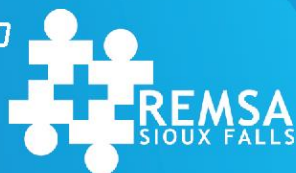




REMSA Emergency Medical Care Guidelines

*Based on 2022 NASEMSO
National Model EMS
Clinical Guidelines*

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Version	Approved by REMSA Medical Board	Adopted by REMSA	Effective
1.2	07/9/2026	07/22/2026	07/30/2026



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*****To identify skills approved for specific EMS Level Providers (EMT/AEMT/Paramedic) visit the following website - <https://www.sdbmoe.gov/media/z3apyeg5/ems-scope-of-practice.pdf>***

*****REMSA Senior Medics who have completed their petition with SD Board of Osteopathic and Medical Examiners (SDBMOE) may utilize the skill of porta cath access, when necessary for venous access.***

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UNIVERSAL CARE



Universal Care Guideline

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

All patient encounters with and care delivery by EMS personnel

Exclusion Criteria

None

Patient Management

Assessment

1. Assess scene safety
 - a. Evaluate for hazards to EMS personnel, patient, and bystanders
 - b. Safely remove patient from hazards prior to beginning medical care
 - c. Determine number of patients
 - d. Determine mechanism of injury or potential source of illness
 - e. Request additional resources if needed and weigh the benefits of waiting for additional resources against rapid transport to definitive care
 - f. Consider declaration of mass casualty incident if needed
2. Use appropriate personal protective equipment (PPE)
 - a. Consider suspected or confirmed hazards on scene
 - b. Consider suspected or confirmed highly contagious infectious disease (e.g., contact [bodily fluids], droplet, airborne)
3. Wear high-visibility, retro-reflective apparel when deemed appropriate (e.g., operations at night or in darkness, on or near roadways).
4. Consider cervical spine stabilization and/or spinal care if traumatic injury suspected. [See [Spinal Care Guideline](#)].
5. Primary survey. (**A**irway, **B**reathing, **C**irculation (**ABC**) is cited below. Although there are specific circumstances where **C**irculation, **A**irway, **B**reathing (**CAB**) may be indicated, such as for cardiac arrest, or **M**assive hemorrhage, **A**irway, **R**espirations, **C**irculation, **H**ypothermia, and head injury (**MARCH**) may be indicated for trauma or major arterial bleeding).
 - a. Airway (assess for patency and open the airway as indicated)—go to [Airway Management Guideline](#)
 - 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, supraglottic airway device, or endotracheal tube
 5. For patients with laryngectomies or tracheostomies, remove all objects or clothing that may obstruct the opening of these devices, maintain the flow of prescribed oxygen, and reposition the head and/or neck
- b. Breathing
 - i. Evaluate rate, breath sounds, accessory muscle use, retractions, patient positioning, and oxygen saturation
 - ii. Provide supplemental oxygen as appropriate to achieve the target of 94–98% oxygen saturation (SPO₂) based upon clinical presentation and assessment of ventilation (e.g., EtCO₂)
 - iii. Apnea (not breathing)—go to [Airway Management Guideline](#)
 - c. Circulation
 - i. Control any major external bleeding [See [General Trauma Management Guideline](#) and/or [Extremity Trauma/External Hemorrhage Management Guideline](#)]
 - ii. Assess pulse
 1. If none—go to [Resuscitation Section](#)
 2. Assess rate and quality of carotid and radial pulses
 - iii. Evaluate perfusion by assessing skin color and temperature
 1. Evaluate capillary refill
 - d. Disability
 - i. Evaluate patient responsiveness: **AVPU** (**A**lert, **V**erbal, **P**ainful, **U**nresponsive)
 - ii. Evaluate gross motor and sensory function in all extremities
 - iii. Check blood glucose in patients with altered mental status (AMS) or suspected stroke. If blood glucose is less than 60 mg/dL—go to [Hypoglycemia Guideline](#)
 - iv. If acute stroke suspected—go to [Suspected Stroke/Transient Ischemic Attack Guideline](#)
 - e. Expose patient for exam as appropriate to complaint
 - i. Be considerate of patient modesty
 - ii. Keep patient warm
6. Assess for urgency of transport

7. 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. Ears
- iii. Naso-oropharynx
- iv. Skull and scalp

b. Neck:

- i. Jugular venous distension
- ii. Tracheal position
- iii. Spinal tenderness

c. Chest:

- i. Retractions
- ii. Breath sounds
- iii. Chest wall tenderness, deformity, crepitus, and excursion
- iv. Respiratory pattern, symmetry of chest movement with respiration

d. Abdomen/Back:

- i. Tenderness or bruising
- ii. Abdominal distension, rebound, or guarding
- iii. Spinal tenderness, crepitus, or step-offs
- iv. Pelvic stability or tenderness

e. Extremities:

- i. Pulses
- ii. Edema
- iii. Deformity/crepitus

f. Neurologic:

- i. Mental status/orientation
- ii. Motor/sensory

g. Evaluate for medical equipment (e.g., pacemaker/defibrillator, left ventricular assist device (LVAD), insulin pump, and dialysis fistula)

8. Obtain baseline vital signs (an initial full set of vital signs is required: pulse, blood pressure, respiratory rate, neurologic status assessment, and obtain pulse oximetry if indicated).
 - a. Neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)] involves establishing a baseline and then trending any change in patient neurologic status
 - i. Glasgow Coma Score (GCS) is frequently used, but there are often errors in applying and calculating this score. With this in consideration, a simpler field approach may be as valid as GCS. Either AVPU or only the motor component of the GCS may more effectively serve in this capacity.
 - ii. Sternal rub as a stimulus is discouraged.
 - b. Patients with cardiac or respiratory complaints
 - i. Pulse oximetry
 - ii. 12-lead electrocardiogram (EKG) should be obtained promptly in patients with cardiac or suspected cardiac complaints
 - iii. Continuous cardiac monitoring, if available
 - iii. Consider waveform capnography for patients with respiratory complaints (essential for critical patients and those patients who require invasive airway management)
 - c. Patient with altered mental status
 - i. Check blood glucose. If low, go to [Hypoglycemia Guideline](#)
 - ii. Consider waveform capnography (essential for critical patients and those patients who require invasive airway management) or digital capnometry
 - d. Stable patients should have at least two sets of pertinent vital signs. Ideally, one set should be taken shortly before arrival at receiving facility
 - e. Critical patients should have pertinent vital signs frequently monitored
9. Obtain **OPQRST** history:
 - a. **O**nset of symptoms
 - b. **P**rovocation: location; any exacerbating or alleviating factors
 - c. **Q**uality of pain
 - d. **R**adiation of pain
 - e. **S**everity of symptoms: pain scale
 - f. **T**ime of onset and circumstances around onset

10. Obtain **SAMPLE** history:
 - a. **Symptoms**
 - b. **Allergies:** medication, environmental, and foods
 - c. **Medications:** prescription and over the counter; bring containers to ED if possible
 - d. **Past medical history:**
 - i. Look for medical alert tags, portable medical records, and advance directives
 - ii. Look for medical devices/implants (some common ones may be dialysis shunt, insulin pump, pacemaker, central venous access port, gastric tubes, and urinary catheter)
 - iii. For females of childbearing age, inquire of potential or recent pregnancy.
 - e. **Last oral intake**
 - f. **Events leading up to the 911 call**

In patients with syncope, seizure, altered mental status, or acute stroke, consider bringing the witness to the hospital or obtain their contact phone number to provide to ED care team

Treatment and Interventions

1. Administer oxygen as appropriate with a target of achieving 94–98% saturation and select the appropriate method of oxygen delivery to mitigate or treat hypercarbia associated with hypoventilation
2. Place appropriate monitoring equipment as dictated by assessment; these may include:
 - a. Continuous pulse oximetry
 - b. Cardiac rhythm monitoring
 - c. Waveform capnography or digital capnometry. Monitor waveform capnography if administering opioids, benzodiazepines, or ketamine.
 - d. Carbon monoxide assessment
3. Establish vascular access if indicated or in patients who are at risk for clinical deterioration.
 - a. If IO is to be used for a conscious patient, consider priming the extensions set with 1 ml of 2% lidocaine and then slowly infusing 0.5 mg/kg of 2% through the IO needle to a maximum of 40 mg to mitigate pain from IO medication administration. Allow to dwell for 1 minute, then flush with 10 ml of normal saline.
4. Monitor pain scale if appropriate
5. Monitor agitation-sedation scale if appropriate
6. Reassess patient

Transfer of Care

1. The content and quality of information provided during the transfer of patient care to another party is critical for seamless patient care and maintenance of patient safety
2. Ideally, a completed electronic or written medical record should be provided to the next caregiver at the time of transfer of care

3. If provision of the completed medical record is not possible at the time of transfer of care, a verbal report and an abbreviated written run report should be provided to the next caregiver
4. The information provided during the transfer of care should include, but is not limited to
 - a. Patient's full name
 - b. Age
 - c. Chief complaint
 - d. History of present illness/Mechanism of injury
 - e. Past medical history
 - f. Medications
 - g. Allergies
 - h. Vital signs with documented times
 - i. Patient assessment and interventions along with the timing of any medication or intervention and the patient's response to such interventions
5. The verbal or abbreviated written run report provided at the time of transfer of care does not take the place of or negate the requirement for the provision of a complete electronic or written medical record of the care provided by EMS personnel

Patient Safety Considerations

1. Routine use of lights and sirens is not warranted
2. Even when lights and sirens are in use, always limit speeds to level that is safe for the emergency vehicle being driven and road conditions on which it is being operated
3. Be aware of legal issues and patient rights as they pertain to and impact patient care (e.g., patients with functional needs or children with special healthcare needs)
4. Be aware of potential need to adjust management based on patient age and comorbidities, including medication dosages
5. The maximum weight-based dose of medication administered to a pediatric patient should not exceed the maximum adult dose except where specifically stated in a patient care guideline
6. Medical direction should be contacted when mandated or as needed
7. Consider air medical transport, if available, for patients with time-critical conditions where ground transport time exceeds 30 minutes

Notes/Educational Pearls

Key Considerations

1. **Pediatrics:** Use a weight-based assessment tool (length-based tape or other system) to estimate patient weight and guide medication therapy and adjunct choice
 - a. Although the defined age varies by state, the pediatric population is generally defined by those patients who weigh up to 40 kg or up to 14 years of age, whichever comes first
 - b. Consider using the pediatric assessment triangle (appearance, work of breathing, circulation) when first approaching a child to help with assessment

2. **Geriatrics:** Although the defined age varies by state, the geriatric population is generally defined as those patients who are 65 years old or more
 - a. In these patients, as well as all adult patients, reduced medication dosages may apply to patients with renal disease (i.e., on dialysis or a diagnosis of chronic renal insufficiency) or hepatic disease (i.e., severe cirrhosis or end-stage liver disease)
3. **Co-morbidities:** Reduced medication dosages may apply to patients with renal disease (i.e., on dialysis or a diagnosis of chronic renal insufficiency) or hepatic disease (i.e., severe cirrhosis or end-stage liver disease)
4. **Vital Signs**
 - a. Oxygen
 - i. Administer oxygen as appropriate with a target of achieving 94–98% saturation
 - ii. Supplemental oxygen administration is warranted to patients with oxygen saturations below this level and titrated based upon clinical condition, clinical response, and geographic location and altitude
 - iii. The method of oxygen delivery should minimize or treat hypercarbia associated with hypoventilation (e.g., noninvasive positive airway pressure devices)
 - b. Normal vital signs (See [Table 1. Normal Vital Signs](#))
 - i. Hypotension is considered a systolic blood pressure less than the lower limit on the chart
 - ii. Tachycardia is considered a pulse above the upper limit on the chart
 - iii. Bradycardia is considered a pulse below the lower limit on the chart
 - iv. Tachypnea is considered a respiratory rate above the upper limit on the chart
 - v. Bradypnea is considered a respiratory rate below the lower limit on the chart
 - c. Hypertension. Although abnormal, may be an expected finding in many patients
 - i. Unless an intervention is specifically suggested based on the patient's complaint or presentation, the hypertension should be documented, but otherwise, no intervention should be taken acutely to normalize the blood pressure
 - ii. The occurrence of symptoms (e.g., chest pain, dyspnea, vision change, headache, focal weakness or change in sensation, altered mental status) in patients with hypertension should be considered concerning, and care should be provided appropriate with the patient's complaint or presentation
5. **Secondary Survey:** If patient has critical primary survey problems, it may not be possible to complete
6. **Critical Patients:** Proactive patient management should occur simultaneously with assessment
 - a. Ideally, one clinician should be assigned to exclusively monitor and facilitate patient-focused care

- b. Other than lifesaving interventions that prevent deterioration enroute, treatment and interventions should be initiated as soon as practical, but should not impede extrication or delay transport to definitive care
- 7. **Air Medical Transport:** Air transport of trauma patients should generally be reserved for higher acuity trauma patients where there is a significant time saved over ground transport, where the appropriate destination is not accessible by ground due to systemic or logistical issues, and for patients who meet the American College of Surgeons Committee on Trauma (ACS-COT) [2022 National Guideline for the Field Triage of Injured Patients](#) anatomic, physiologic, and situational high-acuity triage criteria. In selected circumstances, air medical resources may be helpful for nontrauma care (e.g., stroke, STEMI when geographically constrained)
- 8. **Additional Protective Measures for the EMS Clinician:** Due to suspected or confirmed hazards and/or highly infectious contagious diseases, traditional patient treatment and care delivery may be altered due to recommendations by federal, state, local, or jurisdictional officials

Pertinent Assessment Findings

Refer to individual guidelines

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- At least two sets of vital signs should be documented for every patient
- All patient interventions and response to care should be documented
- All major changes in clinical status including, but not limited to, vital signs and data from monitoring equipment, should be documented

Performance Measures

- Abnormal vital signs should be addressed and reassessed
- Response to therapy provided should be documented including pain scale or agitation-sedation scale (e.g., Richmond Agitation-Sedation Scale (RASS)) reassessment if appropriate
- Limit scene time for patients with time-critical illness or injury unless clinically indicated
- Appropriate utilization of air medical services
- Blood glucose level obtained when indicated
- Compliance with provision of critical information during patient transfer of care
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)

Table 1. Normal Vital Signs

Age	Pulse-Awake (beats/minute)	Pulse-Sleeping (beats/minute)	Respiratory Rate (breaths/minute)	Systolic BP (mmHg)
Preterm less than 1 kg	120–160		30–60	39–59
Preterm 1–3 kg	120–160		30–60	60–76
Newborn	100–205	85–160	30–60	67–84
Up to 1 year	100–190	90–160	30–60	72–104
1–2 years	100–190	90–160	24–40	86–106
2–3 years	98–140	60–120	24–40	86–106
3–4 years	80–140	60–100	24–40	89–112
4–5 years	80–140	60–100	22–34	89–112
5–6 years	75–140	58–90	22–34	89–112
6–10 years	75–140	58–90	18–30	97–115
10–12 years	75–118	58–90	18–30	102–120
12–13 years	60–100	58–90	15–20	110–131
13–15 years	60–100	50–90	15–20	110–131
15 years or older	60–100	50–90	15–20	110–131
Source: Extrapolated from the 2020 American Heart Association Pediatric Advanced Life Support's tables from the Nursing Care of the Critically Ill Child, and from Web Box 1: Existing reference ranges for respiratory rate and heart rate in the appendix of the article by Fleming, et al, published in Lancet <i>Note: While many factors affect blood pressure (e.g., pain, activity, hydration), it is imperative to rapidly recognize hypotension, especially in children. For children of the ages 1–10, hypotension is present if the systolic blood pressure is less than 70 mmHg + (child's age in years x 2) mmHg.</i>				

Table 2. 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. 2020 *Pediatric Advanced Life Support Provider Manual*, American Heart Association, 2020
2. Bass, R. R., Lawner, B., Lee, D. and Nable, J. V. 2015 Medical oversight of EMS systems, in *Emergency Medical Services: Clinical Practice and Systems Oversight, Second Edition* (eds D. C. Cone, J. H. Brice, T. R. Delbridge and J. B. Myers), John Wiley & Sons, Ltd, Chichester, UK
3. Bledsoe BE, Porter RS, Cherry RA. *Paramedic Care: Principles & Practice, Volume 3, 4th Ed.* Brady, 2012
4. Duckworth, Rom, EMS Trauma Care: ABCs vs. MARCH, *Rescue Digest*, September 1, 2017
5. *Emergency Cardiovascular Care: For Healthcare Providers*. American Heart Association, 2020.
6. Fleming, S, et al, Normal ranges of heart rate and respiratory rate in children from birth to 18 years: a systematic review of observational studies, *Lancet*, March 19, 2011,377(9770),1011–1018
7. Gill M, Steele R, Windemuth R, Green SM. A comparison of five simplified scales to the out-of-hospital Glasgow Coma Scale for the prediction of traumatic brain injury outcomes. *Acad Emerg Med*. 2006;13(9):968–73
8. Haziinski, MF, Children are Different, *Nursing Care of the Critically Ill Child*, 3rd ed, Mosby, 2013,1–18
9. Kupas, D. Lights and Siren Use by Emergency Medical Services (EMS): Above All Do No Harm. National Highway Traffic Safety Administration Contract DTNH22-14-F-00579. Published May 2017
10. National Association of State Emergency Medical Services Officials. *State model rules for the regulation of air medical services*. September 2016
11. O'Driscoll BR, Howard LS, Davison AG. BTS guideline for emergency oxygen use in adult patients. *Thorax* 2008;63:vi1-vi68
12. Thomas SH, Brown KM, Oliver ZJ, Spaite DW, Sahni R, Weik TS, et al. An evidence-based guideline for the air medical transportation of trauma patients. *Prehosp Emerg Care* 2014;18 Suppl 1:35–44
13. U.S. Fire Administration. *Traffic incident management systems, FA-330*. March 2012. https://www.usfa.fema.gov/downloads/pdf/publications/fa_330.pdf. Accessed March 24, 2022

