3): 199-212
4. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 887, 2011
5. 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; 252-258
6. Levine M. The effects of intravenous calcium in patient are with digoxin toxicity. *Journal Emerg Medicine,* 2011; 40; 41-46
7. Olsen K. Calcium channel blocker ingestion: An evidence-based consensus guideline for out-of-hospital management, *Clinical Toxicology*, 43: 797-822, 2005
8. Olsen K. What is the best treatment for acute calcium channel blocker overdose? *Ann Emerg Med,* 2013 62; 259-261

Revision Date

September 15, 2014

Carbon Monoxide/Smoke Inhalation

(9914039 – Carbon Monoxide/Smoke Inhalation)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

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

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

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose and then cover to assure retention of body heat
3. Vital signs which include temperature
4. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and consider obtaining a 12-lead EKG
5. Check blood glucose level
6. Monitor pulse oximetry and $ETCO_2$ for respiratory decompensation
7. Patient pertinent history
8. Patient physical

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

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

Performance Measures

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

References

1. Buckley NA et al. Hyperbaric oxygen for carbon monoxide poisoning. *Cochrane Database Syst Rev*. 2011 Apr 13;(4)
2. Hampson N. Practice Recommendations: the diagnosis, management and prevention of carbon monoxide poisoning. *Am J Respir Crit Care Med*, 2012 1095-1101
3. Flomenbaum NL. *Goldfrank's Toxicologic Emergencies*, 8th edition, McGraw-Hill, 2006 1663-1665
4. Hampson N. Pulse oximetry in severe carbon monoxide poisoning. *CHEST,* 1998: 114; 1036-1041
5. Jones A. Recent advances in the management of poisoning. *Ther Drug Monit,* 2002 Feb; 24(1): 150-5
6. Touger M et al. Performance of the RAD-57 pulse co-oximeter compared with standard laboratory carboxy hemoglobin measurement. *Ann Emerg Med*, 2010 Oct; 56(4):382-8

Revision Date:
September 15, 2014

Opioid Poisoning/Overdose

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria:

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

Patient Management

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

Assessment

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

Treatments and Interventions

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

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

Patient Safety Considerations

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

Notes /Educational Pearls:

Key Considerations

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

i. Vicodin® is a combination of acetaminophen and hydrocodone
ii. Percocet® is a combination of acetaminophen and oxycodone
iii. Percodan® is a combination of aspirin and oxycodone
iv. Suboxone® is a combination of buprenorphine and naloxone

5. The IN route has the benefit of no risk of needle stick to the provider

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 2047-2048, 2050
2. Nelson, LR et al. *Goldfrank's Toxicologic Emergencies*, 2010, 579-583
3. United States Department of Justice, Drug Enforcement Administration, United States Code Controlled Substance Act, Title 21, Section 812

Revision Date:

September 15, 2014

Hyperthermia/Heat Exposure

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

Definitions:

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

b. Exertion level
c. Length of time at risk
d. Attire (clothing worn)
e. Children left in cars with evidence of altered mental status and elevated body temperature are likely suffering from hyperthermia

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

Treatment and Interventions

1. Move victim to a cool area and shield from the sun or any external heat source
2. Remove as much clothing as is practical and loosen any restrictive garments
3. If alert and oriented, give small sips of cool liquids
4. If altered mental status, check blood glucose level
5. Maintain airway vigilance for emesis, seizure
6. Place on cardiac monitor and record ongoing vital signs and level of consciousness
7. If temperature is > 104 degrees F (40 degrees C) or if altered mental status is present, begin active cooling by:
   a. Continually misting the exposed skin with tepid water while fanning the victim (most effective)
   b. Truncal ice packs may be used, but are less effective than evaporation
   c. Shivering should be treated as soon as possible
   d. Ice bath immersion provides the most rapid cooling mechanism but may not be available to EMS
8. Establish IV access for heat stroke
9. Give cool fluids at 20 ml/kg boluses and reduce to 10 ml/kg/hr boluses when vitals are stable
10. Monitor for shivering and seizures; treat as below
11. Adult:
    Consider 500 ml normal saline IV fluid bolus for dehydration even if vital signs are normal
    If uncontrolled shivering occurs during cooling:
    a. Midazolam 2.5mg IV/IN, may repeat once in 5 minutes or; 5mg IM may repeat once in 10 minutes

b. Lorazepam 1mg IV, may repeat once in 5 minutes or; 2mg IM, may repeat once in 10 minutes
c. Diazepam 2mg IV, may repeat once in 5 minutes

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Bouchama A, Knochel JP. Heat Stroke. *NEJM,* 2002 346(25): 1978-1988
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. EMRAP November 2013: Volume 13, Issue 11
4. Heled Y, Rav-Acha M, Shani Y et al. The "Golden Hour" for heatstroke treatment. *Mil Med,* 2004 169(3)184-186
5. http://lifeinthefastlane.com/futility-orthostatic-measurements/; accessed August 9, 2014
6. Vicario SJ, Okabajue R, Haltom T. Rapid cooling in classic heatstroke treatment: effect on mortality rates. *Am J Emerg Med*, 1986; 4(5): 394-398

Revision Date

September 15, 2014

Hypothermia/Cold Exposure

(9914023 – Cold Exposure; 9914031 – Hypothermia)

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

Patients suffering systemic or localized cold injuries

Exclusion Criteria

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

Patient Management

Assessment

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

b. Moderate - 32°-28°C – 89.7°-82.5°F
c. Severe - 28°-22° C (or lower) – 82.4°- 68.1° F (or lower)

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

Treatment and Interventions

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

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

b. Manage airway as needed. Care must be taken not to hyperventilate the patient as hypocarbia may reduce the threshold for ventricular fibrillation in the cold patient. Indications and contraindications for advanced airway devices are similar in the hypothermic patient as in the normothermic patient
c. Prevent further heat loss using the above methods
d. Initiate field-rewarming methods such as placement of large heat packs or heat blankets (chemical or electric if feasible) to the anterior chest or wrapped around the patient's thorax if large enough. Forced air warming blankets (e.g. Bair Hugger®) can be an effective field rewarming method if available
e. Handle the patient gently. Attempt to keep the patient in the horizontal position, especially limiting motion of the extremities to avoid increasing return of cold blood to the heart. Once in a warm environment, clothing should be cut off (rather than removed by manipulating the extremities). Move the patient only when necessary such as to remove the patient from the elements
f. Apply cardiac monitor or AED if available
g. Establish IV and provide warmed NS bolus. Repeat as necessary
h. If alterations in mental status, consider measuring finger stick blood glucose and treat as indicated (follow **Hypoglycemia/Hyperglycemia** guideline) and assess for other causes of alterations of mentation
i. Transport as soon as possible to a hospital capable of aggressive resuscitation. If cardiac arrest develops consider transport to a center capable of extracorporeal circulation (if feasible)

5. Frostbite:
   If the patient has evidence of frostbite, and ambulation/travel is necessary for evacuation or safety, avoid rewarming of extremities until definitive treatment is possible. Additive injury occurs when the area of frostbite is rewarmed then inadvertently refrozen. Only initiate rewarming if refreezing is absolutely preventable
   a. If rewarming is feasible and refreezing can be prevented use circulating warm water (98.6 - 102° F/37 - 39° C) to rewarm effected body part, thawing injury completely. If warm water is not available, rewarm frostbitten parts by contact with non-affected body surfaces. Do not rub or cause physical trauma
   b. After rewarming, cover injured parts with loose sterile dressing. If blisters are causing significant pain, and the provider is so trained, these may be aspirated, however, should not be de-roofed. Do not allow injury to refreeze. Follow the **Pain Management** guideline

Patient Safety Considerations

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

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

Notes/Educational Pearls

Key Considerations

Considerations in cardiac arrest

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

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Venden Hoek et al. Part 12: Cardiac Arrest in Special Situations. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*, November 2, 2010
2. McIntosh SE, Hamonko M et al. Wilderness Medical Society guidelines for the prevention and treatment of frostbite. *Wilderness Environ Med*, 2011 Jun; 22(2):156-166
3. Freer L, Imray CHE. Frostbite. In Auerbach PS (ed.), *Wilderness Medicine* (6th ed.). Philadelphia: Elsevier, 2012 181-201
4. Danzl DF. Accidental Hypothermia. In Auerbach PS (ed.), *Wilderness Medicine* (6th ed.). Philadelphia: Elsevier, 2012 116-142
5. "State of Alaska Cold Injury Guidelines – 2014" – Department of Health and Social Services, Division of Public Health. Early release version, provided by Dr. Ken Zafren on July 15, 2014
6. Pennsylvania State ALS Protocols, "Hypothermia/Cold Injury/Frostbite Statewide ALS Protocol" Effective 7/1/2001, accessed 6/11/2013 http://www.portal.state.pa.us/portal/server.pt/community/emergency_medical_services/14138/ems_statewide_protocols/625966
7. New Hampshire State Protocols, "Hypothermia Adult & Pediatric" Effective 2013, accessed 6/11/2013 http://www.nh.gov/safety/divisions/fstems/ems/advlifesup/documents/ptprotocols.pdf
8. Massachusetts EMS Protocols, "Hypothermia/Cold Emergencies", effective 3/1/2012, accessed 6/11/2013 http://www.mass.gov/eohhs/provider/guidelines-resources/clinical-treatment/public-health-oems-treatment-protocols.html

9. Rhode Island EMS Protocols, “Cold Exposure – Frostbite”, effective 10/1/2010, accessed 6/11/2013 http://www.health.ri.gov/publications/protocols/EMSProtocols_Aug2011_RevisedOnly.pdf
10. Maine EMS Protocols, “Hypothermia”, effective 12/1/2011, accessed 6/11/2013: http://www.maine.gov/ems/documents/2013_Maine_EMS_Protocols.pdf
11. Jackson WY EMS Protocol, “Hypothermia/Frostbite”, effective September 2011, accessed 3/15/2014: http://www.tetonwyo.org/fire/docs/Policies/Div17-EMSOperations/Article4-TreatmentProtocols/174.25HypothermiaFrostbite.pdf

Revision Date
September 15, 2014

Drowning

(9914093 – Drowning/Near Drowning)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

Patients without history of drowning.

Patient Management

Assessment

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

Treatment and Interventions

1. Ensure scene safety for patient and rescuers. Remove patient from water as soon as possible. Practice the safest water rescue technique possible, given circumstances on scene. Evacuate to land or a water craft as soon as possible. If there is a delay to accessing shore or a rescue boat, initiate in-water basic life support consisting of ventilation only
2. Manage airway as indicated
3. Follow cardiac arrest guideline as indicated with consideration of ABC strategy for drowning victims in cardiac arrest. Initiate 5 rescue breaths followed by 30 chest compressions. After the initial 5 breaths, use a 2 breaths to 30 compression ratio
4. If mechanism or history suggest cervical spine injury, manage c-spine
5. Monitor vital signs including oxygen saturations
6. If O_2 saturations are less than 92%, provide supplemental oxygen to maintain saturation $\geq$ 94%. Consider positive pressure ventilation in patients with signs or symptoms of respiratory difficulty
7. Consider hypothermia and treat per **Hypothermia/Cold Exposure** guideline

8. If the victim was involved in underwater diving with diving equipment and uncertainty exists regarding the most appropriate therapy, consider contacting direct medical oversight and discussing need for hyperbaric treatment. Include discussion regarding:
    a. Submersion time
    b. Greatest depth achieved
    c. Ascent rate
9. Establish IV access
10. Fluid bolus as indicated
11. Advanced airway management as indicated. Consider CPAP in awake patients with respiratory distress
12. Cardiac monitor

Patient Safety Considerations

1. Avoidance of hyperoxygenation of the drowning victim
2. Rescuer safety considerations

Notes/Educational Pearls

Key Considerations

1. The World Health Organization definition of drowning is "the process of experiencing respiratory impairment from submersion/immersion in liquid"
2. Drowning is further defined in the following categories:
    a. Non-fatal drowning – patients rescued from drowning
    b. Fatal drowning – any death, acutely or subacutely, resultant from drowning
3. Submersion refers to situations in which the patient's airway is underwater. Immersion refers to situations in which the patient's body is in water but the patient's airway remains out of the water
4. Drowning is a common cause of death in children. Risk factors for drowning include male gender, age less than 14 years old, alcohol use, lack of supervision, and risky behavior
5. Rescue efforts should be coordinated between all responding agencies to ensure patient is rapidly accessed and removed from the water
6. Initiation of in-water ventilations may increase survival. In-water chest compressions are futile
7. The European Resuscitation Council recommends 5 initial breaths be provided to the drowning victim. The initial ventilations may be more difficult to achieve as water in the airways may impede alveolar expansion. After the initial 5 breaths and 30 compressions, the standard ratio of 2 breaths to 30 compressions may be resumed
8. Active efforts to expel water from the airway (by abdominal thrusts or other means) should be avoided as they delay resuscitative efforts and increase the potential for vomiting and aspiration
9. Longstanding teaching has suggested that rescuers should always assume c-spine injury in victims of drowning. The 2010 American Heart Association update on special circumstances in cardiac arrest notes that routine c-spine precautions in all victims of drowning is likely unnecessary unless the mechanism or injury, history or physical exam suggests a cervical spine injury. Mechanisms of injury highly suggestive of cervical spine injury include diving, water skiing, surfing or watercraft accidents
10. Uncertainty exists regarding survival in cold water drowning, however, recent literature suggests the following:

a. If water temperature is less than 43° F (6° C) and the patient is submerged with evidence of cardiac arrest:
    i. Survival is possible for submersion time less than 90 minutes and resuscitative efforts should be initiated
    ii. Survival is not likely for submersion time greater than 90 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene
b. If water temperature is greater than 43° F (6° C) and the patient is submerged with evidence of cardiac arrest:
    i. Survival is possible for submersion time less than 30 minutes and resuscitative efforts should be initiated
    ii. Survival is not likely for submersion time greater than 30 minutes and providers may consider not initiating resuscitation or termination of resuscitation on scene

11. Patients may develop subacute respiratory difficulty after drowning and therefore all victims of drowning should be transported for observation

Quality Improvement

Key Documentation Elements

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

Performance Measures

Compliance with this guideline

References

1. Olshaker J. Submersion. *Emerg Med Clin N Am*, 2004
2. Szpilman et al. Current Concepts Drowning. *NEJM*, 2012
3. Idris et al. Recommended guidelines for uniform reporting of data from drowning: The "Utstein Style". *Circulation,* 2003
4. Harris M. ABC of resuscitation, near drowning. *BMJ*, 2003
5. Layon J et al. Drowning, update 2009. *Anesthesiology,* 2009
6. Vanden Hoek T et al. Part 12: Cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation,* 2010

Revision Date

September 15, 2014

SCUBA Injury/Accidents

(No NEMSIS category)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients with recent history of SCUBA diving exhibiting potential signs and/or symptoms of dive related illness/injury, regardless of dive table compliance

Exclusion Criteria

Patients without history of recent SCUBA diving exposure

Patient Management

Assessment

1. Follow **Universal Care** guideline
2. History should include circumstances leading to the complaint, details of mechanism of injury, time under water, and water temperature (if available)
3. Be alert for signs of pulmonary injury (e.g. unequal or abnormal lung sounds, subcutaneous emphysema)
4. Assess for other associated injury such as injury to the head or spine, if mechanism and symptoms suggest

Treatment and Interventions

1. If SCUBA accident includes associated drowning/near-drowning, see **Drowning** guideline
2. Manage airway as indicated
3. If air embolism suspected, place in left lateral recumbent position
4. Monitor vital signs including oxygen saturations
5. If O_2 saturations are less than 92%, provide supplemental oxygen to maintain saturations $\geq$ 94%. Use positive pressure ventilation (e.g. CPAP) carefully in patients for whom pulmonary barotrauma is a consideration
6. Patients with symptoms suspicious for decompression illness (DCI), should be placed on supplemental oxygen regardless of saturations to enhance washout of inert gasses
7. Consider hypothermia and treat per **Hypothermia/Cold Exposure** guideline
8. Consider contacting direct medical oversight and discussing need for hyperbaric treatment and primary transport to facility with HBOT capability. Include discussion regarding factors such as submersion time, greatest depth achieved, ascent rate
9. Establish IV access
10. Fluid bolus as indicated
11. Advanced airway management as indicated
12. Cardiac monitor

Patient Safety Considerations

1. If patient still in the water, seek safest and most rapid means of removal (within your scope of training)
2. Seek assistance early for special rescue/extrication needs
3. Check for multiple patients (e.g. group dive table calculation error(s) or contaminated dive gases)

Notes/Educational Pearls

Key Considerations

1. Rescue efforts should be coordinated between all responding agencies to ensure patient is rapidly accessed and removed from the water if diver unable to do so himself/herself
2. If air medical transport necessary, patient should be transported in cabin pressurized to lowest possible altitude. If transported in unpressurized aircraft (e.g. most helicopter (HEMS) services), patient should be flown at the lowest safe altitude possible
3. Decompression illness may have a variety of presentations depending on system affected (e.g. skin, joint(s), pulmonary, neurologic)
4. SCUBA accidents/incidents can result in a variety of issues, including barotrauma, air embolism and decompression illness (DCI)

Pertinent Assessment Findings

1. Vital signs findings
2. Neurologic status assessment findings
3. Respiratory assessment findings (e.g. oxygen saturation, respiratory rate)
4. Subcutaneous emphysema

Quality Improvement

Key Documentation Elements

1. Water temperature, if available
2. Dive history
   a. Number of dives in recent history (days)
   b. "Bottom time" in dives
   c. Dive profiles
   d. Maximum depth
   e. Rate of ascent
   f. Safety stops utilized, if any
   g. Dive gas (e.g. air vs. mixed gases such as Nitrox, Heliox or Trimix)
3. Timing of onset of symptoms
4. History of altitude exposure after diving

Performance Measures

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

References

1. Doolette DJ, Mitchell SJ. Recreational technical diving part 2: Decompression from deep technical dives. *Diving and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 96–104
2. FAA Aeronautical Information Manual - Decompression Sickness after Scuba Diving. n.d. http://www.faa.gov/air_traffic/publications/atpubs/aim/aim0801.html
3. Fock A, Harris R, Slade M. Oxygen exposure and toxicity in recreational technical divers. *Diving and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 67–71
4. Fock AW. Analysis of recreational closed-circuit rebreather deaths 1998-2010. *Diving and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 78–85
5. Madden D, Lozo M, Dujic Z, Ljubkovic M. Exercise after SCUBA diving increases the incidence of arterial gas embolism. *Journal of Applied Physiology (Bethesda, Md.: 1985)* (June 13, 2013). doi:10.1152/japplphysiol.00029.2013
6. Mitchell SJ, Doolette DJ. Recreational technical diving part 1: An introduction to technical diving methods and activities. *Diving and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 86–93
7. Muth C-M, Tetzlaff K. [Scuba diving and the heart. Cardiac aspects of sport scuba diving]. *Herz* 29, no. 4 (June 2004): 406–413. doi:10.1007/s00059-004-2581-5
8. Sykes O, Clark JE. Patent foramen ovale and scuba diving: a practical guide for physicians on when to refer for screening. *Extreme Physiology & Medicine* 2, no. 1 (2013): 10 doi:10.1186/2046-7648-2-10
9. Türkmen N, Okan A, Selçuk C, Bülent E, Murat SG, Umit NG. Scuba diver deaths due to air embolism: two case reports. *Soudní Lékarství/Casopis Sekce Soudního Lékarstvi Cs. Lékarské Spolecnosti J. Ev. Purkyne* 58, no. 2 (April 2013): 26–28
10. 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 and Hyperbaric Medicine: The Journal of the South Pacific Underwater Medicine Society* 43, no. 2 (June 2013): 72–77
11. Vann, RD, Gerth, PJ, Denoble, CF. Pieper and Thalmann, eds. Experimental trials to assess the risks of decompression sickness in flying after diving. *Divers Alert Network, Department of Anesthesiology, Duke University Medical Center, Durham, NC; Center for Hyperbaric Medicine and Environmental Physiology, Department of Anesthesiology, Duke University Medical Center, Durham, NC; U.S. Navy Experimental Diving Unit, Panama City, FL; Center for Aging, Division of Biostatistics, Department of Community and Family Medicine, Duke University Medical Center, Durham, NC*

Revision Date

September 15, 2014

Altitude Illness

(9914021 – Altitude Sickness)

Patient Care Goals

1. Improve oxygenation through a combination of descent and supplemental O_2
2. Safe but rapid transport from the high altitude environment to a lower altitude environment

Patient Presentation

Inclusion Criteria

Patients suffering from altitude illness, including

1. Acute mountain sickness
2. High altitude pulmonary edema
3. High altitude cerebral edema

Exclusion Criteria

Patients who have not been exposed to altitude

Patient Management

Assessment

1. The definition of altitude illnesses are as follows:
   a. Acute mountain sickness – Headache plus one or more of the following: anorexia, nausea or vomiting, fatigue or weakness, dizziness or lightheadedness or difficulty sleeping. These symptoms must occur in the setting of recent arrival to high altitude (generally considered greater than 5000 – 7000 feet)
   b. High altitude pulmonary edema (HAPE) – Progressive dyspnea, cough, hypoxia, and weakness in high altitude environments (considered 8000 feet or greater). Patients may or may not exhibit symptoms if acute mountain sickness precedes symptoms of HAPE
   c. High altitude cerebral edema (HACE) – Heralded by mental status changes in patients with symptoms of acute mountain sickness including altered mentation, ataxia, or stupor and progressing to coma. Typically seen in high altitude environments (greater than 8000 feet)
2. Assessment should target the signs and symptoms of altitude illness but should also consider alternate causes of these symptoms

Treatment and Interventions

1. Ensure scene safety for rescuers
2. Stop ascent. Patients with acute mountain sickness only may remain at their current altitude and initiate symptomatic therapy. Patients with HACE or HAPE should initiate descent
3. Perform ABCs and manage airway as necessary
4. Administer supplemental oxygen with goal to keep oxygen saturations $\geq$ 94%
5. Descend to lower altitude. Descent is the mainstay of therapy and is the definitive therapy for all altitude related illnesses. Descent should be initiated as soon as scene conditions permit
   a. If severe respiratory distress is present and pulmonary edema is found on exam, provider should start positive pressure ventilation
   b. Establish IV and perform fluid bolus with goal to maintain systolic BP > 90 mm Hg

c. Monitor cardiac rhythm

Patient Safety Considerations

1. The high altitude environment is inherently dangerous. Rescuers must balance patient needs with patient safety and safety for the responders
2. Rapid descent by a minimum of 500-1000 feet is a priority, however rapidity of descent must be balanced by current environmental conditions and other safety considerations

Notes/Educational Pearls

Key Considerations

1. Patients suffering from altitude illness have exposed themselves to a dangerous environment. By entering the same environment, providers are exposing themselves to the same altitude exposure. Be vigilant in looking for symptoms of altitude illness amongst rescuers
2. Descent of 500-1000 feet is often enough to see improvements in patient conditions
3. Patients with HAPE are suffering from non-cardiogenic pulmonary edema and may benefit from positive pressure ventilation via either bag assisted ventilation, CPAP or other means of positive pressure ventilation
4. Patients suffering from altitude illness are commonly dehydrated and require IV fluids. Once resuscitation is complete and the patient requires no further fluid boluses, maintain IV fluids at 125 ml/hr
5. HAPE is the most lethal of all altitude illnesses
6. Consider alternate causes of symptoms of AMS. The symptoms of AMS may be caused by alternate etiologies such as carbon monoxide poisoning (in patients cooking within enclosed areas), dehydration, exhaustion, hypoglycemia, hyponatremia
7. Descent should always be the primary treatment strategy for patients suffering from altitude illness, especially patients suffering from HACE and HAPE. If decent is not possible, or if direct medical oversight permits, the EMS provider may consider the following possible therapies:
    a. Portable hyperbaric chambers are effective for the management of severe altitude illness. However, they should not be used in lieu of decent, only as an alternative should descent be unfeasible
    b. Acute mountain sickness
        i. Ibuprofen or acetaminophen for pain
        ii. Ondansetron 4 mg IV, PO, or sublingual every 6 hours for vomiting
        iii. Acetazolamide – up to 250 PO mg twice a day
            1. Pediatric dosing is 2.5 mg/kg up to a max of 250 mg twice a day
            2. Acetazolamide speeds acclimatization and therefore helps in treating acute mountain sickness
        iv. Dexamethasone - 8 mg IM, IV, or PO followed by 4 mg IM, IV, or PO every 6 hours until symptoms resolve
            1. Pediatric dosing is 0.15 mg/kg IM, IV, or PO every 6 hours
            2. Dexamethasone helps treat the symptoms of acute mountain sickness and may be used as an adjunctive therapy in severe acute mountain sickness when the above measures alone do not ameliorate the symptoms. In these circumstances, patients should also initiate descent, as dexamethasone does not facilitate acclimatization

c. HACE – All below listed therapies should be considered as adjunctive to descent. Descent should always be the primary treatment modality
    i. Dexamethasone – at above adult and pediatric doses
        1. Dexamethasone helps treat the symptoms of HACE and should be initiated in HACE. In these circumstances, patients should also initiate descent
    ii. Consider use of acetazolamide at the above dosing
d. HAPE - All below listed therapies should be considered as adjunctive to descent. Descent should always be the primary treatment modality
    i. Nifedipine SR 60 mg PO once a day may be added to the patient's regimen
    ii. Tadalafil (20-40 mg PO once daily) or sildenafil (20 mg PO three times a day) may be used if nifedipine is not available. Multiple pulmonary vasodilators should not be used concurrently