Functional Needs

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

Assessment

1. Identify the functional need by means of information from the patient, the patient's family, bystanders, medic alert bracelets or documents, or the patient's adjunct assistance devices
2. The physical examination should not be intentionally abbreviated, although the way 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 way the care is provided may need to be modified to accommodate the specific needs of the patient

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. Communication Barriers

a. Language Barriers:

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

b. Sensory Barriers

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

2. Physical Barriers

- a. Ambulatory impairment (e.g., limb amputation and bariatric)
- b. Neuromuscular impairment

3. Cognitive Barriers

- a. Mental illness
- b. Developmental challenge or delay

Pertinent Assessment Findings

1. **Assistance Adjuncts.** Examples of devices that facilitate the activities of daily living for the patient with functional needs include, but are not limited to:
 - a. Extremity prostheses
 - b. Hearing aids
 - c. Magnifiers
 - d. Tracheostomy speaking valves
 - e. White or sensory canes
 - f. Wheelchairs or motorized scooters
2. **Service Animals.** As defined by the **American Disabilities Act**, “any guide dog, signal dog, or other animal individually trained to do work or perform tasks for the benefit of an individual with a disability, including, but not limited to guiding individuals with impaired vision, alerting individuals with impaired hearing to intruders or sounds, providing minimal protection or rescue work, pulling a wheelchair, or fetching dropped items” impaired hearing to intruders or sounds, providing minimal protection or rescue work, pulling a wheelchair, or fetching dropped items”
 - a. Service animals are not classified as a pet and should, by law, always be permitted to accompany the patient with the following exceptions
 - i. A public entity may ask an individual with a disability to remove a service animal from the premises if:
 1. The animal is out of control and the animal's handler does not take effective action to control it; or
 2. The animal is not housebroken
 - b. Service animals are not required to wear a vest or a leash. It is illegal to make a request for special identification or documentation from the service animal's partner. EMS clinicians may only ask the patient if the service animal is required because of a disability and the form of assistance the animal has been trained to perform
 - c. EMS clinicians are not responsible for the care of the service animal. If the patient is incapacitated and cannot personally care for the service animal, a decision can be made whether to transport the animal in this situation
 - d. Animals that solely provide emotional support, comfort, or companionship do not qualify as service animals

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914063—General—Individualized Patient Protocol
- 9914165—Other

Key Documentation Elements

- Document all barriers in the NEMSIS element “eHistory.01—Barriers to Patient Care” (NEMSIS Required National Element)
- Document specific physical barriers in the appropriate exam elements (e.g., “blind” under Eye. Assessment; or paralysis, weakness, or speech problems under [Neurological Assessment](#))
- Document any of the following, as appropriate in the narrative
 - Language barriers
 - The patient’s primary language of fluency
 - The identification of the person assisting with the communication
 - The methods through which the patient augments his/her communication skills
 - Sensory barriers
 - The methods through which the patient augments his/her communication skills
 - Written communication between the patient and the EMS professional is part of the medical record, even if it is on a scrap sheet of paper, and it should be retained with the same collation, storage, and confidentiality policies and procedures that are applicable to the written or electronic patient care report
 - Assistance adjuncts (devices that facilitate the activities of life for the patient).

Performance Measure

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

References

1. International classification of functioning, disability, and health. Presented at: 54th World Health Assembly, WHA 54.21, Agenda Item 13.9; May 21, 2001
2. U.S. Department of Health and Human Services, Office of the Assistant Secretary of Preparedness and Response. *FEMA's Functional Needs Support Services Guidance*. 2012. <http://www.phe.gov/Preparedness/planning/abc/Documents/fema-fnss.pdf>. Accessed August 18, 2017
3. US Department of Labor. Americans with Disabilities Act; 28 Code of Federal Regulations Part 35. July 23, 2010
4. US Department of Labor. Americans with Disabilities Act; 42 U.S. Code, Chapter 126. 1990
5. US Department of Labor. Americans with Disabilities Act; Amendments Act; 42 U.S. Code. 2008

Patient Refusals

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 clinicians have been called to the scene, clinicians should determine the patient's capacity to make decisions. Competency is generally a legal status of a person's ability to make decisions. However, state laws vary in the definition of competency and its impact upon authority. Therefore, one should consult with the respective state EMS office for clarification on legal definitions and patient rights

Patient Management

Assessment

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

Treatment and Interventions

1. Obtain a complete set of vital signs and complete an initial assessment, paying particular attention to the individual's neurologic and mental status
2. Determine the individual's capacity to make a valid judgment concerning the extent of his/her illness or injury. If the EMS clinician has doubts about whether the individual has the mental capacity to refuse or if the patient lacks capacity, the EMS clinician should contact medical direction
3. If patient has capacity, clearly explain to the individual and all responsible parties the possible risks and overall concerns regarding refusing care and that they may reengage the EMS system if needed
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
2. Individuals must be advised of the risks and consequences resulting from refusal of medical care to enable an informed decision regarding consent or refusal of treatment

3. An individual determined to lack decision-making capacity by EMS clinicians 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 had other factors that lead EMS clinicians to suspect suicidal intent, should not be regarded as having demonstrated sufficient decision-making capacity
4. The determination of decision-making capacity may be challenged by communication barriers or cultural differences
5. EMS clinicians should not put themselves in danger by attempting to treat and/or transport an individual who refuses care. Law enforcement personnel should be requested if needed
6. Always act in the best interest of the patient. EMS clinicians, with the support of direct medical oversight, must strike a balance between abandoning the patient and forcing care

7. ***Special Considerations—Minors***

It is preferable for minors to have a parent or legal guardian who can provide consent for treatment on behalf of the child.

- a. All states allow healthcare clinicians 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 EMS clinician can presume consent and proceed with appropriate treatment and transport if the following six conditions are met:
 - i. The child is suffering from an emergent condition that places their life or health in danger
 - ii. The child's legal guardian is unavailable or unable to provide consent for treatment or transport
 - iii. Treatment or transport cannot be safely delayed until consent can be obtained
 - iv. The EMS clinician administers only treatment for emergency conditions that pose an immediate threat to the child
 - v. As a rule, when the EMS clinician's authority to act is in doubt, EMS clinicians should always do what they believe to be in the best interest of the minor
 - vi. If a minor is injured or ill and no parent contact is possible, the EMS clinician may contact medical direction for additional instructions

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914189—General—Refusal of Care

Key Documentation Elements

- Document patient capacity with:
 - All barriers to patient care in the NEMSIS element “eHistory.01—Barriers to Patient Care” (a Required National Element of NEMSIS)
 - Exam fields for “eExam.19—Mental Status” and “eExam.20—Neurological Assessment”
 - Vitals for level of responsiveness and [Glasgow Coma Scale](#)
 - Alcohol and drug use indicator
- Blood glucose level (as appropriate to situation and patient history)
- Patient Age
- Minors who are not emancipated and adults with a legal guardian: guardian name, contact, and relationship
- Any efforts made to contact guardians if contact could not be made
- What the patient’s plan is after refusal of care and/or transport
- Who will be with the patient after EMS departs
- Patient was advised that they can change their mind and EMS can be contacted again at any time
- Patient was advised of possible risks to their health resulting from refusing care and/or transport
- Patient voices understanding of risks. A quotation of the patient’s actual words, stating they understand, is best
- Reason for patient refusing care. A quotation of the patient’s actual words, stating they understand, is best
- Medical direction contact
- Any assessments and treatments performed

Performance Measures

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

References

1. Patient Autonomy and Destination Factors in Emergency Medical Services (EMS) and EMS-Affiliated Mobile Integrated Healthcare/Community Paramedicine Programs. Acep.org. <https://www.acep.org/globalassets/new-pdfs/policy-statements/patient-autonomy-and-destination-factors-in-ems.pdf> Revised October 2015. Accessed

CARDIOVASCULAR



Adult and Pediatric Syncope and Near Syncope

Patient Care Goals

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

Patient Presentation

1. Syncope is heralded by **both** the loss of consciousness and the loss of postural tone and resolves spontaneously without medical interventions. Syncope typically is abrupt in onset and resolves equally quickly. EMS clinicians may find the patient awake and alert on initial evaluation
2. Near syncope is defined as the prodromal symptoms of syncope. The symptoms that can precede syncope last for seconds to minutes with signs and symptoms that may include pallor, sweating, lightheadedness, visual changes, or weakness. It may be described by the patient as “nearly blacking out” or “nearly fainting”
3. Rapid first aid during the onset may improve symptoms and prevent syncope

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:

1. Patients with alternate and obvious cause of loss of consciousness (e.g., trauma—[See Head Injury Guideline](#))
2. Patients with ongoing mental status changes or coma should be treated per the [Altered Mental Status Guideline](#)
3. Patients with persistent new neurologic deficit [See [Suspected Stroke/Transient Ischemic Attack Guideline](#)]

Patient Management

Assessment

1. Pertinent History
 - a. Review the patient’s past medical history including a history of
 - i. Cardiovascular disease (e.g., cardiac disease/stroke, valvular disease, hypertrophic cardiomyopathy, mitral valve prolapse)
 - ii. Seizure
 - iii. Recent trauma
 - iv. Active cancer diagnosis

- v. Dysrhythmias including prior electrophysiology studies/pacemaker and/or implantable cardioverter defibrillator (ICD)
- vi. History of syncope
- vii. History of thrombosis or emboli
- b. History of Present Illness, including:
 - i. Conditions leading to the event: after transition from recumbent/sitting to standing; occurring with strenuous exercise (notably in the young and seemingly healthy)
 - 1. Syncope that occurs during exercise often indicates an ominous cardiac cause. Patients should be evaluated in the emergency department
 - ii. Patient complaints before or after the event including prodromal symptoms
 - iii. History of symptoms described by 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. Current medications (new medications, changes in doses)
 - ii. Fluid losses (nausea/vomiting/diarrhea) and fluid intake
 - iii. Last menstrual period/pregnant
 - iv. Occult blood loss (gastrointestinal (GI)/genitourinary (GU))
 - v. Palpitations
 - vi. Unilateral Leg swelling, history of recent travel, prolonged immobilization, malignancy
- d. Pertinent Physical Exam including:
 - i. Attention to vital signs and evaluation for trauma
 - ii. Note overall patient appearance, diaphoresis, pallor
 - iii. Detailed neurologic exam (including stroke screening and mental status)
 - iv. Heart, lung, abdominal, and extremity exam
 - v. Additional Evaluation:
 - 1. Cardiac Monitoring
 - 2. Oxygen saturation (SPO₂)
 - 3. Ongoing vital signs
 - 4. 12-lead EKG for unexplained syncope
 - 5. Blood glucose level (BGL)

Treatment and Interventions

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

Patient Safety Considerations

1. Patients suffering from syncope due to arrhythmia may experience recurrent arrhythmias and should therefore be placed on a cardiac monitor
2. Geriatric patients suffering falls from standing may sustain significant injury and should be diligently screened for trauma. [\[General Trauma Management Guideline\]](#)

Notes/Educational Pearls

Key Considerations

1. By being most proximate to the scene and to the patient's presentation, EMS clinicians are commonly in a unique position to identify the cause of syncope. Consideration of potential causes, ongoing monitoring of vitals, and cardiac rhythm and detailed exam and history are essential pieces of information to pass on to hospital clinicians
2. For patients where a lower risk etiology is suspected; e.g., vasovagal syncope, decisions regarding delayed, or non-transport should be made in consultation with medical direction if needed
3. High-risk causes of syncope include, but are not limited to, the following:
 - a. Cardiovascular
 - i. Myocardial infarction
 - ii. Aortic stenosis
 - iii. Hypertrophic cardiomyopathy (consider in young patient with unexplained syncope during exertion)
 - iv. Pulmonary embolus
 - v. Aortic dissection
 - vi. Dysrhythmia
 - vii. Mitral valve prolapse is associated with higher risk for sudden death

- b. Neurovascular
 - i. Intracranial hemorrhage
 - ii. Transient ischemic attack or stroke
 - iii. Vertebral basilar insufficiency
- c. Hemorrhagic
 - i. Ruptured ectopic pregnancy
 - ii. GI bleed
 - iii. Aortic rupture
- 4. Consider high-risk 12-lead EKG features including, but not limited to:
 - a. Evidence of QT prolongation (generally over 500 msec)
 - b. Delta waves
 - c. Brugada syndrome (incomplete right bundle branch block (RBBB) pattern in V1/V2 with ST segment elevation)
 - d. Hypertrophic obstructive cardiomyopathy

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914149—Medical—Syncope

Key Documentation Elements

- Presenting cardiac rhythm
- Cardiac rhythm present when patient is symptomatic
- Any cardiac rhythm changes
- Blood pressure
- Pulse
- Blood glucose level (BGL)
- Symptoms immediately preceding event
- Patient status on EMS arrival: recovered or still symptomatic

Performance Measures

- Acquisition of 12-lead EKG
- Application of cardiac monitor
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Stroke—01: Suspected Stroke Receiving Prehospital Stroke Assessment*

References

1. Anderson JB, Willis M, Lancaster H, Leonard K, Thomas C. The evaluation and management of pediatric syncope. *Pediatr Neurol*. 2016; 55:6–13
<https://doi.org/10.1016/j.pediatrneurol.2015.10.018>
2. Benditt DG, Adkisson WO. Approach to the patient with syncope. *Cardiol Clin*. 2013;31(1):9-25
3. Dovgalyuk J, Holstege C, Mattu A, Brady WJ. The electrocardiogram in the patient with syncope. *Am J Emerg Med*. 2007; 25:688–701
4. Fischer J, Choo CS. Pediatric syncope: cases from the emergency department. *Emerg Med Clin North Am*. 2010;28(3):501–16
5. Herbert M, Spangler M, Swadron S, Mason J. Emergency Medicine Reviews and Perspectives (EM:RAP). C3 Continuous Core Content Podcast. *Syncope—Introduction*. November 2016. <https://www.emrap.org/episode/c3syncope/syncope>. Accessed
6. Huff JS, Decker WW, Quinn JV, Perron AD, Napoli AM, Peeters S, et al; American College of Emergency Physicians. Clinical policy: critical issues in the evaluation and management of adult patients presenting to the emergency department with syncope. *Ann Emerg Med*. 2007;49(4):431–44
7. Kessler C, Tristan JM, De Lorenzo R. The emergency department approach to syncope: evidence-based guidelines and prediction rules. *Emerg Med Clin North Am*. 2010;28(3):248-500
8. Khoo C, Chakrabarti S, Arbour L, Krahn AD. Recognizing life-threatening causes of syncope. *Cardiol Clin*. 2013;31(1):51–66
9. Orman R, Mattu A; Emergency Medicine Reviews and Perspectives (EMRAP). Spring Forward into PE. *Cardiology Corner—Syncope*. March 2016
<https://www.emrap.org/episode/springforward/cardiology>. Accessed
10. Ouyang H, Quinn J. Diagnosis and management of syncope in the emergency department. *Emerg Med Clin North Am*. 2010;28(3):471-485

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Chest pain or discomfort in other areas of the body (e.g., arm, jaw, epigastrium) of suspected cardiac origin, shortness of breath, associated or unexplained sweating, nausea, vomiting, or dizziness. Atypical or unusual symptoms are more common in women, the elderly, and diabetic patients. May also present with CHF, syncope, and/or shock
2. Chest pain associated sympathomimetic use (e.g., cocaine, methamphetamine)
3. Some patients will present with likely noncardiac 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 (ASA) and nitrates per the [Pain Management Guideline](#)

Exclusion Criteria

None noted

Patient Management

Assessment, Treatment, and Interventions

1. Signs and symptoms include chest pain, congestive heart failure (CHF), syncope, shock, symptoms similar to a patient's previous MI
2. Assess the patient's cardiac rhythm and immediately address pulseless rhythms, symptomatic tachycardia, or symptomatic bradycardia [See [Cardiovascular Section](#) and [Resuscitation Section](#)]
3. If the patient is dyspneic, hypoxemic, or has obvious signs of heart failure, EMS clinicians should administer oxygen as appropriate with a target of achieving 94–98% saturation [Refer to [Universal Care Guideline](#)]
4. The 12-lead EKG is the primary diagnostic tool that identifies a STEMI; it is imperative that EMS clinicians routinely acquire a 12-lead EKG within 10 minutes for all patients exhibiting signs and symptoms of ACS
 - a. The EKG may be transmitted for remote interpretation by a physician or screened for STEMI by properly trained EMS clinicians or other healthcare providers with or without the assistance of computer-interpretation

- b. Advance notification should be provided to the receiving hospital for patients identified as having a STEMI
 - c. Performance of serial EKGs is encouraged for symptomatic patients with EKGs initially nondiagnostic for STEMI
 - d. All EKGs should be made available to treating personnel at the receiving hospital, whether hand delivered as hard copy or transmitted from the field
- 5. Administer aspirin; chewable, nonenteric-coated aspirin preferred 324 mg
- 6. Establish IV access
- 7. Nitroglycerin 0.4 mg sublingual (SL), can repeat up to three times q (quaque, every) 3-5 minutes if SBP greater than 100 mmHg or MAP is greater than 65
 - a. The use of nitrates should be avoided in any patient who has used a phosphodiesterase inhibitor within the past 48 hours
 - b. Examples include sildenafil (Viagra®, Revatio®), vardenafil (Levitra®, Staxyn®), tadalafil (Cialis®, Adcirca®) which are used for erectile dysfunction and pulmonary hypertension. Also avoid use in patients receiving intravenous epoprostenol (Flolan®) or treprostenil (Remodulin®) which is used for pulmonary hypertension
 - c. Care should always be taken when giving nitroglycerin when the patient's blood pressure is marginal. If used in this setting, the clinician should weigh the risk and benefit of nitrate administration over the administration of an opiate analgesic and be ready to respond to hypotension with fluid bolus or pressor
- 8. If patient is still experiencing pain refractory to nitroglycerin, see pain management guideline. If patient appears to be having relief with administration of nitro, call medical control for additional nitroglycerin administration orders
- 9. If Inferior MI identified on 12 Lead ECG, obtain 12 Lead ECG with V4R (right-sided), if time permits identify R-sided involvement.
- 10. Transport and destination decisions should be based on local resources and system of care
- 11. Early notification to receiving facility of any changes in patient condition or serial EKGs

Patient Safety Considerations

- 1. Observe for signs of clinical deterioration: dysrhythmias, chest pain, shortness of breath, decreased level of consciousness/syncope, or other signs of shock/hypotension
- 2. Perform serial 12-lead EKGs (especially if clinical changes are noted)
- 3. Consider placing defibrillator pads on high-risk patients
- 4. Consider configuring monitor/defibrillator to allow automatic VT/VF alert
- 5. Consider configuring monitor/defibrillator to allow ST-segment trending if available

Notes/Educational Pearls

Key Considerations

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

Ischemic burden time is a risk for morbidity and mortality, EMS can help decrease first medical contact to intervention time/reflow by efficient scripting/training of safely minimizing scene time

Pertinent Assessment Findings

A complete medication list should be obtained from each patient. It is especially important for the treating physician and healthcare providers to be informed if the patient is taking beta-blockers, calcium channel blockers, clonidine, digoxin, blood thinners (anticoagulants), and medications for the treatment of erectile dysfunction or pulmonary hypertension

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914117—Medical—Cardiac Chest Pain
- 9914143—MedicalST-Elevation Myocardial Infarction (STEMI)

Key Documentation Elements

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

Performance Measures

- The time of patient contact by the first medical contact to the time of 12-lead EKG acquisition within 10 minutes
- The time from first diagnostic 12-lead EKG to STEMI notification
- Confirmation patient received ASA (taken prior to EMS arrival, advised by dispatch, given by EMS, or substantiated by other pertinent negatives)

- The time of a STEMI patient's ultimate arrival to a receiving hospital

*The time of EMS notification to the time of activation of a cardiac catheterization laboratory.