Pertinent Assessment Findings

1. Consider airway management needs in the patient with severe alteration in mental status
2. HAPE will present with increasing respiratory distress and rales on exam
3. HACE will present with mental status changes, ataxia, and progressing to coma

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

1. Luks A et al. Wilderness Medical Society consensus guidelines for the prevention and treatment of acute altitude illness. *Wilderness and Environmental Medicine*, 2010
2. Imray C et al. Acute mountain sickness: pathophysiology, prevention and treatment. *Progress in Cardiovascular Diseases,* 2010
3. Barry P et al. Clinical review: altitude illness. *BMJ,* 2003
4. Jackson Hole, Fire/EMS Operations Manual – Treatment Protocol: Altitude Illness. courtesy of Will Smith, MD, Medical Director, Jackson Hole Fire & EMS
5. Bartsch P et al. Acute high-altitude illness. *NEJM*, 2013
6. West J. Concise clinical review: high altitude medicine. *American Journal of Respiratory and Critical Care Medicine,* 2012
7. Gallagher S et al. High altitude illness. *Emerg Med Clin N Am,* 2004

Revision Date

September 15, 2014

Conducted Electrical Weapon (e.g. TASER®)

(No NEMSIS category)

Patient Care Goals

1. Manage the condition that triggered the application of the conducted electrical weapon with special attention to patients meeting criterion for excited delirium
2. Make sure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and staff
3. Perform comprehensive trauma and medical assessment as patients who have received conducted electrical weapon may have already been involved in physical confrontation
4. If discharged from a distance, two single barbed darts (13mm length) should be located. Do not remove barbed dart from sensitive areas (head, neck, hands, feet or genitals)

Patient Presentation

Inclusion Criteria

1. Patient received either the direct contact discharge or the distance two barbed dart discharge of the conducted electrical weapon
2. Patient may have sustained fall or physical confrontation trauma
3. Patient may be under the influence of toxic substances and or may have underlying medical or psychiatric disorder

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Once patient has been appropriately secured or restrained with assistance of law enforcement, perform primary and secondary assessment including 3-lead EKG, pulse oximeter, and consider 12-lead EKG
2. Evaluate patient for evidence of excited delirium manifested by varied combination of agitation, reduced pain sensitivity, elevated temperature, persistent struggling, or hallucinosis

Treatment and Interventions

1. Make sure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and staff. Consider chemical sedation if patient struggling against physical restraints and may harm themselves or others
2. Conservative programs treat all barbed darts as a foreign body and leave them for physician removal while more progressive programs allow EMS or law enforcement to remove barbed darts except for sensitive areas (head, neck, hands, feet or genitals)
3. Treat medical and traumatic injury

Patient Safety Considerations

1. Before removal of the barbed dart, make sure the cartridge has been removed from the conducted electrical weapon
2. Patient should not be restrained in the prone, face down or hog tied position as respiratory compromise is a significant risk
3. Conducted electrical weapon patient may have underlying pathology before being tased (refer to other guidelines for managing the underlying medical/traumatic pathology)
4. Perform a comprehensive assessment with special attention looking for to signs and symptoms that may indicate agitated delirium
5. Transport the patient to the hospital if they have concerning signs or symptoms
6. EMS providers who respond for a conducted electrical weapon patient should not perform a "medical clearance" for law enforcement

Notes/Educational Pearls

Key Considerations

Conducted electrical weapon can be discharged in three fashions: direct contact without the use of the darts, a single dart with addition contact by direct contact of weapon or from a distance up to 35 feet with two darts. The device delivers 19 pulses per second with an average current per pulse of 2.1 milliamps which in combination with toxins/drugs, patient's underlying diseases, excessive physical exertion, and trauma may precipitate arrhythmias, thus consider EKG monitoring and 12-lead EKG assessment

Drive Stun is a direct weapon two-point contact which is designed to generate pain and not incapacitate the subject. Only local muscle groups are stimulated with the Drive Stun technique

Pertinent Assessment Findings

Thoroughly assess the tased patient for trauma as the patient may have fallen from standing or higher. Ascertain if more than one TASER® cartridge was used (by one or more officers, in effort to identify total number of possible darts and contacts)

Quality Improvement

Key Documentation Elements

1. If darts removed, document the removal location in the patient care report
2. Physical exam trauma findings
3. Cardiac rhythm and changes
4. Neurologic status assessment findings

Performance Measures

1. Comprehensive patient documentation as this is a complex patient
2. Abnormal findings or vital signs were addressed
3. Patient received EKG or 12-lead EKG evaluation
4. If indicated, review for appropriate restraint technique

References

1. TASER electronic control devices: field data and risk management. Available at: http://www.taser.com/images/research-and-safety/research-library/downloads/CEWIndex5-29-13.pdf

2. Excited delirium National American College of Emergency Physicians position paper, accessed as of March 3, 2014
http://www.acepnews.com/single-view/d257135701cb06fa0c94609c1eb6e67e.html?tx_ttnews%5Btt_news%5D=1345

Revision Date
September 15, 2014

Electrical Injuries

(9914095 – Electrical Injuries)

Patient Care Goals

1. Prevent additional harm to patient
2. Identify life threatening issues such as dysrhythmias and cardiac arrest
3. Identify characteristics of electrical source to communicate to receiving facility (voltage, amperage, alternating current (AC) versus direct current (DC))
4. Understand that deep tissue injury can be far greater than external appearance
5. Have high index of suspicion for associated trauma due to patient being thrown
6. Determine most appropriate disposition for the patient as many will require burn center care and some may require trauma center care

Patient Presentation

Inclusion Criteria

Exposure to electrical current (AC or DC)

Exclusion Criteria

None

Patient Management

Assessment

1. Verify scene is secure. The electrical source must be disabled prior to assessment
2. Assess primary survey with specific focus on dysrhythmias or cardiac arrest. Apply a cardiac monitor
3. Identify all sites of burn injury. If the patient became part of the circuit, there will be an additional site near the contact with ground
   a. Electrical burns are often full thickness and involve significant deep tissue damage
4. Assess for potential associated trauma and note if the patient was thrown from contact point
   a. If patient has altered mental status, assume trauma was involved and treat accordingly
5. Assess for potential compartment syndrome from significant extremity tissue damage
6. Determine characteristics of source if possible – AC or DC, voltage, amperage and also time of injury

Treatment and Interventions

1. Identify dysrhythmias or cardiac arrest – even patients who appear dead (particularly dilated pupils) may have good outcomes with prompt intervention – see appropriate protocol for additional information
2. Immobilize if associated trauma suspected. See **Trauma** section guidelines
3. Apply dry dressing to any wounds
4. Remove constricting clothing and jewelry since additional swelling is possible
5. Administer fluid resuscitation per burn protocol
   Remember that external appearance will underestimate the degree of tissue injury
6. Electrical injury patients should be taken to a burn center whenever possible since these injuries can involve considerable tissue damage

7. When there is significant associated trauma this takes priority, if local trauma resources and burn resources are not in the same facility

Patient Safety Considerations

1. Verify no additional threat to patient
2. Shut off electrical power
3. Move patient to shelter if electrical storm activity still in area

Notes/Educational Pearls

Key Considerations

1. Electrical current causes injury through three main mechanisms:
    a. Direct tissue damage, altering cell membrane resting potential, and eliciting tetany in skeletal and/or cardiac muscles
    b. Conversion of electrical energy into thermal energy, causing massive tissue destruction and coagulative necrosis
    c. Mechanical injury with direct trauma resulting from falls or violent muscle contraction
2. Anticipate atrial and/or ventricular dysrhythmias as well as cardiac arrest
3. The mortality related to electrical injuries is impacted by several factors:
    a. Route current takes through the body – current traversing the heart has higher mortality
    b. Type of current: AC vs. DC
        i. AC is more likely to cause cardiac dysrhythmias while DC is more likely to cause deep tissue burns however either type of current can cause any injury
        ii. DC typically causes one muscle contraction while AC can cause repeated contractions
        iii. Both types of current can cause involuntary muscle contractions that do not allow the victim to let go of the electrical source
        iv. AC is more likely to cause ventricular fibrillation while DC is more likely to cause asystole
    c. The amount of current impacts mortality more than the voltage

Current level (Milliamperes)	Probable Effect on Human Body of 120 V, 60 Hz AC for 1 second
1 mA	Perception level. Slight tingling sensation. Still dangerous if wet conditions.
5mA	Slight shock felt; not painful but disturbing. Average individual can let go. However, strong involuntary reactions to shocks in this range may lead to injuries.
6mA - 16mA	Painful shock, begin to lose muscular control. Commonly referred to as the freezing current or "let-go" range.
17mA - 99mA	Extreme pain, respiratory arrest, severe muscular contractions. Individual cannot let go. Death is possible.
100mA - 2000mA	Ventricular fibrillation (uneven, uncoordinated pumping of the heart.) Muscular contraction and nerve damage begins to occur. Death is likely.
> 2,000mA	Cardiac arrest, internal organ damage, and severe burns. Death is probable.

Source: https://www.osha.gov/SLTC/etools/construction/electrical_incidents/eleccurrent.html

Pertinent Assessment Findings

1. Identification of potential trauma concomitant with electrical injury
2. Presence of cardiac dysrhythmias

Quality Improvement

Key Documentation Elements

1. Characteristics of electrical current
2. Downtime if found in cardiac arrest
3. Positioning of the patient with respect to the electrical source
4. Accurate description of external injuries
5. Document presence or absence of associated trauma

Performance Measures

1. Confirmation of scene safety
2. Documentation of electrical source and voltage if known
3. Documentation of cardiac monitoring
4. Documentation of appropriate care of associated traumatic injuries

References

1. Electrical Injuries: http://emedicine.medscape.com/article/433682-overview

2. Price TG, Cooper MA. Electrical and Lightning Injuries. Chapter 140 in *Rosen's Emergency Medicine* 7th Edition, 2009
3. Pham TN. Thermal and Electrical Injuries, *Surg Clin North Am,* 01-FEB-2007; 87(1): 185-206

Revision Date
September 15, 2014

Lightning/Lightning Strike Injury

(No NEMSIS category)

Patient Care Goals

1. Identify patient(s) as lightning strike victim(s)
2. Move to safe area
3. Initiate immediate resuscitation on cardiac arrest victim(s), within limits of mass casualty care
4. Cardiac monitoring during transport
5. Treat associated traumatic injuries

Patient Presentation

1. Lightning strikes may happen in a variety of environmental conditions. Most commonly they occur in outdoor or wilderness circumstances. Golf courses, exposed mountains or ledges and farms/fields all present conditions that increase risk of lightning strike, when hazardous meteorological conditions exist
2. Lacking bystander observations or history, it is not always immediately apparent that patient has been the victim of a lightning strike. Subtle findings such as injury patterns might suggest lightning injury

Inclusion Criteria

Patients of all ages who have been the victim of lightning strike injury

Exclusion Criteria

No specific recommendations

Patient Management

Assessment

1. Cardiovascular
   a. Dysrhythmias
   b. Transient hypertension
2. Respiratory
   a. Apnea
   b. Agonal respirations
   c. Respiratory paralysis
3. Neurologic
   a. Seizures
   b. Confusion
   c. Paralysis
   d. Paraplegia
   e. Vertigo/dizziness
   f. Parasthesias
   g. Amnesia
   h. Memory deficits
   i. Anxiety
4. EENT

Fixed/dilated pupils possible (autonomic dysfunction)

5. Skin
   a. Ferning or fern-like superficial skin burn ("Lichtenberg figures")
   b. Vascular instability may result in cool, mottled extremities
   c. Frequent first and/or second degree burns
   d. Third degree burns less common
6. Patient may be in full cardiopulmonary arrest or have only respiratory arrest, as injury is a result of DC current
7. May have stroke-like findings as a result of neurologic insult
8. May have secondary traumatic injury as a result of overpressurization, blast or missile injury.
9. Fixed/dilated pupils may be a sign of neurologic insult, rather than a sign of death/impending death. Should not be used as a solitary, independent sign of death for the purpose of discontinuing resuscitation in this patient population

Treatment and Interventions

1. Assure patent airway
   If in respiratory arrest only, manage airway as appropriate
2. If in cardiopulmonary arrest, refer to **Cardiac Arrest (VF/VT/Asystole/PEA)** guideline
3. Consider IV initiation. Avoid initiation through burned skin
4. Monitor EKG. Be alert for potential arrhythmias
   Consider 12-lead EKG, when available
5. Consider early pain management for burns or associated traumatic injury. See **Pain Management** guideline

Patient Safety Considerations

1. Recognize that repeat strike is a risk. Patient and rescuer safety is paramount
2. Victims do not carry or discharge a current, so the patient is safe to touch and treat

Notes/Educational Pearls

Key Considerations

1. Lightning strike cardiopulmonary arrest patients have a high rate of successful resuscitation, if initiated early, in contrast to general cardiac arrest statistics
2. There may be multiple victims
3. If multiple victims, cardiac arrest patients whose injury was witnessed or thought to be recent should be treated first and aggressively (reverse triage)
4. It may not be immediately apparent that the patient is a lightning strike victim
5. Injury pattern and secondary physical exam findings may be key in identifying patient as a victim of lightning strike
6. Lightning strike is a result of very high voltage, very short duration DC current exposure

Pertinent Assessment Findings

1. Presence of thermal or non-thermal burns
2. Evidence of trauma
3. Evidence of focal neurologic deficits

Quality Improvement

Key Documentation Elements

1. Initial airway status
2. Initial cardiac rhythm
3. Neurologic exam (initial and repeat)
4. Associated/secondary injuries
5. Pain scale documentation/pain management

Performance Measures

1. Cardiopulmonary issues addressed early and documented appropriately
2. Patient transported to closest appropriate facility
3. Pain scale documented and treated per guidelines (when appropriate)

References

1. Aldana NN. Severe rhabdomyolysis without renal injury associated with lightning strike. *Journal of Burn Care & Research: Official Publication of the American Burn Association* 34, no. 3 (June 2013): e209–212. doi:10.1097/BCR.0b013e31825adc98
2. Anderson DR, Gillberg JM, Torrey JW, Koneru JN. Lightning induced inappropriate ICD shock: an unusual case of electromagnetic interference. *Pacing and Clinical Electrophysiology: PACE* 35, no. 6 (June 2012): e159–162. doi:10.1111/j.1540-8159.2010.02914.x
3. Arnoldo BD, Purdue GF. The diagnosis and management of electrical injuries. *Hand Clinics* 25, no. 4 (November 2009): 469–479. doi:10.1016/j.hcl.2009.06.001
4. Blumenthal R. Secondary missile injury from lightning strike. *The American Journal of Forensic Medicine and Pathology* 33, no. 1 (March 2012): 83–85. doi:10.1097/PAF.0b013e31823a8c96
5. 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. *The American Journal of Forensic Medicine and Pathology* 33, no. 3 (September 2012): 222–226. doi:10.1097/PAF.0b013e31822d319b
6. Brunner FX. Bilateral tympanic membrane perforation caused by a lightning accident. *HNO* 32, no. 10 (October 1984): 429–430
7. Centers for Disease Control and Prevention (CDC). “Lightning-associated deaths--United States, 1980-1995.” *MMWR. Morbidity and Mortality Weekly Report* 47, no. 19 (May 22, 1998): 391–394
8. Cherington M, Kurtzman R, Krider EP, Yarnell PR. Mountain medical mystery: Unwitnessed death of a healthy young man, caused by lightning. *The American Journal of Forensic Medicine and Pathology* 22, no. 3 (September 2001): 296–298
9. Cooper MA. Emergent care of lightning and electrical injuries. *Seminars in Neurology* 15, no. 3 (September 1995): 268–278. doi:10.1055/s-2008-1041032
10. Cooper MA. A fifth mechanism of lightning injury. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine* 9, no. 2 (February 2002): 172–174
11. Davis C, Engeln A, Johnson E, McIntosh SE, Zafren K, Islas AA, McStay C, Smith WR, Cushing T, and Wilderness Medical Society. Wilderness Medical Society practice guidelines for the

prevention and treatment of lightning injuries. *Wilderness & Environmental Medicine* 23, no. 3 (September 2012): 260–269. doi:10.1016/j.wem.2012.05.016

12. Desai BK, Fairclough R. A case of a speech impediment following a near lightning strike. *International Journal of Emergency Medicine* 4 (2011): 60. doi:10.1186/1865-1380-4-60
13. Dronacahrya L, Poudel R. Lightning induced atrial fibrillation. *Kathmandu University Medical Journal (KUMJ)* 6, no. 24 (December 2008): 514–515
14. Duclos PJ, Sanderson LM, Klontz KC. Lightning-related mortality and morbidity in Florida. *Public Health Reports (Washington, D.C.: 1974)* 105, no. 3 (June 1990): 276–282
15. Dundon BK, Puri R, Leong DP, Worthley MI. Takotsubo cardiomyopathy following lightning strike." *BMJ Case Reports* 2009 (2009). doi:10.1136/bcr.03.2009.1646
16. Fontanarosa PB. Electrical shock and lightning strike. *Annals of Emergency Medicine* 22, no. 2 Pt 2 (February 1993): 378–387
17. Forster SA, Silva IM, Ramos MLC, Gragnani A, Ferreira LM. Lightning burn--review and case report. *Burns: Journal of the International Society for Burn Injuries* 39, no. 2 (March 2013): e8–12. doi:10.1016/j.burns.2012.08.003
18. Gluncić I, Roje Z, Gluncić V, Poljak K. Ear injuries caused by lightning: report of 18 cases. *The Journal of Laryngology and Otology* 115, no. 1 (January 2001): 4–8
19. Guardiola B, Planella M, Ferreruela M, Velasco J, Pérez-Bárcena J, Llompart-Pou JA. Brain injury secondary to lightning strike. *Medicina Intensiva / Sociedad Espanola de Medicina Intensiva y Unidades Coronarias* 37, no. 5 (July 2013): 367–368. doi:10.1016/j.medin.2012.09.003
20. Haraldsson PO, Bergstedt M. Unconsciousness and persistent tinnitus caused by lightning injury to the ear during telephoning. *Läkartidningen* 80, no. 19 (May 11, 1983): 2024
21. Hinkelbein J, Spelten O, Wetsch WA . Lightning strikes and lightning injuries in prehospital emergency medicine. Relevance, results, and practical implications. *Der Unfallchirurg* 116, no. 1 (January 2013): 74–79. doi:10.1007/s00113-011-2084-9
22. Jefferiss WR. Three cases of lightning-stroke. *British Medical Journal* 1, no. 786 (January 22, 1876): 102
23. Kaliszan M, Karnecki K, Jankowski Z. A case of fatal lightning stroke at an unusual site-- the city center. *Archiwum medycyny sądowej i kryminologii* 62, no. 3 (September 2012): 208–212
24. Kleinschmidt-DeMasters, BK. Neuropathology of lightning-strike injuries. *Seminars in Neurology* 15, no. 4 (December 1995): 323–328. doi:10.1055/s-2008-1041039
25. Ko SH, Chun W, Kim HC. Delayed spinal cord injury following electrical burns: a 7-year experience. *Burns: Journal of the International Society for Burn Injuries* 30, no. 7 (November 2004): 691–695. doi:10.1016/j.burns.2004.03.007
26. Kubilius D, Rimdeika R. Simultaneous lightning injury in a group of people: case report. *Burns: Journal of the International Society for Burn Injuries* 38, no. 3 (May 2012): e9–12. doi:10.1016/j.burns.2012.01.011
27. Lane JR. Clinical lecture on injuries from lightning. *British Medical Journal* 2, no. 605 (August 3, 1872): 114–116

28. Leiria TLL, Pires LM, Kruse ML, de Lima GG. Struck by lightning: a case of nature-induced pre-excited atrial fibrillation. *Circulation. Arrhythmia and Electrophysiology* 6, no. 2 (April 2013): e20–21. doi:10.1161/CIRCEP.112.000150
29. Levy DR, Akiyama T. Lightning-induced ventricular fibrillation. *Cardiology Journal* 14, no. 1 (2007): 91–94
30. Lichtenberg R, Dries D, Ward K, Marshall W, Scanlon P. Cardiovascular effects of lightning strikes. *Journal of the American College of Cardiology* 21, no. 2 (February 1993): 531–536
31. Lightning Safety Awareness: American Meteorological Society Statement, 29 April 2002," n.d. http://www.ametsoc.org/policy/lightningpolicy_2002.html
32. Lightning-related Medical Encounters, Active and Reserve Components, U.S. Armed Forces, January 2009-August 2012. *MSMR* 19, no. 9 (September 2012): 18–19
33. 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 and Electrophysiology Journal* 10, no. 9 (2010): 429–434
34. Modayil PC, Lloyd GW, Mallik A, Bowdler DA. Inner ear damage following electric current and lightning injury: a literature review. *European Archives of Oto-rhino-laryngology: Official Journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS): Affiliated with the German Society for Oto-Rhino-Laryngology - Head and Neck Surgery* (May 7, 2013). doi:10.1007/s00405-013-2544-7
35. Mora-Magaña I, Collado-Corona MA, Toral-Martiñòn R, Cano A. Acoustic trauma caused by lightning. *International Journal of Pediatric Otorhinolaryngology* 35, no. 1 (March 1996): 59–69
36. Myung N-S, Lee I-W, Goh E-K, Kong S-K. Cochlear implantation for severe sensorineural hearing loss caused by lightning. *American Journal of Otolaryngology* 33, no. 6 (December 2012): 767–769. doi:10.1016/j.amjoto.2012.06.007
37. NOAA Lightning Safety and Yearly Lightning Fatalities Statistics. *NOAA NWS Lightning Safety Fatalities*, n.d. http://www.lightningsafety.noaa.gov/fatalities.htm
38. O'Keefe G, Medley, Zane RD Lightning injuries. *Emergency Medicine Clinics of North America* 22, no. 2 (May 2004): 369–403. doi:10.1016/j.emc.2004.02.002
39. Parsaik AK, Jahlskog JE, Singer W, Gelfman R, Sheldon SH, Seime RJ, Craft JM, Staab JP, Kantor B, Low PA. Central hyperadrenergic state after lightning strike. *Clinical Autonomic Research: Official Journal of the Clinical Autonomic Research Society* (June 13, 2013). doi:10.1007/s10286-013-0197-7
40. Pedersen ML, Bülent U, Morten NL, Carl P. Survival following lightning strike and treatment of sequelae. *Ugeskrift for laeger* 173, no. 15 (April 11, 2011): 1138–1139
41. 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. *Emergency Medicine International* 2012 (2012): 167698. doi:10.1155/2012/167698