*The time of arrival at the percutaneous coronary intervention (PCI) center to the time of cardiac catheterization (door-to-balloon time) or if patient not transported directly to PCI center, the time of arrival at receiving hospital to thrombolytics.

*The time of prehospital 12-lead EKG acquisition to the time of device deployment (formerly EKG-to-balloon time).

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

References

1. Bosson KN, Kaji AH, Niemann JT, et al. The utility of prehospital EKG transmission in a large EMS system. *Prehosp Emerg Care*. 2015;19(4):496–503
2. De Champlain F, Boothroyd LJ, Vadeboncoeur A, et al. Computerized interpretation of the prehospital electrocardiogram: predictive value for ST-segment elevation myocardial infarction and impact on on-scene time. *CJEM*. 2014;16(2):94–105
3. Meine TJ, Roe MT, Chen AY, et al. Association of intravenous morphine use and outcomes in acute coronary syndromes: results from the CRUSADE quality improvement initiative. *Am Heart J*. 2005;149(6):1043–9
4. Mission: Lifeline EMS Recognition. American Heart Association. Heart.org. <https://www.heart.org/en/professional/quality-improvement/mission-lifeline/mission-lifeline-ems-recognition>. Accessed
5. Nam J, Caners K, Bowen JM, O'Reilly D. Systematic review and meta-analysis of the benefits of out-of-hospital 12-lead EKG and advance notification in ST-segment elevation myocardial infarction patients. *Ann Emerg Med*. 2014;64(2):176–86
6. O'Connor RE, Abudulaziz AAS, Brady WJ, et al. Part 9: acute coronary syndromes. *Circulation*. 2015;132(18 Suppl 2):S483–500
7. Robichaud L, Ross D, Proulx M-H, et al. Prehospital Nitroglycerin Safety in Inferior ST Elevation Myocardial Infarction. *Prehospital Emergency Care*. 2016;20(1):76–81. doi:10.3109/10903127.2015.1037480
8. Squire BT, Tamayo-Sarver JH, Rashi P, Koenig W, Niemann JT. Effect of prehospital cardiac catheterization lab activation on door-to-balloon time, mortality, and false-positive activation. *Prehosp Emerg Care*. 2014;18(1):1–8
9. Verbeek PR, Ryan D, Turner L, Craig AM. Serial prehospital 12-lead electrocardiograms increase identification of ST-segment elevation myocardial infarction. *Prehosp Emerg Care*. 2012;16(1):109–14

Bradycardia

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Heart rate less than 60 beats per minute (BPM) with either symptoms (altered mental status (AMS), chest pain (CP), congestive heart failure (CHF), seizure, syncope, shock, pallor, diaphoresis) or evidence of hemodynamic instability
2. The major EKG rhythms classified as bradycardia include:
 - a. Sinus bradycardia
 - b. Second-degree AV block
 - i. Type I-Wenckebach/Mobitz I
 - ii. Type II-Mobitz II
 - c. Third-degree AV block, complete heart block
 - d. Ventricular escape rhythms
3. See additional inclusion criteria for pediatric patients

Exclusion Criteria

None noted

Patient Management

Assessment, Treatment, and Interventions

1. Adult Management

- a. Manage airway as necessary
- b. Administer oxygen as appropriate with a target of achieving 94–98% saturation
- c. Initiate monitoring and perform 12-lead EKG
- d. Establish IV access

- e. Check blood glucose and treat hypoglycemia per the [Hypoglycemia Guideline](#) and [Hyperglycemia Guideline](#)
- f. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue
 - i. Atropine 1 mg IV q 3–5 minutes (maximum total dose of 3 mg)
 - ii. Vasopressor medications (in order of preference)
 - 1. Epinephrine IV drip 0.02–0.2 mcg/kg/min titrated to a MAP greater than 65 mmHg
 - OR**
 - 2. Epinephrine by push dose (dilute boluses): for example, prepare 10 mcg/mL by adding 1 mL of 0.1 mg/mL epinephrine to 9 mL of normal saline, then administer 10–20 mcg boluses (1–2 mL) q 2 minutes titrated to MAP greater than 65 mmHg
 - OR**
 - add 1 ml of 1:10,000 to 100 ml bag of NS and run over 5 minutes.
 - iii. Transcutaneous Pacing—If pacing is performed, consider [Pain Management including Procedural Sedation](#)

2. Pediatric Management

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

- a. For infants and newborns, initiate chest compressions for heart rate less than 60 BPM and signs of poor perfusion (altered mental status, hypoxia, hypotension, weak pulse, delayed capillary refill, and cyanosis)
- b. Manage airway and assist ventilations as necessary with minimally interrupted chest compressions using a compression-to-ventilation ratio 15:2 (30:2 if single clinician is present)
- c. Administer oxygen as appropriate with a target of achieving 94–98% saturation
- d. Initiate monitoring and perform 12-lead EKG
- e. Establish IV access
- f. Check blood glucose and treat hypoglycemia per the [Hypoglycemia Guideline](#)
- g. Consider the following additional therapies if bradycardia and symptoms or hemodynamic instability continue:
 - i. Epinephrine by push dose (dilute boluses). For example, prepare 10 mcg/mL by adding 1 mL of 0.1 mg/mL epinephrine to 9 mL of normal saline, then administer 0.01 mg/kg (0.1 mL/kg) maximum single dose 10 mcg (1 mL) q 3–5 minutes titrated to MAP greater than 65 mmHg
 - ii. Also consider atropine 0.01–0.02 mg/kg IV with minimum dose of 0.1 mg if increased vagal tone or cholinergic drug toxicity to maximum initial dose of 0.5 mg (maximum total dose of 3 mg)
 - iii. Transcutaneous pacing: If pacing is performed, consider sedation or pain control

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

Patient Safety Considerations

If pacing is performed, consider [Pain Management including Procedural Sedation](#).

Notes/Educational Pearls

Key Considerations

1. Observe for signs of decreased end-organ perfusion: chest pain (CP), shortness of breath (SOB), decreased level of consciousness, syncope, or other signs of shock/hypotension
2. Patients who have undergone cardiac transplant will not respond to atropine
3. Consider potential culprit medications including beta-blockers, calcium channel blockers, sodium channel blockers/anti-depressants, digoxin, and clonidine.
 - a. If medication overdose is considered, refer to appropriate guideline in the [Toxins and Environmental Section](#)
4. The differential diagnosis includes the following: myocardial infarction (MI), hypoxia, pacemaker failure, hypothermia, sinus bradycardia, athletes, head injury with increased intracranial pressure (ICP), stroke, spinal cord lesion, sick sinus syndrome, AV blocks, overdose, cholinergic nerve agents
5. Consider hyperkalemia in the patient with wide complex bradycardia
6. Bradycardia should be managed via the least invasive manner possible, escalating care as needed
 - a. Third-degree heart block or the denervated heart (as in cardiac transplant) may not respond to atropine and in these cases, proceed quickly to chronotropic agents (such as epinephrine or dopamine) or transcutaneous pacing
 - b. In cases of impending hemodynamic collapse, proceed directly to transcutaneous pacing.
7. Be aware of acute coronary syndrome as a cause of bradycardia in adult patients
8. When dosing medications for pediatric patients, dose should be weight-based for non-obese patients and based on ideal body weight for obese patients
9. Although dopamine is often recommended for the treatment of symptomatic bradycardia, recent research suggests that patients in cardiogenic or septic shock treated with norepinephrine have a lower mortality rate compared to those treated with dopamine
10. **Caution: Norepinephrine can theoretically cause reflex bradycardia**

Pertinent Assessment Findings

None noted

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914115—Medical—Bradycardia

Key Documentation Elements

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

Performance Measures

- Blood sugar obtained
- Correct medication(s) and dose given for patient condition, age, and weight
- Correct application and use of cardiac pacing
- Use of sedation or pain management with cardiac pacing
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - Hypoglycemia—01: Treatment Administered for Hypoglycemia
 - Pediatrics—03: Documentation of Estimated Weight in Kilograms

References

1. Berg KM, Soar J, Andersen LW, et al. Adult Advanced Life Support: 2020 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science With Treatment Recommendations. *Circulation*. 2020;142(16_suppl_1): S92-S139. doi:10.1161/CIR.0000000000000893
2. Brady W, Swart G, Mao R, Aufderheide TP. The efficacy of atropine in the treatment of hemodynamically unstable bradycardia and atrioventricular block: prehospital and emergency department considerations. *Resuscitation*. 1999;41(1):47–55
3. De Backer D, Biston P, Devriendt J, et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010; 362:779–89
4. De Backer, Daniel et al. “Dopamine versus norepinephrine in the treatment of septic shock: a meta-analysis*.” *Critical care medicine* vol. 40,3 (2012): 725-30. doi:10.1097/CCM.0b013e31823778ee
5. Gottlieb M. Bolus dose of epinephrine for refractory post-arrest hypotension. *CJEM*. 2017; 10:1–5
6. Kleinman ME, Chameides L, Schexnayder SM, et al. Part 14: pediatric advanced life support. *Circulation*. 2010;122(18 Suppl.3): S876-S908
7. Link MS, Berkow PJ, Kudenchuk HR, et. al. Part 7: adult advanced cardiovascular life support. *Circulation*. 2015;132(18 Suppl 2): S444–64
8. Marik, Paul E., Dopamine increases mortality in pediatric septic shock. Current Best Evidence. January 01, 2016; 168:253-256 doi.org/10.1016/j.jpeds.2015.10.073
9. 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
10. Weingart S. Push-dose pressors for immediate blood pressure control. *Clin Exp Emerg Med*. 2015;2(2):131–132
11. Xu, Xudong, Xu, Xianghua and Wu, Yueying. “Norepinephrine was superior in death risk reducing and hemodynamics compared to dopamine in treatment of patients with septic shock” *Pteridines*, 2021;32(1):5-10

Implantable Ventricular Assist Devices

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

Adult patients who do not have a VAD in place

Patient Management

Assessment

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

Treatment and Interventions

1. Manage airway as indicated
2. Cardiac monitoring
3. IV access
4. Acquire 12-lead EKG

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

Notes/Educational Pearls

1. You do not need to disconnect the controller or batteries to:
 - a. Defibrillate or cardiovert
 - b. Acquire a 12-lead EKG
2. Automatic noninvasive cuff blood pressures may be difficult to obtain due to the narrow pulse pressure created by the continuous flow pump
3. Flow through many VAD devices is not pulsatile, and patients may not have a palpable pulse or accurate pulse oximetry
4. The blood pressure, if measurable, may not be an accurate measure of perfusion
5. Ventricular fibrillation, ventricular tachycardia, or asystole/PEA may be the patient's "normal" underlying rhythm. Evaluate clinical condition and provide care in consultation with VAD coordinator

6. The patient's travel bag should always accompany them with back-up controller and spare batteries
7. If feasible, bring the patient's power module, cable, and display module to the hospital
8. All patients should carry a spare pump controller with them
9. The most common cause for VAD alarms is low batteries or battery failures
10. Although automatic noninvasive blood pressure cuffs are often ineffective in measuring systolic and diastolic pressure, if they do obtain a measurement, the MAP is usually accurate
11. Other VAD complications
 - a. Infection
 - b. Stroke/Transient ischemic attack (TIA)
 - c. Bleeding
 - d. Arrhythmias
 - e. Cardiac tamponade
 - f. Congestive heart failure (CHF)
 - g. Aortic insufficiency

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

1. Garg S Ayers CR, Fitzsimmons C, et al. In-hospital cardiopulmonary arrests in patients with left ventricular assist devices. *J Card Fail*. 2014;20(12):899–904
2. Mabvuure NT, Rodrigues JN. External cardiac compression during cardiopulmonary resuscitation with left ventricular assist devices. *Interact Cardiovasc Thorac Surg*. 2014;19(2):286–9
3. Mechem M. Prehospital assessment and management of patients with ventricular-assist devices. *Prehosp Emerg Care*. 2013;17(2):223–9
4. Shinar Z, Bellezzo J, Stahovich M, Cheskes S, Chillcott S, Dembitsky W. Chest compressions may be safe in arresting patients with left ventricular assist devices (LVADs). *Resuscitation*. 2014;85(5):702–4
5. Sepsis: SIRS 4 Criteria, Severe Sepsis Criteria and Treatment Nursing Jobs Exam *The Beginner's Guide to Intensive Care: A Handbook for Junior Doctors and Allied Professionals*. Nurses Notes. 2021. <https://nursingjobsexam.com/sepsis-sirs-criteria-severe-sepsis-criteria/>. Accessed

Tachycardia with a Pulse

Patient Care Goals

1. Maintain adequate oxygenation, ventilation, and perfusion
2. Control ventricular rate
3. Restore regular sinus rhythm in unstable patient
4. Search for underlying cause:
 - a. Medications (caffeine, diet pills, thyroid, and decongestants)
 - b. Drugs (cocaine, amphetamines)
 - c. History of dysrhythmia
 - d. Congestive heart failure (CHF)

Patient Presentation

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

Inclusion Criteria

Heart rate greater than 100 BPM in adults or relative tachycardia in pediatric patients

Exclusion Criteria

Sinus tachycardia

Patient Management

Assessment, Treatments, and Interventions

1. Adult Management

- a. Manage airway as necessary
- b. Administer oxygen as appropriate with a target of achieving 94–98% saturation
- c. Initiate monitoring and perform 12-lead EKG
- d. Establish IV access
- e. Check blood glucose and treat hypoglycemia per the [Hypoglycemia Guideline](#)
- f. Consider the following additional therapies if tachycardia with signs and symptoms or hemodynamic instability continues:
 - i. **Regular Narrow Complex Tachycardia—Stable (SVT)**
 1. Perform vagal maneuvers
 2. Adenosine 6 mg IV (proximal site) followed by 10 mL fluid bolus
 - a. If tachycardia continues, give adenosine 12 mg IV
 - b. A third dose of adenosine, 12 mg IV, can be given

3. Can call medical control for use of Diltiazem 10 mg slowly IV over 2 minutes
 - a. After 15 minutes, if ordered, a second dose of diltiazem IV may be given if ordered
- ii. **Regular Narrow Complex Tachycardia—Unstable**
 1. Deliver a synchronized shock of 100J
 2. For responsive patients, consider [Pain Management Including Procedural Sedation](#)
- iii. **Irregular Narrow Complex Tachycardia—Stable** (atrial fibrillation (A-FIB), atrial flutter, and multifocal atrial tachycardia)
 1. Can call medical control for use of Diltiazem 10 mg slowly IV over 2 minutes,
 - a. After 15 minutes, if ordered, a second dose of diltiazem IV may be given if ordered
- iv. **Irregular Narrow Complex Tachycardia—Unstable**
 1. Deliver a synchronized shock of 100J
- v. For responsive patients, consider [Pain Management including Procedural Sedation](#).
Regular Wide Complex Tachycardia—Stable (ventricular tachycardia, supraventricular tachycardia, atrial fibrillation/flutter with aberrancy, accelerated idioventricular rhythms, and pre-excited tachycardias with accessory pathways)
 1. Amiodarone 150 mg IV over 10 minutes
 - a. May repeat once as needed
 2. Lidocaine 1–1.5 mg/kg IV
 - a. May be repeated at 5-minute intervals for a maximum dose of 3 mg/kg IV
 3. Adenosine 6 mg IV (proximal site) followed by 10 mL fluid bolus
 - a. If monomorphic tachycardia continues, give adenosine 12 mg IV
- vi. **Regular Wide Complex Tachycardia—Unstable**
 1. Deliver a synchronized shock of 100J
 2. For responsive patients, consider [Pain Management including Procedural Sedation](#).
- vii. **Irregular Wide Complex Tachycardia—Stable** (A-FIB with aberrancy, pre-excited A-FIB (i.e., A-FIB using an accessory pathway), multifocal atrial tachycardia (MAT), or polymorphic VT/torsades de pointes)
 1. If torsades, give magnesium 1–2 g IV over 10 minutes
 2. Amiodarone 150 mg IV over 10 minutes
 - a. May repeat once as needed

viii. Irregular Wide Complex Tachycardia—Unstable

1. Deliver a synchronized shock of 100J
2. For responsive patients, consider [Pain Management including Procedural Sedation](#).

2. Pediatric Management

- a. Manage airway as necessary
- b. Administer oxygen as appropriate with a target of achieving 94–98% saturation
- c. Initiate monitoring and perform 12-lead EKG
- d. Establish IV access
- e. Check blood glucose and treat hypoglycemia per the [Hypoglycemia Guideline](#)
- f. Consider the following additional therapies if tachycardia and symptoms or hemodynamic instability continue:
 - i. **Regular Narrow Complex Tachycardia—Stable (SVT)**
 1. Perform vagal maneuvers
 2. Adenosine 0.1 mg/kg (maximum of 6 mg)
 3. If unsuccessful, may repeat with 0.2 mg/kg (maximum of 12 mg)
 - 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 (maximum of 6 mg) for SVT with aberrancy
 2. Otherwise give amiodarone 5 mg/kg IV (maximum of 150 mg) over 10 minutes
 - iv. **Regular, Wide Complex Tachycardia—Unstable**
 1. Synchronized cardioversion 0.5–1.0 J/kg

Notes/Educational Pearls

Consider sedation prior to cardioversion if time and patient presentation allows. See [Pain Management including Procedural Sedation](#).

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. A-FIB rarely requires cardioversion in the field. As it is difficult to ascertain the onset of this rhythm, the risk of stroke needs to be considered prior to cardioversion
 3. A wide-complex irregular rhythm should be considered pre-excited A-FIB; extreme care must be taken in these patients
 - a. Characteristic EKG findings include a short PR interval and, in some cases, a delta wave
 - b. Avoid AV nodal blocking agents such as adenosine, calcium channel blockers, digoxin, and possibly beta-blockers in patients with pre-excitation A-FIB (e.g., Wolff-Parkinson-White Syndrome, Lown-Ganong-Levine Syndrome) because these drugs may cause a paradoxical increase in the ventricular response
 - c. Blocking the AV node in some of these patients may lead to impulses that are transmitted exclusively down the accessory pathway, which can result in ventricular fibrillation
 - d. Amiodarone or procainamide may be used as an alternative.
 4. Amiodarone or procainamide can be used as a rate-controlling agent for patients who are intolerant of or unresponsive to other agents, such as patients with CHF who may not otherwise tolerate diltiazem or metoprolol
 - a. Caution should be exercised in those who are not receiving anticoagulation, as amiodarone can promote cardioversion
 5. Biphasic waveforms have been proven to convert A-FIB at lower energies and higher rates of success than monophasic waveforms
 - a. Strategies include dose escalation (100, 120, 140, 160 joules (J) for biphasic) versus beginning with single high energy/highest success rate for single shock delivered
 6. Studies in infants and children have demonstrated the effectiveness of adenosine for the treatment of hemodynamically stable or unstable SV

Pertinent Assessment Findings

None noted

Patient Safety Considerations

1. Only use one antidysrhythmic at a time.
2. Patients who receive beta-blockers (e.g., metoprolol) with calcium channel blockers (e.g., diltiazem) are at increased risk for hypotension and bradycardia

3. If using cardioversion, consider sedation and pain control
4. With irregular wide complex tachycardia (A-FIB with aberrancy such as Wolff-Parkinson-White and Lown-Ganong Levine), avoid use of AV nodal blocking agents (e.g., adenosine, calcium channel blockers, and beta-blockers)
5. Patients with Wolff–Parkinson–White should be given procainamide prior to amiodarone.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914147—Medical—Supraventricular Tachycardia (including A-FIB)
- 9914151—Medical—Ventricular Tachycardia (with pulse)
- 9914199—Medical—Tachycardia

Key Documentation Elements

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

Performance Measures

- Time to clinical improvement from patient contact
- Blood sugar obtained
- Correct medication(s) and dose given for patient condition, age, and weight
- Correct cardioversion joules delivered given patient weight and/or condition
- Use of sedation for responsive patient
- ***National EMS Quality Alliance (NEMSQA) Performance Measures***
(for additional information, see www.nemsqa.org)
 - *Hypoglycemia—01: Treatment Administered for Hypoglycemia*
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*

References

1. DeSouza IS, Martindale JL, Sinert R. Antidysrhythmic drug therapy for the termination of stable, monomorphic ventricular tachycardia: a systematic review. *Emerg Med J*. 2015;32(2):161–7
2. Fengler BT, Brady WJ, Plautz CU. Atrial fibrillation in the Wolff-Parkinson-White Syndrome: EKG recognition and treatment in the ED. *Am J Emerg Med*. 2007;25(5):576–83
3. Fuster V, Rydén LE, Cannom DS, et al. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation – executive summary. *Rev Port Cardiol*. Apr;26(4):383–446
4. Link MS, Berkow LC, Kudenchuk HR, et al. Part 7: adult advanced cardiovascular life support. *Circulation*. 2015;132(18 Suppl 2):S444–64
5. Long B, Koyfman A. Best clinical practice: emergency medicine management of stable monomorphic ventricular tachycardia. *J Emerg Med*. Epub 2016 Oct 15. 2017;4(15):484-492. doi:10.1016/j.jemermed.2016.09.010.
6. McNamara RL, Tamariz LJ, Segal JB, Bass EB. Management of atrial fibrillation: review of the evidence for the role of pharmacologic therapy, electrical cardioversion, and echocardiography. *Ann Intern Med*. 2003;139(12):1018–33
7. Ortiz M, Martin A, Arribas F, et al. Randomized comparison of intravenous procainamide vs. intravenous amiodarone for the acute treatment of tolerated wide QRS tachycardia: the PROCAMIO study. *Eur Hear J*. 2017;38(17):1329–35
8. Somberg JC, Bailin SJ, Haffajee CI, et al. Intravenous lidocaine versus intravenous amiodarone (in a new aqueous formulation) for incessant ventricular tachycardia. *Am J Cardiol*. 2002;90(8):853–9
9. Wann LS, Curtis AB, January CT, et al. 2011 ACCF/AHA/HRS focused update on the management of patients with atrial fibrillation (updating the 2006 guideline): a report of the American College of Cardiology Foundation/American Heart Association task force on practice guidelines. *Circulation*. 2011; 123:104–23
10. Zimetbaum P, Reynolds MR, Ho KK, et al. Impact of a practice guideline for patients with atrial fibrillation on medical resource utilization and costs. *Am J Cardiol*, 2003;92(6):677–81

Suspected Stroke/Transient Ischemic Attack

Patient Care Goals

1. Detect neurological deficits
2. Determine eligibility for transport to a stroke center
3. Identify patients who have potentially sustained a stroke involving a large vessel occlusion (LVO)

Patient Presentation

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

Inclusion Criteria

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

Exclusion Criteria

1. If glucose less than 60 mg/dL (deciliter), treat per the [Hypoglycemia Guideline](#)
2. If trauma and Glasgow Coma Score (GCS) less than or equal to 13, treat per the [Head Injury Guideline](#) and [General Trauma Management Guideline](#)

Patient Management

Assessment

1. Using the BeFast Stroke Scale, determine the following:
 - a. Loss of balance, dizziness
 - b. Vision changes
 - c. Facial droop, severe headache
 - d. Arm weakness or numbness
 - e. Trouble speaking or confusion
 - f. Symptom onset, LKW
2. Using the VAN Assessment, determine if the patient presents with weakness + 1 or more of the following symptoms to indicate an LVO:
 - a. Vision loss, crossed or uneven eyes, or forced gaze
 - b. Inability to talk or follow commands and/or difficulty finding words for common objects
 - c. Neglect of one side of the body
3. Pertinent historical data includes:
 - a. History—"last known well" and source of that information
 - b. Neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)]

- c. Patient is taking warfarin or any anticoagulant medication
 - d. History of recent trauma
 - e. History of recent seizure
 - f. History of recent surgery
 - g. History of recent hemorrhage (e.g., GI bleed)
4. Evaluate for the presence of stroke mimics including:
 - a. Hypoglycemia
 - b. Seizure
 - c. Sepsis
 - d. Migraine
 - e. Intoxication

Treatment and Interventions

1. Determine “last known well” time
2. Administer oxygen as appropriate with a target of achieving 94–98% saturation
3. If seizure activity present, treat per [Seizures Guideline](#)
4. Check blood glucose level (BGL)
 - a. Treat only if glucose less than 60 mg/dL
5. Acquire 12-lead EKG, if possible
6. Early hospital notification per local stroke plan that should include any suspected large vessel occlusion (LVO) stroke

Patient Safety Considerations

1. Prevent aspiration—elevate head of stretcher 15–30 degrees if systolic BP greater than 100 mmHg
 - a. Maintain head and neck in neutral alignment, without flexing the neck
2. Protect paralyzed limbs from injury

Notes/Educational Pearls

Key Considerations

1. Time of onset of stroke or last known well is critical data for patient treatment
 - a. Positive stroke scale with time of onset or last known well less than 4 1/2 hours may be eligible for thrombolytic agents
 - b. Positive stroke severity scale with time of onset or last known well less than 24 hours may be eligible for mechanical thrombectomy
 - i. Consider transport to hospital capable of mechanical thrombectomy per local stroke plan
2. Do not treat hypertension
3. Place on cardiac monitor

4. **Pediatrics:**

- a. Treatment principles remain the same
- b. Although rare, pediatric patients can have strokes
- c. Stroke scales are not validated for pediatric patients
- d. The EMS crew should call ahead to make sure that the hospital can manage the patient

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914145—Medical—Stroke/TIA

Key Documentation Elements

- “Last known well” must be specific
 - If the patient was last known well prior to bedtime the night before, this is the time to be documented (not time the patient woke up with symptoms present)
- Blood glucose results
- Specific validated stroke scale used and findings
- Time of notification to receiving hospital

Performance Measures

- Documentation of time “last known well”
- Use of validated stroke scale
- Blood glucose level obtained
- Minimize EMS scene time
- Hospital stroke team prearrival alert or activation occurred as early as possible after positive stroke assessment finding
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - **Stroke—01: Suspected Stroke Receiving Prehospital Stroke Assessment**
NOTE: This measure can only be evaluated if EMS documentation can be combined with information provided by the receiving hospital

References

1. Kleindorfer, D, Towfighi, A, et al. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association, *Stroke* 2021;52:e364–e467

GENERAL MEDICAL



Abdominal Pain

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Abdominal pain or discomfort related to a nontraumatic cause

Exclusion Criteria

1. Abdominal pain due to trauma [See [General Trauma Management Guideline](#)]
2. Abdominal pain due to or related to pregnancy [See [OB/GYN Section](#)]

Patient Management

Assessment

1. Perform airway assessment and management per the [Airway Management Guideline](#)
2. Obtain vital signs including pulse, blood pressure, respiratory rate, neurologic status assessment
3. Obtain blood glucose if hyperglycemia is suspected per [Hyperglycemia Guideline](#)
4. Provide evaluation and management of pain per the [Pain Management Guideline](#)
5. Obtain vascular access as necessary to provide analgesia and/or fluid resuscitation
6. Assess for life-threatening causes of abdominal pain, which may include:
 - a. Signs and symptoms of ischemic, necrotic, or perforated bowel
 - i. Severe tenderness
 - ii. Abdominal pain with motion or palpation of the abdomen
 - iii. Fever
 - iv. Bloody stool
 - v. Nausea and vomiting
 - vi. Absence of passage of stool or gas
 - vii. Abdominal distention, with tympany to percussion
 - b. Signs and symptoms of dissecting or ruptured abdominal aortic aneurysm (AAA)
 - i. Unequal femoral or distal lower extremity pulses
 - ii. "Pulsatile" abdominal mass
 - iii. Associated back pain and/or chest pain
 - iv. Known history of abdominal aortic aneurysm

- c. Signs and symptoms of ruptured ectopic pregnancy
 - i. Vaginal bleeding
 - ii. Recently diagnosed pregnancy
 - iii. Recent missed period/menstrual cycle in women of childbearing age
- d. Signs and symptoms of appendicitis
 - i. Focal right lower quadrant tenderness, possibly with rebound and guarding
 - ii. Right lower quadrant tenderness noted during palpation of the left lower quadrant (positive Rovsing's sign)
 - iii. Peri-umbilical or diffuse abdominal tenderness with palpation of the abdomen/pelvis
 - iv. Fever
 - v. Nausea, vomiting
 - vi. Lack of appetite
- e. Signs and symptoms of acute cholecystitis
 - i. Right upper quadrant or epigastric tenderness
 - ii. Fever
 - iii. Nausea and vomiting
 - iv. History of gallstones
- f. Signs and symptoms of pyelonephritis
 - i. Fever
 - ii. Nausea, vomiting
 - iii. Urinary frequency/urgency
 - iv. Dysuria
 - v. Hematuria
 - vi. Back/flank pain
 - vii. Costovertebral angle tenderness to percussion
- 7. Assess for signs of shock
 - a. If shock is present, provide treatment per appropriate [Shock Guideline](#)
- 8. Assess for other non-life-threatening causes of abdominal pain
 - a. Signs and symptoms of kidney stone
 - i. Unilateral flank pain
 - ii. Nausea, vomiting
 - iii. Hematuria

Treatment and Interventions

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

Patient Safety Considerations

Abdominal pain in older adults, patients with bleeding disorders, patients on anticoagulation medications, children less than 2 years old and patients that are immunocompromised may be a harbinger for severe illness.

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914109—Medical—Abdominal Pain

Key Documentation Elements

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

Performance Measures

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

References

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

Abuse and Maltreatment

Definitions

1. **Abuse/Maltreatment:** Any act or series of acts of commission or omission by a caregiver or person in a position of power over the patient that results in harm, potential for harm, or threat of harm to a patient of any age group. EMS clinicians should have a heightened awareness for vulnerable populations which include, but is not limited to, children, elderly, and adults with mental or physical disabilities
2. **Child Abuse/Maltreatment:** Child maltreatment includes any act or series of acts of commission or omission by a parent or other caregiver that results in harm, potential for harm, or threat of harm to a child. An act of commission (child abuse) is the physical, sexual, or emotional maltreatment or neglect of a child or children. An act of omission (child neglect) includes, but is not limited to, failure to provide for the child's needs (e.g., physical, emotional, medical/dental, and educational neglect) and failure to supervise (e.g., inadequate supervision or safety precautions, lack of appropriate car seat use, and exposure to violent or dangerous environments)
3. **Human Trafficking:** When people are abducted or coerced into service (e.g., being forced into servitude without compensation and/or prostitution). Signs may include, but are not limited to, patient with branding/tattoos and environmental clues such as padlocks and/or doorknobs removed on interior doors and intact windows that are boarded up

Patient Care Goals

1. Recognize any act or series of acts of commission or omission by a caregiver or person in a position of power over the patient that results in harm, potential for harm, or threat of harm to a patient
2. Take appropriate steps to protect the safety of the responders as well as bystanders
3. Remove the patient from 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
6. Complete all mandatory reporting requirements per state guidelines

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 and any other vulnerable individuals at the scene into a safe situation
 - e. Not to investigate or intervene beyond the steps above
 - f. Leave further intervention to law enforcement personnel

Inclusion/Exclusion Criteria

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

1. Potential clues to abuse/maltreatment from caregivers or general environment
 - a. Caregiver apathy about patient's current situation
 - b. Caregiver overreaction to questions about situation
 - c. Inconsistent histories from caregivers or bystanders regarding what happened
 - d. Information provided by caregivers or patient that is not consistent with injury patterns
 - e. Injuries not appropriate for patient's age or physical abilities (e.g., infants with injuries usually associated with ambulatory children, elders who have limited mobility with injury mechanisms inconsistent with their capabilities)
 - f. Caregiver not allowing adult patient to speak for themselves, or who appears controlling—pay special attention to patients who cannot communicate due to young age or language and/or cultural barriers
 - g. Inadequate safety precautions or facilities where the patient lives and/or evidence of security measures that appear to confine the patient inappropriately
2. Potential clues to abuse or maltreatment that can be obtained from the patient
 - a. Multiple bruises in various stages of healing
 - b. Age-inappropriate behavior (e.g., adults who are submissive or fearful, children who act in a sexually inappropriate way)
 - c. Pattern burns, bruises, or scars suggestive of specific weaponry used
 - d. Evidence of medical neglect for injuries or infections
 - e. Unexplained trauma to genitourinary systems or frequent infections to this system
 - f. Evidence of malnourishment and/or serious dental problems
3. Have a high index of suspicion for abuse in children presenting with a Brief Resolved Unexplained Event (BRUE) [See [Brief Resolved Unexplained Event \(BRUE\) & Acute Events in Infants Guideline](#)].