42. Russell KW, Cochran AL, Sagar TM, Morris SE, McDevitt MC. Lightning burns. *Journal of Burn Care & Research: Official Publication of the American Burn Association* (June 24, 2013). doi:10.1097/BCR.0b013e3182957783
43. Slesinger TL, Bank M, Drumheller BC, Peress DA, Ward MF, Sama AE, Falkowitz JS. Immediate cardiac arrest and subsequent development of cardiogenic shock caused by lightning strike. *The Journal of Trauma* 68, no. 1 (January 2010): E5–7. doi:10.1097/TA.0b013e3181574c23
44. Soomaroo L, Murray V. Weather and environmental hazards at mass Gatherings." *PLoS Currents* 4 (2012): e4fca9ee30afc4. doi:10.1371/4fca9ee30afc4
45. Thacker MTF, Lee R, Sabogal RI, Henderson A. Overview of deaths associated with natural events, United States, 1979-2004. *Disasters* 32, no. 2 (June 2008): 303–315. doi:10.1111/j.1467-7717.2008.01041.x
46. Thomson EM, Thomas MH. Lightning injuries in sports and recreation. *Current Sports Medicine Reports* 12, no. 2 (April 2013): 120–124. doi:10.1249/JSR.0b013e318287728f
47. Walsh KM. Lightning and severe thunderstorms in event management. *Current Sports Medicine Reports* 11, no. 3 (June 2012): 131–134. doi:10.1249/JSR.0b013e3182563e95
48. Walsh KM, Cooper MA, Holle R, Rakov VA, Roeder WP, Ryan M, and National Athletic Trainers' Association. National Athletic Trainers' Association Position Statement: Lightning Safety for Athletics and Recreation. *Journal of Athletic Training* 48, no. 2 (April 2013): 258–270. doi:10.4085/1062-6050-48.2.25
49. Wankhede AG, Sariya DR. Damage due to lightning when it strikes the face. *Forensic Science International* 224, no. 1–3 (January 10, 2013): e1–3. doi:10.1016/j.forsciint.2012.10.014
50. Ward NJ, Little JH, Higgins GL III. Man with confusion and resolved paralysis. Lightning strike injury. *Annals of Emergency Medicine* 59, no. 4 (April 2012): 335, 340 doi:10.1016/j.annemergmed.2011.07.038.
51. Wiesenthal L, Jacoby A, Davis KP, Campagne D, Snowden B, Hughes S. Lightning safety awareness of visitors in three California national parks. *Wilderness & Environmental Medicine* 22, no. 3 (September 2011): 257–261. doi:10.1016/j.wem.2011.03.007
52. Zimmermann C, Cooper MA, Holle RL. Lightning safety guidelines. *Annals of Emergency Medicine* 39, no. 6 (June 2002): 660–664

Revision Date
September 15, 2014

APPENDICES

I. Author, Reviewer, Federal Partner and Staff Information

Authors

Co-Principal Investigators

Carol A. Cunningham, MD
State Medical Director
Ohio Department of Public Safety, Division of EMS
Assistant Professor of Emergency Medicine
Akron General Medical Center and Northeast Ohio Medical University

Richard Kamin, MD
EMS Program Director
University of Connecticut Health Center
Medical Director
Connecticut Department of Health
Office of EMS

Workgroup Authors

Richard L. Alcorta, MD
State EMS Medical Director
Maryland Institute for Emergency Medical Services Systems (MIEMSS)

Craig Bates, MD, MS
Medical Director, Metro Life Flight
Associate Medical Director, Cleveland Department of Public Safety
Clinical Assistant Professor of Emergency Medicine, Case School of Medicine
Metrohealth Medical Center

Eric H. Beck, DO, MPH, NREMT-P
Chief Innovation Officer
Evolution Health
Associate Chief Medical Officer
AMR and Envision Healthcare

Sabina Braithwaite, MD, MPH
Medical Director, Wichita-Sedgwick County EMS System
Clinical Associate Professor of Emergency Medicine, University of Kansas

Eileen M. Bulger, MD
Professor of Surgery, Chief of Trauma
University of Washington

Anthony DeMond, MD
La Plata, Colorado, Fire-Based EMS and Durango Airport Medical Director

Mary Katherine Harper, DO
Physician/Core Faculty
Kingman Regional Medical Center

Douglas F. Kupas, MD
Commonwealth EMS Medical Director
Bureau of EMS
Pennsylvania Department of Health

Brian Moore, MD
Assistant Professor, Pediatrics
University of New Mexico
State Medical Director, New Mexico

Joe A. Nelson, DO, MS
State EMS Medical Director
Florida Department of Health

Manish I. Shah, MD
Assistant Professor, Department of Pediatrics, Section of Emergency Medicine
Baylor College of Medicine
Texas Children's Hospital

J. Matthew Sholl, MD, MPH
Associate Professor and EMS Medical Director
Department of Emergency Medicine
Maine Medical Center

Harry Sibold, MD
Montana State EMS Medical Director
Montana Board of Medical Examiners

Peter P. Taillac, MD
Clinical Professor
University of Utah School of Medicine
State EMS Medical Director
Utah Bureau of EMS and Preparedness
Utah Department of Health

Contributing Authors

Kathleen Adelgais, MD, MPH
Associate Professor, Pediatrics
University of Colorado Denver School of Medicine

Lisa L. Booze, PharmD, CSPI
Clinical Coordinator
Maryland Poison Center
University of Maryland School of Pharmacy

Lorin Browne, DO
Assistant Professor, Pediatrics
Medical College of Wisconsin
Pediatric Medical Director
Milwaukee County and Kenosha County EMS

Mark X. Cicero, MD
Assistant Professor of Pediatrics
Director, Pediatric Disaster Preparedness
Section of Pediatric Emergency Medicine
Department of Pediatrics
Yale University School of Medicine

Toni Gross, MD, MPH
Clinical Associate Professor of Child Health
University of Arizona College of Medicine – Phoenix
Phoenix Children's Hospital

Kate Remick, MD
Assistant Professor, Pediatrics
University of Texas Southwestern Medical School at Austin
Dell Children's Medical Center of Central Texas
Associate EMS Medical Director
City of Austin/Travis County EMS

Technical Reviewers

Timothy T. Pieh, MD
Medical Director
Emergency Medicine
MaineGeneral Medical Center

Amy Raubenolt, MD, MPH, MEd
EMS Medical Director
Akron General Medical Center

James C. Suozzi, DO, NRP
Associate Medical Director EMS/Trauma Medical Director
Cheshire Medical Center/Dartmouth-Hitchcock

Key Federal Partners for Project

Drew Dawson
Director
Office of Emergency Medical Services
National Highway Traffic Safety Administration

Elizabeth Edgerton, MD, MPH
Director
Division of Child, Adolescent and Family Health (DCAFH) Maternal and Child Health Bureau
Health Resources and Services Administration

Susan McHenry
Office of Emergency Medical Services
National Highway Traffic Safety Administration
Cooperative Agreement Project Manager

Project Staff

Mary Hedges
Program Manager
Guidelines Project Manager
National Association of State EMS Officials

Kevin McGinnis, MPS, Paramedic
Program Manager
Guidelines Project Technical Writer/Editor
National Association of State EMS Officials

II. Public Review Comment Contributors

Listed in the order comments were received through two comment periods:

Association of Critical Care Transport

National EMS Management Association

Vincent McGregor Jr., Lord Fairfax Community College

Erik Glassman, National Safety Council

Dave Finger, National Volunteer Fire Council

James M. Osaki, DDS, Indian Health Service

Paul Hinchey, MD, National Association of EMTs (NAEMT)

EMS for Children (EMSC)

American Academy of Pediatrics

Danny Thomas, Medical College of Wisconsin

Ken Zafren, MD, Alaska State EMS Medical Director

Stephen Vetrano, MD, New Jersey State EMS Medical Director

Wayne Vanderkolk, MD, Michigan

American College of Surgery – Committee on Trauma (ACS-COT) via Cathy Gotschall, National Highway Traffic Safety Administration

Nebraska Attack on Asthma

Eric Jaeger, True North Group

Shawn Baumgartner, NRP ASM, Valley Ambulance Services, Inc

Carman Allen, Kansas EMSC Coordinator

Robert Lloyd, Paramedic, Eastlake, Ohio

Andrew Johnson, New York Office of EMS

Marlow Macht, MD, Clark County, Washington

Rick Sherlock, Association of Air Medical Services (AAMS)

Jay Cloud, San Jacinto College, Pasadena, Texas

Whitney Levano, Utah EMSC Advisory Committee

Emergency Nurses Association (ENA)

Craig Manifold, NAEMT

North Carolina Chapter of National Association of EMS Physicians (NAEMSP)

David Sugarman for Scott Sasser of Centers for Disease Control and Prevention

Richard Childress, International Association of Flight and Critical Care Paramedics

John Lyng, North Memorial Ambulance; Standards & Clinical Practice Committee, NAEMSP

Michael Millin, MD, Johns Hopkins University

Philip Ewing, Utah Southwestern Medical Center

Sean Caffrey, National EMS Management Association (NEMSMA)

Christian Martin-Gill, MD, University of Pittsburgh Medical Center

Richard “Chip” Cooper, New Hampshire EMS Office

Patrick Drayna, MD, Medical College of Wisconsin/Children's Hospital of Wisconsin

David Seigel, MD, NICHD Liaison to the American Association of Pediatrics (AAP) Disaster Preparedness Advisory Council

Tom Derenne, American Academy of Emergency Medicine (AAEM) EMS Committee

Paul Hinchey, MD, NAEMT

Ken Knipper, National Volunteer Fire Council (NVFC)

Mary Fallat, Pediatric Surgery

Arthur Cooper, MD

American College of Emergency Physicians (ACEP) Pediatric Committee

Paul Sharpe, NASEMSO Data Managers Chair

III. Medications

The project team considered the use of Institute for Safe Medication Practices (ISMP) Tall Man Letters methodology to avoid the miscommunication of lookalike drug names. Upon review of the list and the limited number of medications carried by EMS, as well as the expected use of this document, it was elected not to institute this measure into our medication list. We recommend EMS agencies consider incorporating these measures into practice where appropriate.

Additional information regarding Tall Man Letters can be found on the ISMP website: http://www.ismp.org/tools/tallmanletters.pdf and the US Food and Drug Administration website: http://www.fda.gov/Drugs/DrugSafety/MedicationErrors/ucm164587.htm.

Reference: Trade names, class, pharmacologic action and contraindications (relative and absolute) information from the website http://www.medscape.com, accessed July 14, 2014 and July 15, 2014. Additional references include the 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care and position statements from the American Academy of Clinical Toxicology and the European Association of Poison Control Centers (http://clintox.org/documents/positionpapers/Cathartics.pdf). *NOTE*: Not all contraindications listed on the http://www.medscape.com website were included for the purposes of this document. Contraindications which were not pertinent to EMS providers were not included for the purposes of streamlining this document.

MEDICATIONS

Name, Class, Pharmacologic Action, Indications, Contraindications

(The indications cited for the medications are specific to the EMS/prehospital setting.)

Acetazolamide
Name – Diamox Sequels®
Class – Carbonic anhydrase inhibitors
Pharmacologic Action - Inhibits hydrogen ion excretion in renal tubule, increasing sodium, potassium, bicarbonate, and water excretion and producing alkaline diuresis
Indications – Acute mountain sickness
Contraindications – Known hypokalemia/hyponatremia, hypersensitivity to acetazolamide or sulfa, liver disease, renal disease, cirrhosis, long term administration in patients with chronic, noncongestive angle-closure glaucoma

Acetaminophen

Name – There are multiple over-the-counter medications, as well as scheduled drugs, that include acetaminophen (Tylenol®) as an active ingredient
Class – Analgesics, antipyretic, other
Pharmacologic Action - May work peripherally to block pain impulse generation; may also inhibit prostaglandin synthesis in CNS
Indications - Pain control, fever control
Contraindications - Hypersensitivity, severe acute liver disease

Acetic acid (vinegar)

Name - Vinegar
Class – Other
Pharmacologic Action – Stabilizes nematocyst discharge in non-United States jellyfish thus decreasing pain
Indications – Pain control for jellyfish envenomation (outside of the United States (US))
Contraindications – May increase nematocyst discharge for US jellyfish and therefore should be used outside of the US only

Acetylcysteine

Name - Mucomyst®, Acetadote®
Class – Antidotes, other
Pharmacologic Action - Acts as sulfhydryl group donor to restore liver glutathione; may also scavenge free radicals to prevent delayed hepatotoxicity as antioxidant; encourages sulfation pathway of metabolism for acetaminophen
Indications – Antidote for acetaminophen overdose
Contraindications – Acute asthma
WARNING: Nausea and vomiting are common adverse effects following the oral administration of acetylcysteine

Activated Charcoal

Name – Actidose-Aqua®
Class – Antidotes, other
Pharmacologic Action - Adsorbs a variety of drugs and chemicals (e.g. physical binding of a molecule to the surface of charcoal particles); desorbtion 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 patents suffering from dystonia/akasthesia
Contraindications – Documented hypersensitivity, use controversial in lower respiratory tract disease (such as acute asthma), premature infants and neonates

Dopamine

Name - Intropin®

Class – Inotropic agent; catecholamine; pressor

Pharmacologic Action - Endogenous catecholamine, acting on both dopaminergic and adrenergic neurons. Low dose stimulates mainly dopaminergic receptors, producing renal and mesenteric vasodilation; higher dose stimulates both beta-1-adrenergic and dopaminergic receptors, producing cardiac stimulation and renal vasodilation; large dose stimulates alpha-adrenergic receptors

Indications – As a pressor agent used in the management of shock

Contraindications - Hypersensitivity to dopamine, pheochromocytoma, ventricular fibrillation, uncorrected tachyarrhythmias

WARNING: Dopamine is a vesicant and can cause severe tissue damage if extravasation occurs

Droperidol

Name - Inapsine®

Class – Antiemetic agents; antipsychotic

Pharmacologic Action - Antiemesis: dopamine receptor blockade in brain, predominantly dopamine-2 receptor. When reuptake is prevented, a strong antidopaminergic, antiserotonergic response occurs. Droperidol reduces motor activity, anxiety, and causes sedation; also possesses adrenergic-blocking, antifibrillatory, antihistaminic, and anticonvulsive properties

Indications – For use in the patient with acute delirium or psychosis

Contraindications – Hypersensitivity, known or suspected prolonged QT interval; QTc interval > 450 msec in females or $\geq$ 440 msec in males

WARNING: Use with caution in patients with bradycardia, cardiac disease, concurrent MAO inhibitor therapy, Class I and Class III dysrhythmics or other drugs that prolong the QT interval and cause electrolyte disturbances due to its adverse cardiovascular effects, i.e. QT prolongation, hypotension, tachycardia, and torsades de pointes

Epinephrine

Name – EpiPen®, TwinJect®, Adrenaclick®, Auvi-Q, Adrenalin®, AsthmaNefrin®, Vaponefrin®

Class - Alpha/beta adrenergic agonist

Pharmacologic Action - Strong alpha-adrenergic effects, which cause an increase in cardiac output and heart rate, a decrease in renal perfusion and peripheral vascular resistance, and a variable effect on BP, resulting in systemic vasoconstriction and increased vascular permeability. Strong beta-1- and moderate beta-2-adrenergic effects, resulting in bronchial smooth muscle relaxation
Secondary relaxation effect on smooth muscle of stomach, intestine, uterus, and urinary bladder

Indications – For use in the management of patients suffering anaphylaxis, shock, cardiac arrest, bradycardia, or in the nebulized form for croup/bronchiolitis and IM form for refractory acute asthma

Contraindications – Hypersensitivity, cardiac dilatation and coronary insufficiency

Famotidine

Name - Pepcid®

Class – Histamine H2 antagonist

Pharmacologic Action - Blocks H2 receptors of gastric parietal cells, leading to inhibition of gastric secretions

Indications - For the management of gastric or duodenal ulcers, gastroesophageal reflux, as an adjunct in the treatment of urticarial and/or pruritus in patients suffering from allergic reaction

Contraindications - Hypersensitivity to famotidine or other H2-receptor antagonists

Fentanyl

Name –Currently only available in the generic form (formerly Sublimaze®)

Class – Synthetic opioid, opioid analgesics

Pharmacologic Action - Narcotic agonist-analgesic of opiate receptors; inhibits ascending pain pathways, thus altering response to pain; increases pain threshold; produces analgesia, respiratory depression, and sedation

Indications – Management of acute pain

Contraindications – Hypersensitivity

WARNING: Should be used with caution in the elderly and in patients with hypotension, suspected gastrointestinal obstruction, head injury, and concomitant CNS depressants

Glucagon

Name – GlucaGen®, Glucagon Emergency Kit®, GlucaGen HypoKit®

Class - Hypoglycemia antidotes, glucose-elevating agents, other antidotes (e.g. beta-blocker or calcium channel blocker overdose)

Pharmacologic Action - Insulin antagonist. Stimulates cAMP synthesis to accelerate hepatic glycogenolysis and gluconeogenesis. Glucagon also relaxes smooth muscles of GI tract

Indications – For the management of hypoglycemic patients as well as patients suffering symptomatic bradycardia after beta blocker or calcium channel blocker overdose

Contraindications – Hypersensitivity, pheochromocytoma, insulinoma

WARNING: Nausea and vomiting are common adverse effects following the administration of glucagon

Haloperidol

Name – Haldol®, Haldol Decanoate®, Haloperidol LA®, Peridol®

Class – First generation antipsychotic

Pharmacologic Action - Antagonizes dopamine-1 and dopamine-2 receptors in brain; depresses reticular activating system and inhibits release of hypothalamic and hypophyseal hormones

Indications – For the management of acute psychosis or agitated/violent behavior refractory to non-pharmacologic interventions

Contraindications – Documented hypersensitivity, Severe CNS depression (including coma), neuroleptic malignant syndrome, poorly controlled seizure disorder, Parkinson's disease

WARNING: Risk of sudden death, torsades de pointes, and prolonged QT interval from off-label IV administration of higher than recommended dose. Continuous cardiac monitoring is required if administering IV

Hydrocortisone succinate

Name – Cortef®, SoluCortef®

Class - Corticosteroid

Pharmacologic Action - Glucocorticoid; elicits mild mineralocorticoid activity and moderate anti-inflammatory effects; controls or prevents inflammation by controlling rate of protein synthesis, suppressing migration of polymorphonuclear leukocytes (PMNs) and fibroblasts, and reversing capillary permeability

Indications – For the management of adrenal insufficiency

Contraindications - Untreated serious infections (except tuberculous meningitis or septic shock), idiopathic thrombocytopenic purpura, intrathecal administration (injection), documented hypersensitivity

Hydroxocobalamin

Name – Cyanokit®

Class – Cyanide antidote

Pharmacologic Action - Vitamin B12 with hydroxyl group complexed to cobalt which can be displaced by cyanide resulting in cyanocobalamin that is renally excreted

Indications – For the management of cyanide toxicity

Contraindications – Documented hypersensitivity

WARNING: Will cause discoloration of the skin and urine, can interfere with pulse oximetry. Due to its interference with certain diagnostic blood tests, the performance of prehospital phlebotomy is preferable prior to the administration of hydroxocobalamin

Ibuprofen

Name – There are multiple over-the-counter medications that include ibuprofen, such as Advil®, Motrin®

Class – Non-steroidal anti-inflammatory drug (NSAID)

Pharmacologic Action - Inhibits synthesis of prostaglandins in body tissues by inhibiting at least 2 cyclo-oxygenase (COX) isoenzymes, COX-1 and COX-2. May inhibit chemotaxis, alter lymphocyte activity, decrease proinflammatory cytokine activity, and inhibit neutrophil aggregation; these effects may contribute to anti-inflammatory activity

Indications – For the acute management of pain or as an antipyretic

Contraindications - Aspirin allergy; perioperative pain in setting of coronary artery bypass graft (CABG) surgery; preterm infants with untreated proven or suspected infection; bleeding with active intracranial hemorrhage or GI bleed; thrombocytopenia, coagulation defects, proven or necrotizing enterocolitis, significant renal impairment, congenital heart disease where patency or the patent ductus arteriosis (PDA) is necessary for pulmonary or systemic blood flow

Ipratropium

Name – Atrovent®

Class – Anticholinergics, respiratory

Pharmacologic Action - Anticholinergic (parasympatholytic) agent; inhibits vagally mediated reflexes by antagonizing acetylcholine action; prevents increase in intracellular calcium concentration that is caused by interaction of acetylcholine with muscarinic receptors on bronchial smooth muscle

Indications – For the management of asthma and COPD

Contraindications - Documented hypersensitivity to ipratropium, atropine, or derivatives.

Ketamine

Name – Ketalar®

Class – General anesthetics, systemic

Pharmacologic Action - Produces dissociative anesthesia. Blocks N-methyl D-aspartate (NMDA) receptor

Indications – For the management of agitated or violent behavior

Contraindications – Hypersensitivity

RELATIVE/CONTROVERSIAL CONTRAINDICATIONS: Head trauma, intracranial mass/hemorrhage, hypertension, angina, and stroke, underlying psychiatric disorder

WARNING: Overdose may lead to panic attacks and aggressive behavior; rarely seizures, increased ICP, and cardiac arrest. Very similar in chemical makeup to PCP (phencyclidine), but it is shorter acting and less toxic

Ketoralac

Name - Toradol®

Class – Non-steroidal anti-inflammatory drug (NSAID)

Pharmacologic Action - Inhibits synthesis of prostaglandins in body tissues by inhibiting at least 2 cyclo-oxygenase (COX) isoenzymes, COX-1 and COX-2. May inhibit chemotaxis, alter lymphocyte activity, decrease proinflammatory cytokine activity, and inhibit neutrophil aggregation; these effects may contribute to anti-inflammatory activity

Indications – For the acute management of moderately severe pain

Contraindications – Allergy to aspirin, ketorolac, or other NSAIDS; women who are in active labor or are breastfeeding, significant renal impairment particularly when associated with volume depletion, previous or current GI bleeding, intracranial bleeding, coagulation defects, patients with a high risk of bleeding

Lidocaine

Name – Lidocaine CV®, Lidopen®, Xylocaine®

Class – Class Ib antidysrhythmics

Pharmacologic Action - Class 1b antidysrhythmic; combines with fast sodium channels and thereby inhibits recovery after repolarization, resulting in decreasing myocardial excitability and conduction velocity
Indications – For the management of refractory or recurrent ventricular fibrillation or pulseless VT
Contraindications - Hypersensitivity to lidocaine or amide-type local anesthetic, Adams-Stokes syndrome, SA/AV/intraventricular heart block in the absence of artificial pacemaker. CHF, cardiogenic shock, second and third degree heart block (if no pacemaker is present), Wolff-Parkinson-White Syndrome

Lorazepam
Name - Ativan®
Class – Anticonvulsants, other; antianxiety agent; anxiolytics; benzodiazepines
Pharmacologic Action - Sedative hypnotic with short onset of effects and relatively long half-life; by increasing the action of gamma-aminobutyric acid (GABA), which is a major inhibitory neurotransmitter in the brain, lorazepam may depress all levels of the CNS, including limbic and reticular formation
Indications – For the management of seizures, uncontrolled shivering in hypothermia, and for the management of agitated or violent patients suffering behavioral emergencies
Contraindications - Documented hypersensitivity, acute narrow angle glaucoma, severe respiratory depression, sleep apnea

Magnesium sulfate
Name - MgSO4
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 gabba-aminobutyric acid (GABA) receptor system; increase in neuronal membrane permeability to chloride ions enhances the inhibitory effects of GABA; the shift in chloride ions causes hyperpolarization (less excitability) and stabilization of the neuronal membrane

Indications – For the management of seizures, uncontrolled shivering in hypothermia, and for the management of agitated or violent patients suffering behavioral emergencies
Contraindications - Documented hypersensitivity, severe respiratory depression, sleep apnea
WARNING: May cause respiratory depression, arrest, or apnea

Morphine Sulfate
Name – MS Contin®, Avinza®, Depodur®, Duramorph®, Infumorph®, Astramorph®, Kadian®, MSO_4
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_2O

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_2 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 phopsphodiesterase-5 inhibitors). There is potential for dangerous hypotension, narrow angle glaucoma (controversial: may not be clinically significant). Nitrates are contraindicated in the presence of hypotension (SBP < 90 mm Hg or ≥30 mm Hg below baseline), extreme bradycardia (< 50 bpm), tachycardia in the absence of heart failure (> 100 bpm), and right ventricular infarction

Norepinephrine

Name – Levophed®, Levarterenol®

Class – Alpha/beta adrenergic agonist

Pharmacologic Action - Strong beta-1 and alpha-adrenergic effects and moderate beta-2 effects, which increase cardiac output and heart rate, decrease renal perfusion and peripheral vascular resistance, and cause variable BP effects
Indications – As a pressor agent used in the management of shock
Contraindications – Hypersensitivity, hypotension due to blood volume deficit, peripheral vascular thrombosis (except for lifesaving procedures)
RELATIVE CONTRAINDICATIONS: concomitant use with some general anesthetics: chloroform, trichloroethylene, cyclopropane, halothane
WARNING: Norepinephrine is a vesicant and can cause severe tissue damage if extravasation occurs. Do not use in the same IV line as alkaline solutions as these may deactivate it

Olanzapine
Name – Zyprexa®
Class – Antipsychotic, second generation, antimanic agents
Pharmacologic Action - May act through combination of dopamine and serotonin type 2 receptor site antagonism
Indications – For the management of agitated or violent patients suffering a behavioral emergency
Contraindications - Documented hypersensitivity
WARNING: Patients are at risk for severe sedation (including coma) or delirium after each injection and must be observed for at least 3 hours in registered facility with ready access to emergency response services. Patients are at significant risk of severe sedation when olanzapine is administered with benzodiazepines or to patients who have are taking benzodiazepines