Patient Management

Assessment

1. Primary survey and identify any potentially life-threatening issues
2. Document thorough secondary survey to identify clues of for potential abuse/maltreatment:
 - a. Multiple bruises in various stages of healing. A complete skin exam can help identify suggestive findings that would otherwise be missed
 - b. Age-inappropriate behavior (e.g., adults who are submissive or fearful, children who act in a sexually inappropriate way)
 - c. Pattern burns, bruises, or scars suggestive of specific weaponry used
 - d. Evidence of medical neglect for injuries or infections

- e. Unexplained trauma to genitourinary systems or frequent infections to this system
 - f. Evidence of malnourishment and/or serious dental problems
3. Assess physical issues and avoid extensive investigation of the specifics of abuse or maltreatment, but document any statements made spontaneously by patient:
 - a. Avoid asking directed questions of a child

Treatment and Interventions

1. Address life-threatening issues
2. Remove the patient to a safe place even if no medical indication for transport
3. Report concerns about potential abuse/maltreatment to law enforcement immediately, in accordance with state law, including:
 - 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 (including Child Protective Services agencies where appropriate) per mandatory reporting laws

Patient Safety Considerations

1. If no medical emergency exists, the next priority is safe patient disposition/removal from the potentially abusive situation
2. Do not confront suspected perpetrators of abuse/maltreatment. This can create an unsafe situation for EMS and for the patient
3. In situations of parental or religious objections to life-saving medical care when EMS suspects abuse, law enforcement should be notified for assistance

Notes/Educational Pearls

Key Considerations

1. All states have specific mandatory reporting laws that dictate which specific crimes such as suspected abuse or maltreatment must be reported and to whom they must be reported. It is important to be familiar with the specific laws in your state including specifically who must make disclosures, what the thresholds are for disclosures, and to whom the disclosures must be made
2. Clues to abuse or maltreatment can vary depending on the age group of the patient and on the nature of the abuse. Remember that not all abuse or maltreatment involves physical harm. EMS clinicians are often unique in being the only members of the medical team to observe the home environment or injury scene. It is important to realize that the job of EMS is to document their concerns, assess the patient for potentially serious injuries, make sure that their concerns are disclosed to the appropriate legal authorities, and work towards getting the patient into a safe situation. EMS personnel should not take it upon themselves to investigate, interview, or intervene above and beyond those concepts and should leave further intervention to the appropriate law enforcement personnel

3. Abuse and maltreatment can happen to patients of all ages
4. 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
5. 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

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914187—General—Neglect or Abuse Suspected

Key Documentation Elements

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

Performance Measures

None noted

References

1. Blue Campaign. DHS.gov. <https://www.dhs.gov/blue-campaign>. Accessed
2. Child Abuse and Neglect Prevention. CDC.gov. <https://www.cdc.gov/violenceprevention/childabuseandneglect/index.html>. Accessed
3. Christian, Committee on Child Abuse and Neglect. The Evaluation of Suspected Child Physical Abuse. *Pediatrics*. 2015;135(5): e1337-e1354
4. COMMITTEE ON BIOETHICS. Conflicts between religious or spiritual beliefs and pediatric care: informed refusal, exemptions, and public funding. *Pediatrics* 2013; 132:962.
5. Elder Abuse. CDC.gov. <https://www.cdc.gov/violenceprevention/elderabuse/index.html>. Accessed

Agitated or Violent Patient/Behavioral Emergency

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 or violent behavior, are a danger to self or others and in the sole assessment of the EMS clinician require physical and/or pharmacologic restraint to mitigate injury to self or others

Exclusion Criteria

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

Patient Management

Assessment

1. Note medications/substances on scene that may contribute to the agitation, or may be relevant to the treatment of a contributing medical condition
2. Maintain and support airway
3. Note respiratory rate and effort—if possible, monitor pulse oximetry and/or capnography
4. Assess circulatory status:
 - a. Blood pressure (if possible)
 - b. Pulse rate
 - c. Capillary refill
5. Assess mental status
 - a. Check blood glucose (if possible)
6. Obtain temperature (if possible)
7. Assess for evidence of traumatic injuries

Treatment and Interventions

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

2. Pharmacologic management

a. Notes:

- i. Selection of medications for pharmacologic management should be based upon the patient's clinical condition, current medications, and allergies in addition to EMS resources and medical direction
- ii. The medications are annotated to indicate when they are preferred for patients that are particularly high-risk for violence as assessed by a validated scale—note that the dosing can be adjusted to achieve different levels of sedation
- iii. The numbering of medications below is not intended to indicate a hierarchy/preference of administration

b. Dissociative Agents (provides sedation and anesthesia)

i. Ketamine (option for high violence risk)

1. **Adults:**

- a. 2 mg/kg IV; 1 minute onset of action

OR

- b. 4 mg/kg IM, max dose 400 mg; 3–5 minute onset of action

c. Benzodiazepines

i. Midazolam

1. **Adults:**

- a. 2-5 mg IV/IN; 3–5 minute onset of action,

- May repeat 1x after 10 minutes to a max total dose of 10 mg

OR

- b. 5-10 mg IM; 10–15 minute onset of action

- May repeat 1x after 10 minutes to a max total dose of 15 mg

- c. 65 years of age, max initial and total doses are half

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

iii. Diazepam (alternate only, not stocked on truck)

1. **Adults:**

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

OR

- b. 10 mg IM; 15–30 minute onset of action

- d. Antipsychotics
 - i. Haloperidol (alternate only, not stocked on truck)
 - 1. **Adults:**
 - a. 5 mg IV; 5–10 minute onset of action
 - OR**
 - b. 5–10 mg IM; 10–20 minute onset of action
 - e. Antihistamines for dystonic reaction
 - i. Diphenhydramine
 - 1. **Adults:** 25–50 mg IM/IV
 - 2. **Pediatrics:** 1 mg/kg IM/IV/PO (maximum dose of 25 mg)
2. Physical Management Devices
- a. Body
 - i. Stretcher straps should be applied as the standard procedure for all patients during transport
 - ii. Physical management devices, including stretcher straps, should never restrict the patient's chest wall motion
 - iii. If necessary, sheets may be used as improvised supplemental stretcher straps. Other forms of improvised physical management devices should be discouraged
 - iv. Supplemental straps or sheets may be necessary to prevent flexion/extension of torso, hips, legs by being placed around the lower lumbar region, below the buttocks, and over the thighs, knees, and legs
 - b. Extremities
 - i. Soft devices should not require a key to release them
 - ii. Secure all four extremities to maximize safety for patient, staff, and others
 - iii. Secure all extremities to the stationary frame of the stretcher
 - iv. Multiple knots should not be used to secure a device

Patient Safety Considerations

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

- 1. Don PPE
- 2. Do not attempt to enter or control a scene where physical violence or weapons are present
- 3. Dispatch law enforcement immediately to secure and maintain scene safety
- 4. If patient is handcuffed and under arrest during transport, a police officer will ride along in the back of the ambulance

5. Urgent de-escalation of patient agitation is imperative in the interest of patient safety as well as for EMS personnel and others on scene
6. 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. **Delirium with agitated behavior:** A postmortem diagnosis of exclusion for sudden death thought to result from metabolic acidosis (most likely from lactate) stemming from physical agitation or physical control measures and potentially exacerbated by stimulant drugs (e.g., cocaine) or alcohol withdrawal
 - b. **Positional asphyxia:** Sudden death from restriction of chest wall movement and/or obstruction of the airway secondary to restricted head or neck positioning resulting in hypercarbia and/or hypoxia
7. Apply a cardiac monitor as soon as possible, particularly when pharmacologic management medications have been administered
8. All patients who have received pharmacologic management medications must be monitored closely for the development of hypoventilation and oversedation
 - a. Utilize capnography if available
9. Patients who have received antipsychotic medication for pharmacologic management must be monitored closely for the potential development of:
 - a. Dystonic reactions (this can easily be treated with diphenhydramine/benzodiazepines)
 - b. Mydriasis (dilated pupils)
 - c. Ataxia
 - d. Cessation of perspiration
 - e. Dry mucous membranes
 - f. Cardiac arrhythmias (particularly QT prolongation)
10. Patients who require physical management should also receive pharmacological treatment for agitation to prevent consequences of delirium with agitated behavior
11. Placement of stretcher in sitting position prevents aspiration and reduces the patient's physical strength by placing the abdominal muscles in the flexed position
12. Patients who are more physically uncooperative should be physically secured with one arm above the head and the other arm below the waist, and both lower extremities individually secured
13. The following techniques should be expressly **prohibited** for use by EMS clinicians:
 - a. Secure or transport in a prone position with or without hands and feet behind the back (hobbling or "hog-tying")
 - b. "Sandwiching" patients between backboards
 - c. Techniques that constrict the neck or compromise the airway

Notes/Educational Pearls

Key Considerations

1. Direct medical direction should be contacted at any time for advice, especially when patient's level of agitation is such that transport may place all parties at risk
2. Transport by air is not advised
3. Stretchers with adequate foam padding, particularly around the head, facilitates patient's ability to self-position the head and neck to maintain airway patency
4. For patients with key-locking devices, applied by another agency, consider the following options:
 - a. Remove device and replace it with a device that does not require a key
 - b. Administer pharmacologic management medication then remove and replace device with another non-key-locking device after patient has become more cooperative
 - c. Transport patient accompanied in patient compartment by person who has device key
 - d. Transport patient in the vehicle of person who has the device key if medical condition of patient is deemed stable, direct medical direction so authorizes, and law allows

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914053—General—Behavioral/Patient Restraint

Key Documentation Elements

- Etiology of agitated or violent behavior if known
- Patient's medications, other medications or substances found on scene
- Patient's medical history or other historic factors reported by patient, family, or bystanders
- Physical evidence or history of trauma
- Adequate oxygenation by pulse oximetry
- Blood glucose measurement
- Measures taken to establish patient rapport

- Dose, route, and number of doses of pharmacologic management medications administered
- Clinical response to pharmacologic management medications
- Number and physical sites of placement of physical management devices
- Duration of placement of physical management devices
- Repeated assessment of airway patency
- Repeated assessment of respiratory rate, effort, pulse oximetry/capnography
- Repeated assessment of circulatory status with blood pressure, capillary refill, cardiac monitoring
- Repeated assessment of mental status and trends in the level of patient cooperation
- Repeated assessment of capillary refill in patient with extremity securing devices
- Communications with EMS medical direction
- Initiation and duration of engagement with law enforcement

Performance Measures

- Incidence of injuries to patient, EMS personnel, or others on scene
- Incidence of injuries to patient, EMS personnel, or others during transport
- Medical or physical complications (including sudden death) in patients
- Advance informational communication of EMS protocols for the management of agitated and violent patients to others within the emergency care system and law enforcement
- Initiation and engagement with EMS medical direction
- Initiation and duration of engagement with law enforcement
- ***National EMS Quality Alliance (NEMSQA) Performance Measures***
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*

References

1. Adimando AJ, Poncin YB, Baum CR. Pharmacological management of the agitated pediatric patient. *Pediatr Emerg Care*. 2010;26(11):856–60
2. Calver L, Drinkwater V, Gupta R, Page CB, Isbister GK. Droperidol v. haloperidol for sedation of aggressive behavior in acute mental health: randomized controlled trial. *Br J Psychiatry*. 2015;206(3):223–228
3. Calver L, Page CB, Downes MA, et al. The Safety and Effectiveness of Droperidol for Sedation of Acute Behavioral Disturbance in the Emergency Department. *Ann Emerg Med*. 2015;66(3):230–238.e1
4. Calver L, Isbister GK. High dose droperidol and QT prolongation: analysis of continuous 12-lead recordings. *British Journal of Clinical Pharmacology*. 2014;77(5):880–886
5. Drayna PC, Estrada C, Wang W, Saville BR, Arnold DH. Ketamine sedation is not associated with clinically meaningful elevation of intraocular pressure. *Am J Emerg Med*. 2012;30(7):1215–8
6. Ely EW, Truman B, Shintani A, et al. Monitoring sedation status over time in ICU patients: reliability and validity of the Richmond Agitation-Sedation Scale (RASS). *JAMA*. 2003;289(22):2983–91
7. Gerson R, Malas N, Feuer V, Silver GH, Prasad R, Mroczkowski MM. Best Practices for Evaluation and Treatment of Agitated Children and Adolescents (BETA) in the Emergency Department: Consensus Statement of the American Association for Emergency Psychiatry [published correction appears in *West J Emerg Med*. 2019 May;20(3):537] [published correction appears in *West J Emerg Med*. 2019 Jul;20(4):688–689]. *West J Emerg Med*. 2019;20(2):409–418. doi:10.5811/westjem.2019.1.41344
8. Halstead SM, Deakyne SJ, Bajaj L, Enzenauer R, Roosevelt GE. The effect of ketamine on intraocular pressure in pediatric patients during procedural sedation. *Acad Emerg Med*. 2012;19(10):1145–50
9. Ho JD, Smith SW, Nystrom PC, et al. Successful management of excited delirium syndrome with prehospital ketamine: two case examples. *Prehosp Emerg Care*. 2013;17(2): 274–9.
10. Isbister GK, Calver LA, Page CB, Stokes B, Bryant JL, Downes MA. Randomized controlled trial of intramuscular droperidol versus midazolam for violence and acute behavioral disturbance: the DORM study. *Ann Emerg Med*. 2010;56(4):392–401 e1.
11. Kupas DF, Wydro GC. Patient restraint in emergency medical services systems. *Prehosp Emerg Care*. 2002;6(3):340–5
12. Sonnier L, Barzman D. Pharmacologic management of acutely agitated pediatric patients. *Paediatr Drugs*. 2011 1;13(1):1–10
13. Swift RH, Harrigan EP, Cappelleri JC, Kramer D, Chandler LP. Validation of the behavioural activity rating scale (BARS): a novel measure of activity in agitated patients. *J Psychiatr Res*. 2002;36(2):87–95
14. Tsze DS, Steele DW, Machan JT, Akhlaghi F, Linakis JG. Intranasal ketamine for procedural sedation in pediatric laceration repair: a preliminary report. *Pediatr Emerg Care*. 2012;28(8):767–70
15. *White Paper Report on Excited Delirium Syndrome*. ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009

Anaphylaxis and Allergic Reaction

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients of all ages with suspected allergic reaction and/or anaphylaxis

Exclusion Criteria

None noted

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 and symptoms of anaphylaxis
 - a. Anaphylaxis—More severe and is characterized by an acute onset involving:
 - i. The skin (urticaria) and/or mucosa with either respiratory compromise or decreased BP or signs of end-organ dysfunction

OR

 - ii. Hypotension for that patient after exposure to a known allergen
 1. **Adults:** Systolic BP less than 90
 2. **Pediatrics:** See [Appendix V. Abnormal Vital Signs](#)

OR

 - iii. Two or more of the following occurring rapidly after exposure to a likely allergen:
 1. Skin and/or mucosal involvement (urticaria, itchy, swollen tongue/lips)
 - a. Skin involvement may be ABSENT in up to 40% of cases of anaphylaxis
 2. Respiratory compromise (dyspnea, wheezing, stridor, hypoxemia)
 3. Persistent gastrointestinal symptoms (vomiting, abdominal pain, diarrhea)
 4. Hypotension or associated symptoms (syncope, hypotonia, chest tightness, incontinence)
 - b. Nonanaphylactic Allergic Reaction
 - i. Signs involving only **one** organ system (e.g., localized angioedema that does not compromise the airway, or not associated with vomiting; hives alone)

Treatment and Interventions

1. If signs of allergic reaction **without** signs of anaphylaxis, go to [6](#)
2. If signs of anaphylaxis, administer:
 - a. **Adult** (25 kg or more) epinephrine 0.5 mg IM in the anterolateral thigh. If a SD EMT has completed the required training, they may administer 0.3 mg IM in the anterolateral thigh.
 1. **May repeat after 5 minutes**
 2. **After two doses of IM epinephrine, if the patient is still symptomatic, consider an epinephrine IV drip.**

Epinephrine by push dose (dilute boluses): for example, prepare 10 mcg/mL by adding 1 mL of 1:10,000 epinephrine to 9 mL of normal saline, then administer 10–20 mcg boluses (1–2 mL) q 2 minutes titrated to MAP greater than 65 mmHg.

OR

Add 1 mL 1:10,000 Epinephrine to 100 mL bag of NS and run over 5 minutes
 - b. **Pediatric** (less than 25 kg) epinephrine 0.15 mg IM in the anterolateral thigh. If a SD EMT has completed the required training, they may administer 0.15 mg IM in the anterolateral thigh.
 1. **May repeat every five minutes**
 2. **After two doses of IM epinephrine, if the patient is still symptomatic, consider an epinephrine IV drip.**

Add 1 mL 1:10,000 Epinephrine to 100 mL bag of NS and run with 60 gtt set at 30-60 gtt/min
3. If respiratory distress with wheezing is present, consider administering
 - a. Albuterol 2.5-5 mg nebulized
4. Steroids should be administered in the prehospital setting
 - a. Methylprednisolone (2 mg/kg, maximum dose 125 mg) IV/IM
5. 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
6. For urticaria or pruritus, administer a diphenhydramine 50 mg IM, IV for adults and 1 mg/kg, up to maximum dose of 50 mg IM, IV for peds.
 - a. The IV route is preferred for the patient in severe symptoms
7. Transport as soon as possible, and perform ongoing assessment as indicated. Cardiac monitoring is not required, but should be considered for those with known heart problems or who received multiple doses of epinephrine.