Ondansetron
Name – Zofran®, Zofran ODT®, Zuplenz®
Class – Antiemetic, selective 5-HT3 antagonist
Pharmacologic Action - Mechanism not fully characterized; selective 5-HT3 receptor antagonist; binds to 5-HT3 receptors both in periphery and in CNS, with primary effects in GI tract. Has no effect on dopamine receptors and therefore does not cause extrapyramidal symptoms
Indications – For the management of nausea or vomiting
NOTE: EKG monitoring is recommended in patients who have electrolyte abnormalities, CHF, or bradyarrhythmias or who are also receiving other medications that cause QT prolongation
Contraindications – Hypersensitivity, coadministration with apomorphine; combination reported to cause profound hypotension and loss of consciousness
WARNING: May cause dose-dependent QT prolongation, avoid in patients with congenital long QT syndrome

Oxymetazoline
Name – Afrin®, Duramist Plus®, Dristan 12 Hr®, Sinarest 12 Hour®, Vicks Sinus 12 Hour®
Class – Decongestants, intranasal

Pharmacologic Action - Alpha-adrenergic agonist; stimulates alpha-adrenergic receptors and produces vasoconstriction in the arterioles of the nasal mucosa
Indications – For the management of epistaxis in the patient suffering facial trauma
Contraindications - Hypersensitivity

Potassium iodide
Name – Pima Syrup®, SSKI®, ThyroSafe®, ThyroShield®
Class – Antidotes, other; antithyroid agents
Pharmacologic Action – As a thyroid protective agent: Systemically circulating potassium iodide is readily taken up by thyroid gland by sodium/iodide transporter in basal membrane; blocking the thyroid uptake of radioactive isotopes of iodine; concentration gradient of thyroid gland to plasma is 20-50:1
Indications – Indicated during environmental radiation emergency to block uptake of radioactive iodine isotopes in thyroid and reduce risk of thyroid cancer
Contraindications - Iodine sensitivity (although allergy to radiocontrast media, contact dermatitis from iodine-containing antibacterials, allergy to seafood should not be considered evidence of potassium iodide allergy), hyperthyroidism, respiratory failure

Pralidoxime chloride (2-PAM)
Name – Protopam®, 2PAM Antidote®, Pralidoxime Auto Injector®, a component of Mark I® kits and DuoDote®
Class – Cholinergic, toxicity antidote
Pharmacologic Action - Binds to organophosphates and breaks alkyl phosphate-cholinesterase bond to restore activity of acetylcholinesterase
Indications – For the management of toxicity caused by organophosphate insecticides and related nerve gases (e.g. tabun, sarin, soman)
Contraindications – Documented hypersensitivity

Procainamide
Name – Pronestyl®, Procanbid®
Class – Class Ia antidysrhythmic
Pharmacologic Action - Class Ia (membrane stabilizing) antidysrhythmic agent; inhibits recovery after repolarization resulting in decreasing myocardial excitability and conduction velocity. Direct membrane depressant that decreases conduction velocity, prolongs refractoriness, decreases automaticity and reduces repolarization abnormalities
Indications – For the management of stable patients with regular, wide complex tachycardia
Contraindications - Hypersensitivity to procainamide or other ingredients, complete heart block, second or third degree AV block, systemic lupus erythematosus (SLE), torsades de pointes
RELATIVE CONTRAINDICATION: Patients with QT prolongation

Prochlorperazine

Name – Compazine®

Class – Antiemetic agent; antipsychotics, phenothiazine

Pharmacologic Action - Antiemetic: antidopaminergic effect, blocking dopamine receptors in the brain, blocking vagus nerve in GI tract. Antipsychotic: Blocking mesolimbic dopamine receptors, and blocking alpha-adrenergic receptors (D1 and D2) in brain

Indications – For the management of nausea and vomiting

Contraindications - Documented hypersensitivity to phenothiazines, coma, severe CNS depression, concurrent use of large amounts of CNS depressants, poorly controlled seizure disorder, subcortical brain damage, pediatric surgery, children < 2 years or weighing < 9 kg

Sildenafil

Name – Revatio®, Viagra®

Class – Pulmonary artery hypertension therapy, PDE-5 inhibitors; phosphodiesterase-5 enzyme inhibitor

Pharmacologic Action - Inhibits PDE-5, increasing cyclic guanosine monophosphate (cGMP) to allow smooth-muscle relaxation

Indications – As an adjunct to descent in the management of high altitude pulmonary edema (HAPE)

Contraindications - Concomitant use of organic nitrates in any form (e.g. nitroglycerin, isosorbide, illicit "poppers") either regularly or intermittently, increases risk of severe or potentially fatal hypotension, hypersensitivity

WARNING: Hypotension may occur due to vasodilation

Sodium Bicarbonate

Name - Bicarb

Class – Antidote, other

Pharmacologic Action - Increases blood and urinary pH by releasing a bicarbonate ion, which in turn neutralizes hydrogen ion concentrations

Indications – For the management of cardiac arrest in cases in which either hyperkalemia or tricyclic antidepressant (TCA) overdose are suspected as contributory, QRS prolongation in known or suspected TCA overdose

Contraindications – Documented hypersensitivity, severe pulmonary edema, known alkalosis, hypernatremia, or hypocalcemia

Sodium Nitrite

Name - Nithiodote®

Class – Cyanide antidote

Pharmacologic Action - Nitrites create methemoglobins to bind to cyanide

Indications – For the management of cyanide toxicity

Contraindications – Documented hypersensitivity, suspected or confirmed smoke inhalation and/or carbon monoxide poisoning

WARNING: There is a risk of worsening hypoxia due to methemoglobin formation. In addition, sodium nitrite can cause serious adverse reactions and death from hypotension and methemoglobin formation. Monitor to ensure adequate perfusion and oxygenation during treatment with sodium nitrite

Sodium Thiosulfate

Name- Nithiodote®

Class – Cyanide antidote

Pharmacologic Action - Thiosulfate is sulfur donor utilized by rhodenase to convert cyanide to less toxic thiocyanate

Indications – For the management of cyanide toxicity

Contraindications – Documented hypersensitivity

Sorbitol

Name - Sorbitol

Class – Laxatives, osmotic

Pharmacologic Action - Polyalcoholic sugar with hyperosmotic effects

Indications – Administered for the management of patients suffering from toxic ingestions

Contraindications - Acute abdominal pain, nausea, vomiting, or other symptoms of appendicitis or undiagnosed abdominal pain, documented hypersensitivity

WARNING: Sorbitol is no longer recommended to be given with activated charcoal

Tadalafil

Name – Cialis®, Adcirca®

Class – Pulmonary artery hypertension therapy, PDE-5 inhibitors; phosphodiesterase-5 enzyme inhibitor

Pharmacologic Action - Pulmonary arterial hypertension (PAH): inhibits PDE-5, increasing cyclic guanosine monophosphate (cGMP) to allow relaxation of pulmonary vascular smooth-muscle cells and vasodilation of pulmonary vasculature

Indications – As an adjunct to descent in the management of high altitude pulmonary edema (HAPE)

Contraindications - Concomitant use of any form of organic nitrates (e.g. nitroglycerin, isosorbide dinitrate, isosorbide mononitrate, illicit "poppers"), either regularly or intermittently; may potentiate hypotensive effect of nitrates. Hypersensitivity, including Stevens-Johnson syndrome and exfoliative dermatitis

WARNING: Hypotension may occur due to vasodilation

Ziprasidone

Name - Geodon®

Class – Second generation antipsychotic

Pharmacologic Action - Acts as antagonist at dopamine-2 and serotonin type 1 and 2 (5HT1D, 5HT2A) receptors; acts as agonist at serotonin 5HT1A receptor; moderately inhibits reuptake of norepinephrine and serotonin; has alpha-blocking and antihistaminic activity
Indications – For the management of agitated or violent patients suffering a behavioral emergency
Contraindications - Documented hypersensitivity, any drugs or conditions that prolong QT interval, recent acute myocardial infarction, uncompensated heart failure

IV. Approved Abbreviations

The following is the Project's list of approved medical abbreviations used in this document:

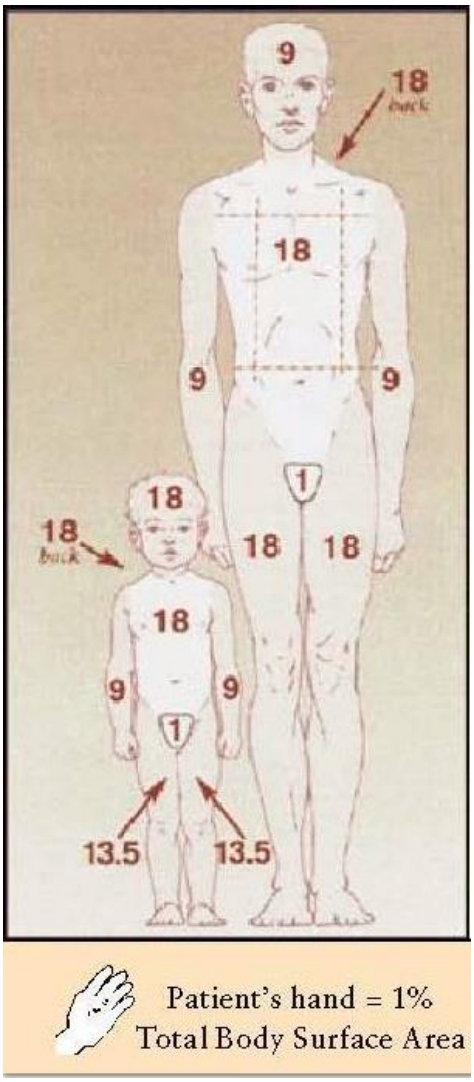
< (≤)	less than (less than or equal to)
> (≥)	more/greater than (more/greater than or equal to)
ACS	acute coronary syndrome
AED	automatic external defibrillator
A-FIB	atrial fibrillation
ALS	advanced life support
AMS	altered mental status
ASA	aspirin
AV	atrioventricular
BLS	basic life support
BP	blood pressure
BPM	beats per minute
BSA	body surface area
BVM	bag-valve-mask
CABG	coronary artery bypass graft
CAD	coronary artery disease
CC	chief complaint
CDC	Centers for Disease Control and Prevention
CHF	congestive heart failure
CNS	central nervous system
CO	carbon monoxide
CO_2	carbon dioxide
COPD	chronic obstructive pulmonary disease
CP	chest pain
CPAP	continuous positive airway pressure
CPR	cardiopulmonary resuscitation
C-SECTION	caesarean section
C-SPINE	cervical spine
CT	cat scan, Cardiac Technician
CVA	cerebrovascular accident (stroke)
D5W	5% dextrose in water
DKA	diabetic ketoacidosis
DNI	do not intubate
DNR	do not resuscitate
DT	delirium tremens
Dx	diagnosis
EKG	electrocardiogram

EEG	electroencephalogram
EENT	eye, ear, nose, and throat
EMS	emergency medical services
EMT	emergency medical technician
ET	endotracheal
ETA	estimated time of arrival
$ETCO_2$	end-tidal CO_2
ETOH	ethanol (alcohol)
ETT	endotracheal tube
FBAO	foreign body airway obstruction
FiO_2	fraction of inspired oxygen
g	gram(s)
GI	gastrointestinal
gtts	drops
GU	gastrourinary
GYN	gynecology (gynecological)
HR	heart rate (hour)
ICU	intensive care unit
IM	intramuscular
IO	intraosseous
IV	Intravenous
IVP	intravenous push
J	joules
JVD	jugular vein distension
kg	kilogram
KVO	keep vein open
LPM	liters per minutes
LR	lactated ringers
mcg	microgram(s)
MED	medicine
mg	milligram(s)
MI	myocardial infarction (heart attack)
mmol	millimole
MOLST	medical orders for life-sustaining treatment
MS	mental status
msec	millisecond
MVC	motor vehicle crash
N/V	nausea/vomiting
NC	nasal cannula
NRB	non-rebreather
NS	normal saline
NSR	normal sinus rhythm

OB/GYN	obstetrics/gynecology
O_2	oxygen
P	pulse
PAC	premature atrial contraction
PE	pulmonary embolus
PEA	pulseless electrical activity
PO	orally
POLST	physician orders for life-sustaining treatment
PPE	personal protection equipment
prn	as needed
PVC	premature ventricular contraction
q	every (e.g. q 3-5 minutes)
RR	respiratory rate
Rx	medicine
sat	saturation
SBP	systolic blood pressure
SC	subcutaneous
SL	sublingual
SOB	shortness of breath
ST	sinus tachycardia
SVT	supraventricular tachycardia
T	temperature
TBSA	total body surface area
TCA	tricyclic antidepressants
TIA	transient ischemic attack
TID	three times a day
TKO	to keep open
VF	ventricular fibrillation
VS	vital signs
VT	ventricular tachycardia
yo	years old (years of age)

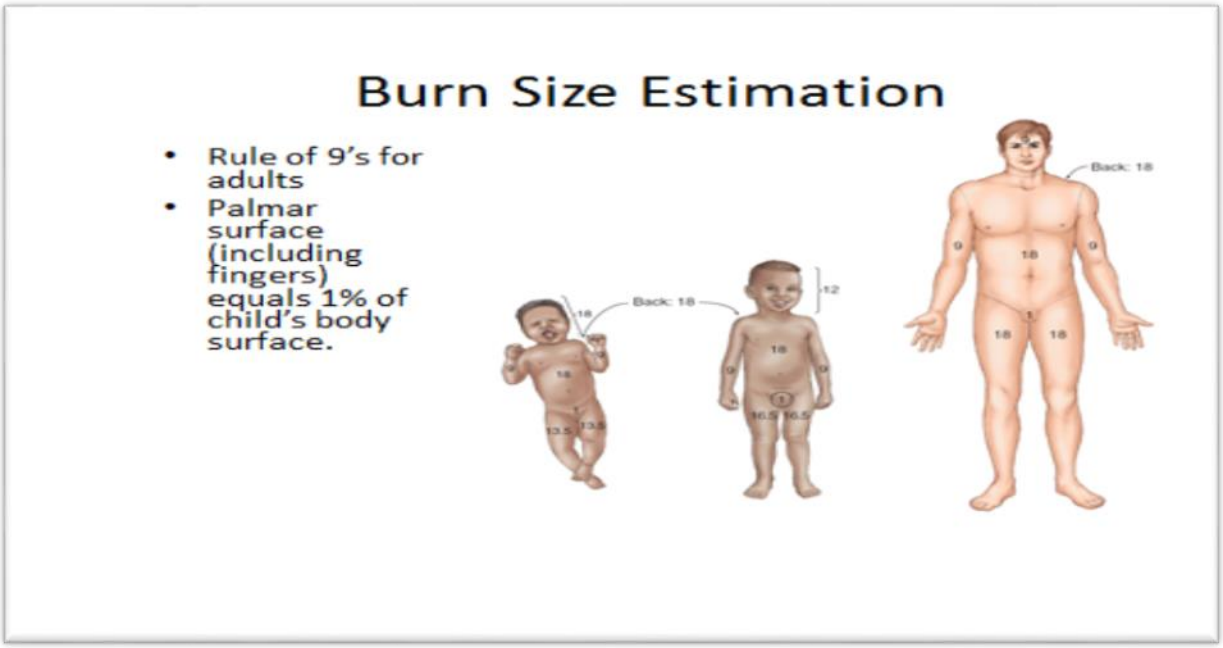
V. Burn and Burn Fluid Charts

Burn Size Chart 1



Source: Used with permission, University of Utah Burn Center

Burn Size Chart 2



Source: American Heart Association, *Pediatric Advanced Life Support* Textbook, 2013

Percentage of Total Body Surface Area by Age, Anatomic Structure, and Body Habitus

Adult

Anatomic structure	Surface area
Anterior head	4.5%
Posterior head	4.5%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	9%
Posterior leg, each	9%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia, perineum	1%

Child

Anatomic structure	Surface area
Anterior head	9%
Posterior head	9%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	6.75%
Posterior leg, each	6.75%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia/perineum	1%

Adult, obese > 80 kg

Anatomic structure	Surface area
Head and neck	2%
Anterior torso	25%
Posterior torso	25%
Leg, each	20%
Arm, each	5%
Genitalia/perineum	0%

Infant < 10 kg

Anatomic structure	Surface area
Head and neck	20%
Anterior torso	16%
Posterior torso	16%
Leg, each	16%
Arm, each	8%
Genitalia/perineum	1%

Parkland Formula

For patients who require fluid resuscitation, consider use of the Parkland formula to calculate the volume of normal saline or Lactated Ringer's solution that should be administered intravenously to ensure hemodynamic stability.

Volume of Intravenous Fluid required in the first 24 hours (in ml) =
(4 X patient weight in kg) X (Percentage of total body surface area burned)

The first half of the volume of fluid should be administered over the first 8 hours following the burn with the remaining fluid administered over the following 16 hours.

For pediatric patients, a weight-based assessment tool (length-based tape or other system) should be used to provide a more accurate estimate of the patient's weight. Likewise, the total body surface area (BSA) estimates are different for pediatric patients compared to adults due to larger head and trunk size. For children, the palmar surface of the hand (not including the fingers is approximately equal to 1% BSA. The guidelines listed above will provide assistance during the estimation of the percentage of total body surface area burned for patients of various ages and body habitus.

Burn Injury IV Fluid Rates
Fluid Infusion Rate > 30 KG

*Fluid of choice LR/NS, DO NOT use dextrose containing fluids

Wt (lbs)	Wt (kg)	% TBSA	/Hr for 1st 8 Hrs of care	60 gtt set, gtt/min	20 gtt set, gtt/min	15 gtt set, gtt/min	10 gtt set, gtt/min
66	30	10	75	75	25.0	18.8	12.5
66	30	20	150	150	50.0	37.5	25.0
66	30	30	225	225	75.0	56.3	37.5
66	30	40	300	300	100.0	75.0	50.0
66	30	50	375	375	125.0	93.8	62.5
66	30	60	450	450	150.0	112.6	75.0
88	40	10	100	100	33.3	25.0	16.7
88	40	20	200	200	66.7	50.0	33.3
88	40	30	300	300	100.0	75.0	50.0
88	40	40	400	400	133.3	100.0	66.7
88	40	50	500	500	166.7	125.00	83.3
88	40	60	600	600	200.0	150.0	100.0
110	50	10	125	125	41.7	31.3	20.8
110	50	20	250	250	83.3	62.5	41.7
110	50	30	375	375	125.0	93.8	62.5
110	50	40	500	500	166.7	125.0	83.3
110	50	50	625	625	208.3	156.3	104.2
110	50	60	750	750	250.0	187.6	125.0
132	60	10	150	150	50.0	37.5	25.0
132	60	20	300	300	100.0	75.0	50.0
132	60	30	450	450	150.0	112.5	75.0
132	60	40	600	600	200.0	150.0	100.0
132	60	50	750	750	250.0	187.5	125.0
132	60	60	900	900	300.0	225.0	150.0
154	70	10	175	175	58.3	43.8	29.2
154	70	20	350	350	116.7	87.5	58.3
154	70	30	525	525	175.0	131.3	87.5
154	70	40	700	700	233.3	175.0	116.7
154	70	50	875	875	291.7	218.8	145.8
154	70	60	1050	1050	350.0	262.6	175.0
176	80	10	200	200	66.7	50.0	33.3
176	80	20	400	400	133.3	100.0	66.7
176	80	30	600	600	200.0	150.0	100.0
176	80	40	800	800	266.7	200.0	133.3
176	80	50	1000	1000	333.3	250.0	166.7
176	80	60	1200	1200	400.0	300.0	200.0
198	90	10	225	225	75.0	56.3	37.5
198	90	20	450	450	150.0	112.5	75.0
198	90	30	675	675	225.0	168.8	112.5
198	90	40	900	900	300.0	225.0	150.0
198	90	50	1125	1125	375.0	281.3	187.5
198	90	60	1350	1350	450.0	337.6	225.0
220	100	10	250	250	83.3	62.5	41.7
220	100	20	500	500	166.7	125.0	83.3
220	100	30	750	750	250.0	187.5	125.0
220	100	40	1000	1000	333.3	250.0	166.7
220	100	50	1250	1250	416.7	312.5	208.3
220	100	60	1500	1500	500.0	375.0	250.0
242	110	10	275	275	91.6	68.7	45.9
242	110	20	550	550	183.4	137.5	91.6
242	110	30	825	825	275	206.2	137.5
242	110	40	1100	1100	366.6	275.0	183.4
242	110	50	1375	1375	458.4	343.7	229.1
242	110	60	1650	1650	550.0	412.4	275
264	120	10	300	300	99.9	74.9	50.1
264	120	20	600	600	200.1	150.0	99.9
264	120	30	825	825	300.0	224.9	150.0
264	120	40	1200	1200	399.9	300.0	200.1
264	120	50	1500	1500	500.1	374.9	249.9
264	120	60	1650	1650	600.0	449.8	300

Patients with traumatic injuries may require additional fluids.

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 1st 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

10

Used with permission, University of Utah Burn Center. https://crisisstandardsofcare.utah.edu.

VI. Neurologic Status Assessment

Neurologic status assessment involves establishing a baseline and then trending any change in patient neurologic status. Glasgow Coma Score (GCS) is frequently used, but there are often errors in applying and calculating this score. With this in consideration, Glasgow Coma Score may not be more valid than a simpler field approach. Either AVPU (Alert, Verbal, Painful, Unresponsive – see below) or only the motor component of the GCS may more effectively serve in this capacity.

Glasgow Coma Score

	Points	Pediatric	Adult
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 patients is alert

V: The patient responds to verbal stimulus

P: The patient responds to painful stimulus

U: The patient is completely unresponsive

VII. Normal Vital Signs

Age	Heart Rate	Resp Rate	Systolic BP	Temp (°C)
0 d – 1 m	> 205	> 60	< 60	<36 or >38
≥ 1 m - 3 m	> 205	> 60	< 70	<36 or >38
≥ 3 m - 1 r	> 190	> 60	< 70	<36 or >38.5
≥ 1 y - 2 y	> 190	> 40	< 70 + (age in yr × 2)	<36 or >38.5
≥ 2 y - 4 y	> 140	> 40	< 70 + (age in yr × 2)	<36 or >38.5
≥ 4 y - 6 y	> 140	> 34	< 70 + (age in yr × 2)	<36 or >38.5
≥6 y- 10 y	> 140	> 30	< 70 + (age in yr × 2)	<36 or >38.5
≥ 10 y - 13 y	> 100	> 30	< 90	<36 or >38.5
> 13 y	> 100	>16	< 90	<36 or >38.5

VIII. Evidence-based Guidelines - Grade Methodology

An Overview of GRADE Methodology

Although engagement in quality EMS research has increased significantly, the demand for evidence-based quality prehospital research continues to exceed its availability. The need for evidence-based prehospital patient care protocols was clearly recognized by the Institute of Medicine of the National Academies and clearly stated in 2007 in *The Future of Emergency Care: Emergency Medical Services at the Crossroads.*

The Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) methodology is a transparent process where the available research is reviewed and assessed by a panel of subject matter experts. Following this thorough review process, the available research is reviewed and graded for its validity based upon the assessment of the workgroup, and an evidence-based guideline (EBG) is developed based upon the outcome of the workgroup.

The Federal Interagency Committee on Emergency Medical Services (FICEMS) and the National EMS Advisory Council (NEMSAC) approved a National Prehospital Evidence-based Guideline Model Process for the development, implementation, and evaluation of evidence-based guidelines. This Model Process recommends the use of the GRADE methodology for the guideline development tool. The six process steps of the GRADE EBG development tool are:

- Assemble the expert panel and provide GRADE training
- Define the EBG content area and establish the specific clinical questions to address in patient, intervention, comparison, and outcome (PICO) format
- Prioritize outcomes to facilitate systematic literature searches
- Create GRADE tables (or evidence profiles) for each PICO question
- Vet and endorse GRADE evidence tables and draft recommendations
- Synthesize recommendations into an EMS protocol and visual algorithm

The current evidence-based guidelines cited in this document were created for and released by NHTSA; however, the GRADE methodology is not proprietary to NHTSA or any other organization. Local, regional, and state EMS agencies and EMS systems are encouraged to support the ongoing need for quality prehospital care, improved patient outcome, and the growing demand for EBGs for EMS.

References:

Brown KM. The development of evidence-based prehospital guidelines using a GRADE-based methodology, *Prehospital Emergency Care,* 2014, Suppl 1:3-14, 2014