Patient Safety Considerations

1. Time to epinephrine delivery
2. Concentration of epinephrine in relation to route
3. Weight-based dosing of medications

Notes/Educational Pearls

Key Considerations

1. When anaphylaxis is suspected, **EMS personnel should always consider epinephrine as first line treatment**
2. Allergic reactions and anaphylaxis are serious and potentially life-threatening medical emergencies. It is the body's adverse reaction to a foreign protein (e.g., food, medicine, pollen, insect sting or any ingested, inhaled, or injected substance). A localized allergic reaction (e.g., urticaria or angioedema that does not compromise the airway) may be treated with antihistamine therapy. 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
3. 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
4. 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 (AMS)
 - c. Other Considerations
 - i. Angioedema (drug-induced)
 - ii. Aspiration/airway obstruction
 - iii. Vasovagal event
 - iv. Asthma or chronic obstructive pulmonary disease (COPD)
 - v. Heart failure

5. Gastrointestinal symptoms occur most commonly in food-induced anaphylaxis, but can occur with other causes
 - a. Oral pruritus is often the first symptom observed in patients experiencing food-induced anaphylaxis
 - b. Abdominal cramping is also common, but nausea, vomiting, and diarrhea are frequently observed as well
6. Patients with asthma are at high-risk for a severe allergic reaction
7. There is no proven benefit to using steroids in the management of allergic reactions and/or anaphylaxis
8. There is controversy among experts with very low-quality evidence to guide management for the use of empiric IM epinephrine after exposure to a known allergen in asymptomatic patients with a history of prior anaphylaxis

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914111—Medical—Allergic Reaction/Anaphylaxis

Key Documentation Elements

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

Performance Measures

- Percentage of patients with anaphylaxis that receive epinephrine for anaphylaxis:
 - Via the IM route (vs. other routes)
 - Via the IM route in the anterolateral thigh (vs. other locations)
- Percentage of patients with anaphylaxis who receive:
 - Epinephrine within 10 minutes of arrival
 - The appropriate weight-based dose of epinephrine

- Percentage of patients that require airway management in the prehospital setting (and/or the emergency department)
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*

References

1. Banerji, A, Rudders SA, Corel B, Garth AP, Clark S, Camargo, CA Jr. Predictors of hospital admission for food-related allergic reactions that present to the emergency department. *Ann Allergy Asthma Immunol.* 2011;106(1):42–8
2. Breuer C, Wachall B, Gerbeth K, Abdel-Tawab M, Fuhr U. Pharmacokinetics, and pharmacodynamics of moist inhalation epinephrine using a mobile inhaler. *Eur J Clin Pharmacol.* 2013;69(6):303–10
3. Capps JA, Sharma V, Arkwright, PD. Prevalence, outcome, and prehospital management of anaphylaxis by first aiders and paramedical ambulance staff in Manchester, UK. *Resuscitation.* 2010;81(6):653–7
4. Dahlof C, Mellstrand T, Svedmyr N. Systemic absorption of adrenaline after aerosol, eye-drop and subcutaneous administration to healthy volunteers. *Allergy.* 1987;42(3):215–21
5. Hauswald M. Can paramedics safely decide which patients do not need ambulance transport or emergency department care? *Prehosp Emerg Care.* 2002;6(4):383–6
6. Heilborn H, Hjemdahl P, Daleskog M, Adamsson U. Comparison of subcutaneous injection and high-dose inhalation of epinephrine—implications for self-treatment to prevent anaphylaxis. *J Allergy Clin Immunol.* 1986;78(6):1174–9
7. Hompes S, Köhli A, Nemat K, et al. Provoking allergens and treatment of anaphylaxis in children and adolescents – data from the anaphylaxis registry of German-speaking countries. *Pediatr Allergy Immunol.* 2011;22(6):568–74
8. Huang F, Chawla K, Jarvinen KM, Nowak-Wegrzyn A. Anaphylaxis in a New York City pediatric emergency department: Triggers, treatments, and outcomes. *J Allergy Clin Immunol.* 2012;129(1):162–168.e1–3
9. Iribarren C, Tolstykh IV, Miller MK, Eisner, MD. Asthma and the prospective risk of anaphylactic shock and other allergy diagnoses in a large integrated health care delivery system. *Ann Allergy Asthma Immunol.* 2010;104(5):371–7
10. Kanwar M, Irvin CB, Frank JJ, Weber K, Rosman H. Confusion about epinephrine dosing leading to iatrogenic overdose: a life-threatening problem with a potential solution. *Ann Emerg Med.* 2010;55(4):341–4
11. Lieberman P, Nicklas RA, Randolph C, et al. Anaphylaxis-a practice parameter update 2015. *Ann Allergy Asthma Immunol.* 2015;115(5):341–84
12. Pointer JE, Levitt MA, Young JC, Promes SB, Messana BJ, Ader ME. Can paramedics using guidelines accurately triage patients? *Ann Emerg Med.* 2011;38(3):268–77
13. Rea TD, Edwards C, Murray JA, Cloyd DJ, Eisenberg, MS. Epinephrine use by emergency medical technicians for presumed anaphylaxis. *Prehosp Emerg Care.* 2004;8(4):405–10

14. Runge JW, Martinez JC, Caravati EM, Williamson SG, Hartsell, SC. Histamine antagonists in the treatment of acute allergic reactions. *Ann Emerg Med.* 1992;21(3):237–42
15. Sampson HA. Anaphylaxis and emergency treatment. *Pediatrics.* 2003;111(6 Pt 3):1601–8
16. Sampson HA, Munoz–Furlong A, Campbell RL, et al. Second symposium on the definition and management of anaphylaxis: summary report—Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network Symposium. *J Allergy Clin Immunol.* 2004;117(2):391–7
17. Sheikh A, Shehata YA, Brown SG, Simons FE. Adrenaline (epinephrine) for the treatment of anaphylaxis with and without shock. *Cochrane Database Syst Rev.* (4) 2008 CD006312
18. Sheikh A, Simons FE, Barbour V, Worth A. Adrenaline auto-injectors for the treatment of anaphylaxis with and without cardiovascular collapse in the community. *Cochrane Database Syst Rev.* 2012 Aug 15;(8):CD008935
19. Sheikh A, ten Broek V, Brown SG, Simons FE. H1-antihistamines for the treatment of anaphylaxis with and without shock. *Cochrane Database Syst Rev.* 2007 Jan 24;(1):CD006160
20. Silvestri S, Rothrock SG, Kennedy D, Ladde J, Bryant M, Pagane J. Can paramedics accurately identify patients who do not require emergency department care? *Prehosp Emerg Care.* 2002;6(4):387–90
21. Simons FE, Chan ES, Gu X, Simons KJ. Epinephrine for the out-of-hospital (first aid) treatment of anaphylaxis in infants: is the ampule/syringe/needle method practical? *J Allergy Clin Immunol.* 2001;108(6):1040–4
22. Simons FE, Gu X, Johnston, LM, Simons KJ. Can epinephrine inhalations be substituted for epinephrine injection in children at risk for systemic anaphylaxis? *Pediatrics.* 2000;106(5):1040–4
23. Simons FE, Roberts JR, Gu X, Simons KJ. Epinephrine absorption in children with a history of anaphylaxis. *J Allergy Clin Immunol.* 1998;101(1 Pt 1):33–7
24. Taillac PP, Brown L, Lubogo N, Nichols J, Shah MI. An evidence-based guideline for pediatric prehospital allergic reaction management using GRADE methodology. Manuscript in preparation
25. Watson NT, Weiss EL, Harter PM. Famotidine in the treatment of acute urticaria. *Clin Exp Dermatol.* 2000;25(3):186–9
26. Yavuz ST, Sahiner UM, Buyuktiryaki B, et al. Clinical features of children with venom allergy and risk factors for severe systemic reactions. *Int Arch Allergy Immunol.* 2013;160(3):313–21

Altered Mental Status

Patient Care Goals

1. Identify treatable causes
2. Perform appropriate assessment and diagnostics (e.g., oxygen saturation, glucose check, monitor)
3. Protect patient from complications of altered mental status (e.g., respiratory failure, shock, cardiopulmonary arrest)

Patient Presentation

Inclusion Criteria

Impaired decision-making capacity

Exclusion Criteria

Traumatic brain injury

Patient Management

Assessment

Look for treatable causes of altered mental status (AMS):

1. Airway: Make sure airway remains patent; reposition patient as needed
2. Breathing: Look for respiratory depression; check SPO₂, EtCO₂, and CO detector readings
3. Circulation: Look for signs of poor perfusion
4. Glasgow Coma Score and/or AVPU
5. Pupils
6. Head and neck: Evaluate for signs of trauma
7. Neck: Rigidity or pain with range of motion
8. Stroke assessment tool including focal neurologic findings
9. Blood glucose level
10. EKG or cardiac monitor: arrhythmia limiting perfusion
11. Breath odor: Possible unusual odors include alcohol, acidosis, ammonia
12. Chest/Abdominal: Intra-thoracic hardware, assist devices, abdominal pain or distention, signs of trauma
13. Extremities/skin: Track marks, hydration, edema, dialysis shunt, temperature to touch (or if able, use a thermometer), and signs of trauma
14. Signs of infection: Fever, cough, skin changes, and dysuria
15. Environment: Survey for pills, paraphernalia, substance use, medication patches, medical devices, ambient temperature, social indicators of neglect, carbon monoxide exposures, multiple casualties with same complaint

Treatment and Interventions

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

Patient Safety Considerations

1. With depressed mental status, initial focus is on airway protection, oxygenation, ventilation, and perfusion
2. The violent patient may need pharmacologic and/or physical management to insure proper assessment and treatment
3. Hypoglycemic and hypoxic patients can be irritable and violent [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]

Notes/Educational Pearls

Key Considerations

1. History from bystanders and caregivers
2. Age of the patient
3. Development age and baseline functional status
4. Consider the following differential using the mnemonic **AEIOU-TIPS**:

A—Alcohol, **A**buse, **A**typical migraine

E—Epilepsy, **E**lectrolytes

I—Insulin (hypoglycemia)

O—Oxygen, **O**verdose

U—Uremia (kidney failure)

T—Trauma, **T**umor

I—Infection

P—Psych, **P**oisoning

S—Seizure, **S**ubarachnoid hemorrhage, **S**epsis

5. Environment where patient found
6. Recent complaints (e.g., headache, chest pain, difficulty breathing, vomiting, fever)
7. Medical alert tags and accessory medical devices
8. Evaluate for reduced PO intake and/or vomiting and/or diarrhea or dehydration as a cause of AMS in the pediatric and geriatric populations
9. Evidence of ingestion or topical placement (e.g., pill bottles/medications, patches, detergent pods)
10. Medications a child may have access to including but not limited to (includes patches, drops, pills, injectables):
 - a. Analgesics
 - b. Antidepressants
 - c. Antihypertensives/Cardiac medications
 - d. Oral hypoglycemic
 - e. Opioids
 - f. Benzodiazepines
 - g. Antiepileptics
 - h. Prenatal vitamins
11. Substance use in the home (e.g., tobacco, marijuana, cocaine, amphetamines, PCP, and alcohol)
12. Use of herbal or holistic medications

Pertinent Assessment Findings

1. Track marks
2. Breath odor
3. Skin temperature
4. Rash and/or petechiae
5. Evidence of trauma
6. Focal neurologic changes
7. Location

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914113—Medical—Altered Mental Status

Key Documentation Elements

- Glasgow Coma Score (GCS) or AVPU description
- Baseline developmental status and change from baseline
- Temperature was taken when able
- Patient and medic safety were considered
- Pupil and neck exam were done
- Evaluation of perfusion and skin exam were performed
- IV fluids given for poor perfusion

Performance Measure

- Hypoglycemia considered and treated appropriately
 - Blood glucose level obtained
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Hypoglycemia—01: Treatment Administered for Hypoglycemia*
- Sepsis considered as a possible cause of hypotension
- Hypotension appropriately treated
- Naloxone is used as therapeutic intervention, not a diagnostic tool
- CO detector is used when available

References

1. Frisch A, Miller T, Haag A, Martin-Gill C, Guyette FX, Suffoletto BP. Diagnostic accuracy of a rapid checklist to identify delirium in older patients transported by EMS. *Prehosp Emerg Care*, 2013 Apr-Jun; 17(2): 230–4
2. Kumar A, Roberts D et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med*, 2006 Jun; 34(6): 1,589–96
3. Leong LB, Jian KH, Vasu A, Seow E. Prospective study of patients with altered mental status: clinical features and outcome. *Int J Emerg Med*, 2008 Sep; 1(3): 179–82
4. Sanello A, Gausche-Hill M, Mulkerin W, Sporer KA, Brown JF, Koenig KL, Rudnick EM, Salvucci AA, Gilbert GH. Altered mental status: Current evidenced-based guidelines for prehospital care. *West J Emerg Med* 2018;19(3):527–541
5. Thomas AA, Mazor S. Unintentional marijuana exposure presenting as altered mental status in the pediatric emergency department: A case series. *J Emerg Med*. 2017 Dec;53(6): e119–e123. Pediatric Education for Prehospital Professionals, Fourth Edition; <https://www.peppsite.com>. Accessed

Back Pain

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Back pain or discomfort related to a nontraumatic cause

Exclusion Criteria

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

Patient Management

Assessment

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

- v. Hematuria
 - vi. Abdominal pain
 - vii. Costovertebral angle tenderness to percussion
- 6. Assess for signs of shock. If shock is present, provide treatment per appropriate [Shock Guideline](#)
- 7. Assess for other non-life-threatening causes of back pain
 - a. Kidney stone
 - i. Unilateral flank pain
 - ii. Nausea, vomiting
 - iii. Possible hematuria
 - iv. History of kidney stones

Treatment and Interventions

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

Patient Safety Considerations

None noted

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914051—General—Back Pain

Key Documentation Elements

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

Performance Measures

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

References

None noted

End-of-Life Care/Hospice Care

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients enrolled in hospice or end-of-life care, or who have advance care directives, experiencing complaints related to the illness for which the patient is receiving those services

Exclusion Criteria

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

Patient Management

Assessment, Treatment, and Interventions

1. Perform general patient management
2. Engage with the patient's hospice or end-of-life care team or their primary care physician if possible. If not a viable option, may contact medical direction if needed
3. If the patient can communicate and has the capacity to make decisions regarding treatment and transport, consult directly with the patient before treatment and/or transport
4. If the patient lacks the capacity to make decisions regarding treatment and/or transport, identify any advanced care planning in place for information relating to advanced care planning and consent for treatment
 - a. Advance directives
 - b. Medical/Physician Order for Life-Sustaining Treatment (MOLST/POLST) or similar directing forms
 - c. Comfort One
 - d. Guardian, power of attorney, or other accepted healthcare proxy
5. If the patient requires pain relief [See [Pain Management Guideline](#)]
 - a. Opioid medications are frequently the most appropriate choices for pain management
 - b. Multimodal analgesia may be required for pain relief
 - c. Do not withhold opioids for fear of respiratory depression as patient comfort is the primary goal for hospice and end-of-life care

6. If the patient is experiencing severe respiratory distress, consider:
 - a. Oxygen and bedside/handheld fan
 - b. Noninvasive ventilation (CPAP) if aligned with patient care goals
7. If the patient has nausea [See [Nausea-Vomiting Guideline](#)]
8. If the patient has excessive secretions or aspiration, provide suctioning
9. If the patient is anxious or has delirium, in addition to nonpharmacologic interventions such as creating a quiet environment, frequent reassurance, touch and verbal orientation, consider:
 - a. Lorazepam
 - i. Adults: 1-2 mg IV
 - ii. Pediatrics: 0.1 mg/kg IV, max dose of 2 mg.
 - b. Versed
 - i. Adult: 2-5 mg IV/IN
 - ii. Pediatrics: 0.2 mg/kg IV/IN, max dose of 5 mg.
10. In collaboration with hospice or end-of-life care clinician, coordinate with guardian, power of attorney, or other accepted healthcare proxy if non-transport is considered

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- Interaction with hospice or end-of-life care clinician
- Confirmation of advanced directive or other advanced care documentation
- Pain score if applicable

Performance Measures

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

References

1. Coyne PJ, Viswanathan R, Smith TJ. Nebulized fentanyl citrate improves patients' perception of breathing, respiratory rate, and oxygen saturation in dyspnea. *J Pain Symptom Manage*. 2002;23(2):157–60
2. Farahmand S, Shiralizadeh S, Talebian MT, et al. Nebulized fentanyl vs intravenous morphine for ED patients with acute limb pain: a randomized clinical trial. *Am J Emerg Med*. 2014;32(9):1011– 5
3. Portenoy RK, Mehta Z, Ahmed E. Cancer pain management with opioids: Optimizing analgesia. Post TW, ed. UpToDate. Waltham, MA: UpToDate Inc. <https://www.uptodate.com/contents/cancer-pain-management-with-opioids-optimizing-analgesia..> Accessed
4. Prehospital Evidence Based Practice Program (PEP) [Internet]. Halifax, Nova Scotia: Dalhousie University—Division of Emergency Medical Services <https://emspep.cdha.nshealth.ca>. Accessed
5. Shirk MB, Donahue KR, Shirvai J. Unlabeled uses of nebulized medications. *Am J Health Syst Pharm*. 2006;63(18):1704–16

Hyperglycemia

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

Patient in cardiac arrest

Patient Management

Assessment

1. Monitoring:
 - a. Check blood glucose level
2. Secondary survey pertinent to altered blood glucose level:
 - a. Constitutional: assess for tachycardia, hypotension, and tachypnea
 - b. Eyes: assess for sunken eyes from dehydration
 - c. Nose/mouth/ears: assess for dry mucous membranes or tongue bite from seizure
 - d. Abdominal pain including nausea and vomiting especially in children
 - e. Neurologic
 - i. Assess Glasgow Coma Score (GCS) and mental status
 - ii. Assess for focal neurologic deficit: motor and sensory
3. Evaluate for possible concomitant sepsis and septic shock [See [Shock Guideline](#)]
4. Obtain 12-lead EKG to assess for findings consistent with hyperkalemia or acute coronary syndrome

Treatment and Interventions

1. If altered level of consciousness, stroke, or sepsis/septic shock, treat per [Altered Mental Status Guideline](#), [Suspected Stroke/Transient Ischemic Attack Guideline](#), or [Shock Guideline](#) accordingly
2. If glucose greater than 250 mg/dL with symptoms of dehydration, vomiting, abdominal pain, or altered level of consciousness
 - a. Provide volume expansion with normal saline bolus
 - i. **Adult:** Normal saline 500 mL if symptoms of hypovolemic shock, follow [Shock Guideline](#). May repeat as time allows
 - ii. **Pediatric:** Normal saline 10 mL/kg bolus IV, reassess, and repeat up to 40 mL/kg total; if symptoms of hypovolemic shock, follow [Shock Guideline](#).
3. If findings of hyperkalemia are present, administer IV fluids and consider administration of:
 - a. Calcium chloride: 1 gm IV/IO over 5 minutes, ensure IV patency and do not exceed 1 mL per minute
4. If findings of hyperkalemia, consider administration of sodium bicarbonate 1 mEq/kg (max dose of 50 mEq) IV bolus over 5 minutes and consider albuterol 5 mg via nebulizer (can be repeated if no response is seen) to the two places in the document where the administration of albuterol is suggested for the treatment of hyperkalemia
5. Reassess patient
 - a. Reassess vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment), mental status, and signs of dehydration
 - b. If mental status changes, reassess blood glucose level and provide appropriate treatment if hypoglycemia has developed
6. Disposition
 - a. Transport to closest appropriate receiving facility

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914121—Medical—Hyperglycemia

Key Documentation Elements

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

Performance Measures

- When in scope of practice, point of care blood glucose checked for all patients with symptoms of altered level of consciousness, seizure, stroke, or hyperglycemia
- When hyperglycemia documented, appropriate volume replacement given while avoiding overzealous repletion before insulin therapy at receiving center
- 12-lead EKG obtained
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - o **Pediatrics—03: Documentation of Estimated Weight in Kilograms**

References

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

Hypoglycemia

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Patients with blood glucose less than 60 mg/dL with symptoms of hypoglycemia
2. Patients with altered level of consciousness [See [Altered Mental Status Guideline](#)]
3. Patients with stroke symptoms (e.g., hemiparesis, dysarthria) [See [Suspected Stroke/Transient Ischemic Attack Guideline](#)]
4. Patients with seizure [See [Seizures Guideline](#)]
5. Patients with history of diabetes and other medical symptoms
6. Patients with suspected alcohol ingestion
7. Patients with metabolic disorders (glycogen storage disease, fatty oxidation or organic acid disorders, maple syrup urine disease)
8. Patients who appear to be intoxicated

Exclusion Criteria

Patient in cardiac arrest

Patient with normal mental status in absence of inclusion criteria listed above

Patient Management

Assessment

1. Monitoring:
 - a. Check blood glucose level
2. Secondary survey pertinent to altered blood glucose level:
 - a. Evaluate for presence of an automated external insulin delivery device (insulin pump)
 - b. Constitutional: assess for tachycardia and hypotension
 - c. Eyes: assess for sunken eyes from dehydration
 - d. Nose/mouth/ears: assess for dry mucous membranes or tongue bite from seizure
 - e. Neurologic:
 - i. Assess GCS and mental status
 - ii. Assess for focal neurologic deficit: motor and sensory

Treatment and Interventions

1. If altered level of consciousness or stroke, treat per [Altered Mental Status Guideline](#) or [Suspected Stroke/Transient Ischemic Attack Guideline](#) accordingly
2. If blood glucose is 60 mg/dL or less administer one of the following:
 - a. Conscious patient with a patent airway:
 - i. Glucose, oral (in form of glucose tablets, glucose gel, tube of cake icing, etc.)
 1. **Adult** Dosing: 15 g
 2. **Pediatric** Dosing: 15 g
 - b. Unconscious patient, or patients who are unable to protect their own airway:
 - i. Dextrose IV—administer in incremental doses until mental status improves or maximum field dosing is reached (if available, D10% is preferred)
 1. Maximum field **adult** dosing: 25 g of 10–50% dextrose IV
 - a. 250 mL of 10% dextrose
 - b. 500 mL of 5% dextrose
 2. For Peds use D5 or refer to the dose chart within the pearls
 - ii. Remove or disable insulin pump if above treatments cannot be completed
 - c. For patients with an insulin pump who are hypoglycemic with associated altered mental status (GCS <15)
 - i. Stop the pump, disconnect, or remove at insertion site if patient cannot ingest oral glucose or ALS is not available
 - ii. Leave the pump connected and running if able to ingest oral glucose or receive ALS interventions
3. Reassess patient
 - a. Reassess vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) and mental status
 - b. Repeat check of blood glucose level if previous hypoglycemia and mental status has not returned to normal
 - i. It is not necessary to repeat check of blood glucose level blood sugar if mental status has returned to normal
 - c. If maximal field dosage of dextrose solution does not achieve euglycemia and normalization of mental status:
 - i. Initiate transport to closest appropriate receiving facility for further treatment of refractory hypoglycemia
 - ii. Evaluate for alternative causes of altered mental status
 - iii. Continue treatment of hypoglycemia using dextrose solutions as noted above
4. Disposition
 - d. If hypoglycemia with continued symptoms, transport to closest appropriate receiving facility
 - e. Hypoglycemic patients who have had a seizure should be transported to the hospital regardless of their mental status and response to therapy

Key Considerations

1. Using 10% dextrose is as effective and safer than other stronger concentrations
2. Consider contribution of oral diabetic medications to hypoglycemia
3. If possible, have family/patient turn off insulin pump
4. Consider potential for intentional overdose of hypoglycemic agents
5. Avoid overshoot hyperglycemia when correcting hypoglycemia. Administer dextrose-containing IV fluids in small doses until either mental status improves or a maximum field dose is achieved

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01) *(for additional information, go to www.nemsis.org)*

- 9914125—Medical—Hypoglycemia/Diabetic Emergency

Key Documentation Elements

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

Performance Measures

- When in scope of practice, blood glucose is checked for all patients with symptoms of altered level of consciousness, seizure, stroke, or hypoglycemia
- If patient released at scene, criteria documented for safe release
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - Hypoglycemia—01: Treatment Administered for Hypoglycemia
 - Pediatrics—03: Documentation of Estimated Weight in Kilograms

References

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

Nausea/Vomiting

Patient Care Goals

Identify hypoglycemia or hyperglycemia
Prevent dehydration

Patient Presentation

Inclusion Criteria

Currently nauseated and/or vomiting

Exclusion Criteria

None noted

Patient Management

Assessment

1. Routine patient care (e.g., vital signs)
2. History and physical examination focused on potential causes of nausea and vomiting (e.g., gastrointestinal, cardiovascular, obstetric, gynecologic, hypoglycemia, hyperglycemia, neurologic, oncologic, psychogenic, or toxidrome) as well as medications that may prolong the QT interval
3. Obtain glucose level

Treatment and Interventions

1. Antiemetic medication administration
 - a. Isopropyl alcohol: Allow patient to inhale vapor from isopropyl alcohol wipe 3 times q (quaque, every) 15 minutes as tolerated
 - b. Ondansetron (contraindicated for suspected or known diagnosis of prolonged QT syndrome)
 - i. **Adult:**
 1. 4 mg IV**OR**
 2. 4 or 8 mg SL of the ODT formulation
 - ii. **Pediatric** (6 months–14 years old):
 1. 0.15 mg/kg IV (maximum dose of 4 mg)**OR**
 2. 2 mg SL for ages 1–5 years old; age 4 and older use 4 mg of the ODT formulation
 - c. Dystonic and extrapyramidal symptoms are possible side effects of antiemetics. If encountered, consider diphenhydramine.
 - i. **Adult:** 25–50 mg IV/IM/PO
 - ii. **Pediatric:** 1 mg/kg IV/IM/PO (maximum dose 50 mg)

Patient Safety Considerations

1. Ondansetron should not be administered to patients who have a prolonged QT interval as it can cause torsades
2. For very young pediatric patients, ondansetron can be sedating
3. Medications that prolong the QT interval may alter treatment options

Notes/Educational Pearls

Key Considerations

1. Ondansetron is preferred in children for the treatment of nausea and vomiting
2. IV form of ondansetron may be given PO in same dose
3. 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)
4. While ondansetron has not been adequately studied in pregnancy to determine safety, women should be counseled regarding the available data. In the first trimester of pregnancy, the administration of ondansetron not indicated

Pertinent Assessment Findings

1. Vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment)
2. Risk factors for heart disease/EKG if applicable
3. Pregnancy status
4. Abdominal exam
5. Blood glucose levels

Quality Improvement

Associated NEMIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914131—Medical—Nausea/Vomiting

Key Documentation Elements

- Patient age
- Patient weight and/or length-based weight measure for pediatric patients
- Medications given, including time, clinician level, dose, dose units, route, response, and complications
- Vital signs before and after medication administration
- History and physical regarding etiology of nausea/vomiting
- EKG performed and interpretation documented if cardiac risk factors are present

Performance Measures

- In patients with nausea and vomiting, appropriate medication(s) was/were administered (including proper dosage) and the patient's response to treatment is documented
- Any event where complications occurred, such as a dystonic reaction, should have event and appropriate responsive interventions performed and documented
- **EMS® NEMSQA Measure** (for additional information, see www.nemsqa.org)
 - o *Pediatrics—03: Documentation of Estimated Weight in Kilograms*

References

1. ACOG Practice Bulletin No. 189: Nausea and Vomiting of Pregnancy. Committee on Practice Bulletins-Obstetrics. *Obstet Gynecol*. 2018;131(1): e15
2. Beadle KL, Helbling AR, Love SL, April MD, Hunter CJ. Isopropyl alcohol nasal inhalation for nausea in the emergency department: a randomized controlled trial. *Ann Emerg Med*. 2016;68(1):1–9
3. Colletti J, Brown KM, Sharieff GQ, Barata IA, Ishimine P; ACEP Pediatric Emergency Medicine Committee. The management of children with gastroenteritis and dehydration in the emergency department. *J Emerg Med*. 2010;38(5):686–98
4. Kenneday D. Ondansetron and pregnancy: understanding the data. *Obstet Med*. 2016;9(1):28–33
5. *Nausea and Vomiting of Pregnancy*. The American College of Obstetricians and Gynecologists; September 2015. Practice Bulletin Number 153
6. Niño-Serna LF, Acosta-Reyes J, Veroniki A, et al. Antiemetics in Children with Acute Gastroenteritis: A Meta-analysis. *Pediatrics*. 2020;145(4): e20193260
7. Patanwala A, Amini R, Hays DP, Rosen P. Antiemetic therapy for nausea and vomiting in the emergency department. *J Emerg Med*. 2010;39(3):330–6
8. Salvucci AA, Squire B, Burdick M, Luoto M, Brazzel D, Vaezazizi R. Ondansetron is safe and effective for prehospital treatment of nausea and vomiting by paramedics. *Prehosp Emerg Care*. 2011;15(1):34–8
9. Warden CR, Moreno R, Daya M. Prospective evaluation of ondansetron for undifferentiated nausea and vomiting in the prehospital setting. *Prehosp Emerg Care*. 2008;12(1):87–91

Pain Management Including Procedural Sedation

Patient Care Goals

1. Compassionately manage all patients with pain
2. Minimize adverse events in the treatment of pain

Patient Presentation

Inclusion Criteria

Patients who are experiencing pain regardless of transport interval

Exclusion Criteria

None

Patient Management

Assessment, Treatment, and Interventions

1. Choice of medication class, route of administration, dosing and frequency are based on pain severity and the need for escalation from oral to parenteral routes
2. The dosing guidelines apply to patients of all ages except where noted
3. Determine patient's pain score assessment using standard pain scale
 - a. Less than 4 years old or those with cognitive impairment unable to self-report:
 - i. Observational Scales
 1. [Faces, Legs, Arms, Cry, Consolability \(FLACC\)](#)
 - b. 4–12 years old:
 - i. Self-report scale
 1. [Wong Baker Faces](#)
 - c. Greater than 12 years old:
 - i. Self-report scale
 1. **Numeric Rating Scale (NRS)**
4. Nonpharmacologic pain management options include:
 - 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. Minor pain or as an adjunct for moderate/severe pain consider the following nonopioid analgesic options:
 - a. Acetaminophen 500-1000 mg PO or 1000 mg IV for adults and 15 mg/kg IV for pediatrics (maximum dose 1 g)
 - b. Ibuprofen 400 mg PO for adults

6. For Moderate to Severe pain, analgesics include:
 - a. Fentanyl 1 mcg/kg IN, IM, IV or IO (maximum initial dose of 100 mcg)
 - b. Ketamine 0.25 mg/kg IM, IV or IO (maximum initial dose 25 mg; maximum cumulative dose 100 mg)(For IV/IO dilute in 100 ml NS)
7. Noninvasive capnography must be monitored if opioid medication is used as it is an earlier predictor of hypoventilation than pulse oximetry
8. Prior to moving or splinting orthopedic injuries, may administer 2-5 mg midazolam IV/IN for adults (0.1 mg/kg IV/IN for peds), if using fentanyl.
9. Procedural Sedation for cardioversion or pacing if needed:
 - a. Ketamine 0.25 mg/kg IV/IO in adults (0.25 mg/kg in peds IV/IO/IM)
 - b. Midazolam as alternative 2-5 mg IV/IO in adults (0.1 mg/kg in peds IV/IO/IN)
10. If sedation is needed for CPAP, may administer lorazepam 0.5 to 1 mg slow IV push if needed for anxiety
11. Consider administration of oral, sublingual, or IV antiemetics to prevent nausea [See [Nausea/Vomiting Guideline](#)]
12. If indicated based on pain assessment, and vital signs allow, repeat pain medication administration (excluding acetaminophen and nonsteroidal anti-inflammatory medicines) after 5 minutes of the previous dose
13. Transport in position of comfort and reassess as indicated

Patient Safety Considerations

1. All patients should have drug allergies identified prior to administration of pain medication
2. Administer opioids with caution to patients with Glasgow Coma Score (GCS) less than 15, hypotension, identified medication allergy, hypoxia (SPO₂ less than 90%) after maximal supplemental oxygen therapy, or signs of hypoventilation
3. Opioids are contraindicated for patients who have taken monoamine oxidase inhibitors (MAOI) during the previous 14 days
4. Avoid non-steroidal anti-inflammatory medications such as ibuprofen and ketorolac in patients with NSAID allergy, aspirin-sensitive asthma, renal insufficiency, pregnancy, or known peptic ulcer disease
5. Ketorolac should not be used in patients with hypotension (due to renal toxicity)
6. Use of splinting techniques and application of ice should be done to reduce the total amount of medication used to keep the patient comfortable

Notes/Educational Pearls

Key Considerations

1. Intranasal routes of opioid analgesia are preferred as the initial dosing route in pediatrics where IV access may be problematic; consider in other patient populations when an IV is not otherwise indicated
2. Onset of action is dependent on the pharmacokinetics of the drug class as well as route of administration; oral analgesics are effective for pain control but have a slower onset of action so plan accordingly

3. Pain severity scores should be recorded before and after analgesic medication administration and upon arrival at destination
4. Patients with acute abdominal pain should receive analgesic interventions—Use of analgesics for acute abdominal pain does not mask clinical findings or delay diagnosis
5. Opiates may cause a rise in intracranial pressure

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914071—General—Pain Control

Key Documentation Elements

- Documentation of patient vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) with pulse oximetry
- Acquisition of patient's allergies prior to administration of medication
- Documentation of initial patient pain scale assessment
- Documentation of medication administration with correct dose
- Documentation of patient reassessment with repeat vital signs and patient pain scale assessment

Performance Measures

- The clinical efficacy of prehospital analgesia in terms of adequacy of dosing parameters
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patient*

Table 2. Universal Pain Assessment Tool

Wong-Baker FACES®						
Verbal Descriptor Scale						
	No Pain	Mild Pain	Moderate Pain	Severe Pain	Very Severe Pain	Excruciating Pain
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

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

References

1. Attard AR, Corlett MJ, Kidner NJ, Leslie AP, Fraser IA. Safety of early pain relief for acute abdominal pain. *BMJ*. 1992;305(6853):554–6
2. Bieri D, Reeve R, Champion GD, Addico at L, Ziegler J. The Faces Pain Scale for the self-assessment of the severity of pain experienced by children: Development, initial validation and preliminary investigation for ratio scale properties. *Pain* 1990;41:139–150
3. Brewster GS, Herbert ME, Hoffman JR. Medical myth: analgesia should not be given to patients with acute abdominal pain because it obscures the diagnosis. *West J Med*. 2000;172(3):209–10
4. De Nadal M, Munar F, Poca MA, Sahuquillo J, Garnacho A, Rosselló J. Cerebral hemodynamic effects of morphine and fentanyl in patients with severe head injury: absence of correlation to cerebral autoregulation. *Anesthesia*. 2000; 92:1–11
5. Hicks CL, von Baeyer CL, Spafford P, van Korlaar I, Goodenough B. The Faces Pain Scale—Revised: Toward a common metric in pediatric pain measurement. *Pain*. 2001; 93:173–83
6. Jennings PA, Cameron P, Bernard S. Ketamine as an analgesic in the pre-hospital setting: a systematic review. *Acta Anaesthesiol Scand*. 2011;55(6):638–43
7. Lindbeck, George et al. ([Evidence-Based Guidelines for Prehospital Pain Management: Literature and Methods \(nasemso.org\)](http://www.nasemso.org)). Accessed
8. LoVecchio F, Oster N, Sturmman K, Nelson LS, Flashner S, Finger R. The use of analgesics in patients with acute abdominal pain. *J Emerg Med*. 1997;15(6):775–9
9. Manterola C, Astudillo P, Losada H, Pineda V, Sanhueza A, Vial M. Analgesia in patients with acute abdominal pain. *Cochrane Database Syst Rev*. 2007 Jul 18;(3) CD005660
10. Merkel S, et al. The FLACC: A behavioral scale for scoring postoperative pain in young children., *Pediatr Nurse*. 1997;23(3):293–7
11. Pace S, Burke TF. Intravenous morphine for early pain relief in patients with acute abdominal pain. *Acad Emerg Med*. 1996;3(12):1086–92
12. *Prehospital use of Ketamine in Battlefield Analgesia 2012–13*. Falls Church, VA: Defense Health Agency; March 8, 2012. Correspondence to Assistant Secretary of Defense (Health Affairs)
13. Porter K. Ketamine in prehospital care. *Emerg Med J* 2004; 21:351–4
14. Powell, Jonathan R., et al. Evidence-Based Guidelines for Prehospital Pain Management: Literature and Methods. *Prehospital Emergency Care*.
15. Ranji SR, Goldman LE, Simel DL, Shojania KG. Do opiates affect the clinical evaluation of patients with acute abdominal pain? *JAMA*. 2006;296(14):1764–74
16. Svenson JE, Abernathy MK. Ketamine for prehospital use: new look at an old drug. *Am J Emerg Med*. 2007; 25:977–80
17. Vermuelen B, Morabia A, Unger PF, et al. Acute appendicitis: influence of early pain relief on the accuracy of clinical and US findings in the decision to operate—a randomized trial. *Radiology*. 1999;210(3):639–43
18. Wiel E, Zitouni D, Assez N, et al. Continuous infusion of ketamine for out-of-hospital isolated orthopedic injuries secondary to trauma: a randomized controlled trial. *Prehosp Emerg Care*. 2015;19(1):10–16
19. Wood PR. Ketamine: prehospital and in-hospital use. *Trauma*. 2003;5(2):137–40

Seizures

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

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

Assessment

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

Treatment and Interventions

1. If signs of airway obstruction are present and a chin-lift, jaw thrust, positioning, and/or suctioning does not alleviate it, place oropharyngeal airway (if gag reflex is absent) or nasopharyngeal airway
2. Place pulse oximeter and/or waveform capnography to monitor oxygenation/ventilation
3. Administer oxygen as appropriate with a target of achieving 94–98% saturation. Use bag-valve-mask (BVM) ventilation if oxygenation/ventilation are compromised
4. Assess perfusion
5. Assess neurologic status
6. Routes for treatment
 - a. IN/IM routes are preferred over IV or IO routes (if not already established)
 - b. IV placement is not necessary for treatment of seizures, but could be obtained if needed for other reasons
7. Anticonvulsant Treatment
 - a. If vascular access is absent
 - i. Midazolam 2-5 mg (maximum dose 10 mg)(pediatric dose 0.2 mg/kg), IM/IN
 - b. If vascular access (IV or IO) is present:
 - i. Midazolam 2-5 mg IV/IO, maximum 5 mg (pediatric dose 0.1 mg/kg). May repeat second dose at half the dose administered initially.
 - ii. Lorazepam 1-4 mg IV/IO, maximum 4 mg (pediatric dose 0.1 mg/kg). May repeat one time.
 - iii. Diazepam 0.2 mg/kg IV/IO, maximum 10 mg (not stocked unless needed as alternate)
8. Glucometry
 - a. If still actively seizing, check blood glucose level
 - b. If less than 60 mg/dL, treat per the [Hypoglycemia Guideline](#)
9. Administer magnesium sulfate in the presence of seizure in the third trimester of pregnancy or postpartum [See [Eclampsia/Pre-eclampsia Guideline](#)]
10. For febrile seizures, consider the following interventions after stopping the seizure. Please note that the administration of nonsteroidal anti-inflammatory medications is contraindicated in infants less than 6 months of age. The following interventions provide symptomatic relief for fevers, but do not stop the seizure:
 - a. Acetaminophen 15 mg/kg, maximum dose 1000 mg, IV/IO (if unable to swallow)
AND/OR
 - b. Removing excessive layers of clothing
AND/OR
 - c. Applying cool compresses to the body
11. Consider acquiring a 12-lead EKG following cessation of seizure in patients without a history of seizure to determine possible cardiac cause

Patient Safety Considerations

1. Trained personnel should be able to give medication without contacting medical direction, however, more than two doses of benzodiazepines are associated with high-risk of airway compromise
 - a. Use caution, weigh risks/benefits of deferring treatment until hospital, and/or consider consultation with medical direction if patient has received two doses of benzodiazepines by bystanders and/or prehospital clinicians
2. Hypoglycemic patients who are treated in the field for seizure should be transported to hospital, regardless of whether 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 medical direction
3. For new onset seizures or seizures that are refractory to treatment, consider other potential causes including, but not limited to, trauma, stroke, electrolyte abnormality, toxic ingestion, pregnancy with eclampsia, hyperthermia
4. A variety of safe and efficacious doses for benzodiazepines have been noted in the literature for seizures
 - a. The doses for anticonvulsant treatment noted above are those that are common to the forms and routes of benzodiazepines noted in this guideline
 - b. One dose, rather than a range, has been suggested to standardize a common dose in situations when an EMS agency may need to switch from one type of benzodiazepine to another due to cost or resource limitations
5. Recent evidence supports the use of midazolam IM as an intervention that is at least as safe and effective as intravenous lorazepam for prehospital seizure cessation

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914141—Medical—Seizure

Key Documentation Elements

- Actively seizing during transport and time of seizure onset/cessation
- Onset, focality, direction of eye deviation
- Concurrent symptoms of apnea, cyanosis, vomiting, bowel/bladder incontinence, or fever

- Medication amounts/routes given by bystanders or prehospital clinicians
- Neurologic status (GCS, nystagmus, pupil size, focal neurologic deficit, or signs of stroke)
- Blood glucose level

Performance Measures

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

References

1. Alldredge BK, Gelb AM, Isaacs SM, et al. A comparison of lorazepam, diazepam, and placebo for the treatment of out-of-hospital status epilepticus. *N Engl J Med*. 2001;345(9):631–7
2. Alldredge BK, Wall DB, Ferriero DM. Effect of prehospital treatment on the outcome of status epilepticus in children. *Pediatr Neurol*. 1995;12(3):213–6
3. Appleton R, Sweeney A, Choonara I, Robson J, Molyneux E. Lorazepam versus diazepam in the acute treatment of epileptic seizures and status epilepticus. *Dev Med Child Neurol*. 1995;37(8):682–8
4. Arya R, Gulati S, Kabra M, Sahu JK, Kalra V. Intranasal versus intravenous lorazepam for control of acute seizures in children: a randomized open-label study. *Epilepsia*. 2011;52(4):788–93
5. Bhattacharyya M, Kalra V, Gulati S. Intranasal midazolam vs rectal diazepam in acute childhood seizures. *Pediatr Neurol*. 2006;34(5):355–9
6. Cain E, Ackroyd-Stolarz S, Alexiadis P, Murray D. Prehospital hypoglycemia: the safety of not transporting treated patients. *Prehosp Emerg Care*. 2003;7(4):458–65
7. Chamberlain JM, Altieri MA, Futterman C, Young GM, Ochsenschlager DW, Waisman Y. A prospective, randomized study comparing intramuscular midazolam with intravenous diazepam for the treatment of seizures in children. *Pediatr Emerg Care*. 1997;13(2):92–4
8. Chin RF, Neville BG, Peckham C, Wade A, Bedford H, Scott RC. Treatment of community-onset, childhood convulsive status epilepticus: a prospective, population-based study. *Lancet Neurol*. 2008;7(8):696–703
9. Fisgin T, Gurer Y, Tezic T, et al. Effects of intranasal midazolam and rectal diazepam on acute convulsions in children: prospective randomized study. *J Child Neurol*. 2002;17(2):123–6
10. Frascone RJ, Jensen J, Wewerka SS, Salzman JG. Use of the pediatric EZ-IO needle by emergency medical services providers. *Pediatr Emerg Care*. 2009;25(5):329–32
11. Galustyan SG, Walsh-Kelly CM, Szewczuga D, Bergholte J, Hennes H. The short-term outcome of seizure management by prehospital personnel: a comparison of two protocols. *Pediatr Emerg Care*. 2003;19(4):221–5

12. Holliman CJ, Wuerz RC, Vazquez-de Miguel G, Meador SA. Comparison of interventions in prehospital care by standing orders versus interventions ordered by direct (online) medical command. *Prehosp Disaster Med.* 1994;9(4):202–9
13. Holsti M, Dudley N, Schunk J, et al. Intranasal midazolam vs rectal diazepam for the home treatment of acute seizures in pediatric patients with epilepsy. *Arch Pediatr Adolesc Med.* 2010;164(8):747–53
14. Lahat E, Goldman M, Barr J, Bistrizter T, Berkovitch M. Comparison of intranasal midazolam with intravenous diazepam for treating febrile seizures in children: prospective randomized study. *Br Med J.* 2000;321(7253):83–6
15. Lamhaut L, Dagron C. Comparison of intravenous and intraosseous access by pre-hospital medical emergency personnel with and without CBRN protective equipment. *Resuscitation.* 2010;81(1):65–8
16. Mahmoudian T, Zadeh MM. Comparison of intranasal midazolam with intravenous diazepam for treating acute seizures in children. *Epilepsy Behav.* 2004;5(2):253–5
17. McIntyre J, Robertson S, Norris E, et al. Safety and efficacy of buccal midazolam versus rectal diazepam for emergency treatment of seizures in children: a randomized controlled trial. *Lancet.* 2005;366(9481):205–10
18. McMullan J, Sasson C, Pancioli A, Silbergleit R. Midazolam versus diazepam for the treatment of status epilepticus in children and young adults: a meta-analysis. *Acad Emerg Med.* 2010;17(6):575–82
19. Mittal P, Manohar R, Rawat AK. Comparative study of intranasal midazolam and intravenous diazepam sedation for procedures and seizures. *Indian J Pediatr.* 2006;73(11):975–8
20. 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
21. Muchohi SN, Kokwaro GO, Ogutu BR, et al. Pharmacokinetics and clinical efficacy of midazolam in children with severe malaria and convulsions. *Br J Clin Pharmacol.* 2008;66(4):529–38
22. Muchohi SN, Obiero K, Newton CR, et al. Pharmacokinetics and clinical efficacy of lorazepam in children with severe malaria and convulsions. *Br J Clin Pharmacol.* 2008;65(1):12–21
23. Rainbow J, Browne GJ, Lam LT. Controlling seizures in the prehospital setting: diazepam or midazolam? *J Paediatr Child Health.* 2002;38(6):582–6
24. Schwartz D, Amir L, Dichter R, et al. The use of a powered device for intraosseous drug and fluid administration in a national EMS: a 4-year experience. *J Trauma.* 2008;64(3):650–5
25. Shah I, Deshmukh CT. Intramuscular midazolam vs. intravenous diazepam for acute seizures. *Indian J Pediatr.* 2005;72(8):667–70
26. Shah MI, Macias CG, Dayan PS, et al. An evidence-based guideline for pediatric prehospital seizure management using GRADE methodology. *Prehosp Emerg Care.* 2014;18 Suppl 1:15–24

27. 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
28. Silbergleit R, Durkalski V, Lowenstein D, et al; NETT Investigators. Intramuscular versus intravenous therapy for prehospital status epilepticus. *N Engl J Med*. 2012;366(7):591–600
29. Silbergleit R et al. RAMPART (rapid anticonvulsant medication prior to arrival trial): a double-blind randomized clinical trial of the efficacy of IM midazolam versus IV lorazepam in the pre-hospital treatment of status epilepticus by paramedics. *Epilepsia*. 2011;52 Suppl 8:45–7
30. Sporer KA, Johnson NJ. Detailed analysis of prehospital interventions in medical priority dispatch system determinants. *West J Emerg Med*. 2011;12(1):19–29
31. Sreenath TG, Gupta P, Sharma KK, Krishnamurthy S. Lorazepam versus diazepam--phenytoin combination in the treatment of convulsive status epilepticus in children: a randomized controlled trial. *Eur J Paediatr Neurol*. 2010;14(2):162–8
32. Talukdar B, Chakrabarty B. Efficacy of buccal midazolam compared to intravenous diazepam in controlling convulsions in children: a randomized control trial. *Brain Dev*. 2009;31(10):744–9
33. Vilke GM, Sharieff GQ, Marino A, Gerhart AE, Chan TC. Midazolam for the treatment of out-of- hospital pediatric seizures. *Prehosp Emerg Care*. 2002;6(2):215–7
34. Wuerz RC, Swope GW, Holliman J, Vazquez-de Miguel G. Online medical direction: a prospective study. *Prehosp Disaster Med*. 1995;10(3):51–4
35. Zarate L, Mandelco B, Wilshaw R, Ravert P. Peripheral intravenous catheters started in prehospital and emergency department settings. *J Trauma Nurs*. 2008;15(2):47–52

Shock

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

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 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 capillary refill (> 3 seconds)
 - c. Flash capillary refill (> 1 second) seen in early septic shock
 - d. Decreased urine output
 - e. Respiratory rate greater than 20 breaths per minute in adults or elevated in children (See [normal vital signs table](#))
 - f. Hypotension for age (lowest acceptable systolic blood pressure in mmHg):
 - i. Less than 1 years of age: 60
 - ii. 1–10 years old: (age in years) (2) + 70
 - iii. Greater than 10 years old: 90
 - g. Tachycardia or bradycardia for age, out of proportion to temperature [See [Appendix V. Abnormal Vital Signs](#)]
 - h. Weak, decreased or bounding pulses
 - i. Cool/mottled or flushed/ruddy skin
2. Potential etiologies of shock:
 - a. Hypovolemic (hemorrhagic or non-hemorrhagic)
 - b. Distributive (sepsis, anaphylaxis, neurogenic, overdose, endocrine)
 - c. Cardiogenic (cardiomyopathy, dysrhythmia, valve disorder)
 - d. Obstructive (pulmonary embolism (PE), tension pneumothorax, cardiac tamponade)
 - e. Combined (one form causing another)

Exclusion Criteria

Shock due to suspected trauma [See [Trauma Section](#)]

Patient Management

Assessment

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

Treatment and Interventions

1. Check vital signs
2. Administer oxygen as appropriate with a target of achieving 94–98% saturation
3. Cardiac monitor
4. Pulse oximetry and EtCO₂ (reading of less than 25 mmHg may be sign of poor perfusion)
5. Check blood sugar, and correct if less than 60 mg/dL
6. EKG
7. Establish IV access. If unable to obtain within two attempts or less than 90 seconds, place an IO needle

8. IV fluid volume goal attained by giving boluses that are pressure infused over less than 15 minutes each based on patient's condition and clinical impression. Fluid volume goal to achieve a mean arterial pressure (adults) or other targets (pediatrics). Mean Arterial Pressure is calculated: $(MAP = [(2 \times \text{diastolic}) + (\text{systolic})]/3)$
 - a. Adult
 - i. Physiologic target: MAP goal 65 mmHg
 - ii. Fluid goal of up to 30 mL/kg of isotonic fluid by administering rapid, predetermined boluses (e.g., 500 mL) unless the MAP goal is achieved, or pulmonary edema develops
 - b. Pediatric
 - i. Physiologic targets: Systolic blood pressure at least fifth percentile for age, strong distal pulses, warm skin perfusion, capillary refill less than 2 seconds and improving mental status
 - ii. Fluid goal of up to a total of 60 mL/kg or 1 liter of isotonic fluid by giving 20 mL/kg of isotonic fluid by administering rapid boluses (for cardiogenic shock give 10 mL/kg boluses)
9. If there is a history of adrenal insufficiency, long-term steroid dependence, or fluid-refractory shock requiring vasopressors give:
 - a. Methylprednisolone 2 mg/kg IV (maximum 125 mg)
10. Vasopressors (shock unresponsive to IV fluids) titrated to physiologic targets
 - a. Cardiogenic, hypovolemic, obstructive shock and distributive shock
 - i. Norepinephrine 1 mcg/minute and titrate to effect
 1. Preference in both neurogenic and infectious (sepsis) causes of distributive shock
11. For anaphylactic shock, treat per the [Anaphylaxis and Allergic Reaction Guideline](#)
12. Provide advanced notification to the hospital
13. Antipyretics for fever—nonsteroidal anti-inflammatory agents are contraindicated in infants less than 6 months of age
 - a. Acetaminophen IV (15 mg/kg; maximum dose of 1000 mg)

Patient Safety Considerations

Recognition of cardiogenic shock. If the patient condition deteriorates after fluid administration, rales or hepatomegaly develop, then consider cardiogenic shock and withholding further fluid administration

Notes/Educational Pearls

Key Considerations

1. Early, aggressive IV fluid administration is essential in the treatment of suspected septic shock
2. Patients predisposed to shock:
 - a. Immunocompromised (patients undergoing chemotherapy or with a primary or acquired immunodeficiency)
 - b. Adrenal insufficiency (Addison's disease, congenital adrenal hyperplasia, chronic or recent steroid use)

- c. History of a solid organ or bone marrow transplant
 - d. Infants
 - e. Elderly
3. In most adults, tachycardia is the first sign of compensated shock, and may persist for hours. Tachycardia can be a late sign of shock in children and a tachycardic child may be close to cardiovascular collapse
 4. Hypotension indicates uncompensated shock, which may progress to cardiopulmonary failure within minutes. Hypotension is a late and ominous sign in pediatric uncompensated shock
 5. Hydrocortisone succinate, if available, is preferred over methylprednisolone and dexamethasone for the patient with adrenal insufficiency because of its dual glucocorticoid and mineralocorticoid effects:
 - a. Patients with no reported history of adrenal axis dysfunction may have adrenal suppression due to their acute illness, and hydrocortisone should be considered for any patient showing signs of treatment-resistant shock
 - b. Patients with adrenal insufficiency may have an emergency dose of hydrocortisone available that can be administered IV or IM

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- Medications administered
- Full vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) with reassessment q 15 minutes or more frequently as appropriate
- Lactate level (if available)
- Neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)]
- Amount of fluids given

Performance Measures

- Percentage of patients who have full vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment, temperature, and O₂ saturation) documented
- Presence of a decision support tool (laminated card, a protocol, or electronic alert) to identify patients in shock
- Percentage of patients with suspected shock for whom advanced notification to the hospital was provided

- Mean time from abnormal vitals to initiation of a fluid bolus
- Percentage of patients who receive pressors for ongoing hypotension after receiving 30 mL/kg isotonic fluid in the setting of shock

References

1. Annane D, Bellissant E, Bollaert P, Briegel J, Keh, D, Kupfer Y. Corticosteroids for treating severe sepsis and septic shock. 2004. *Cochrane Database Syst Rev*. 2004;(1):CD002243
2. Band, RA, Gaieski DF, Hylton JH, Shofer FS, Goyal M, Meisel ZF. Arriving by emergency medical services improves time to treatment endpoints for patients with severe sepsis or septic shock. *Acad Emerg Med*. 2011;18(9):934–40
3. Bernardin G, Pradier C, Tiger F, Deloffre P, Mattei M. Blood pressure and arterial lactate level are early indicators of short-term survival in human septic shock. *Intensive Care Med*. 1996;22(1):17–25
4. Boluyt N, Bollen C, Bos A, Kok J, Offringa M. Fluid resuscitation in neonatal and pediatric hypovolemic shock: A Dutch Pediatric Society evidence-based clinical practice guideline. *Intensive Care Med*. 2006;32(7):995–1003
5. Brierley J, Carcillo JA, Choong K, et al. Clinical practice parameters for hemodynamic support of pediatric and neonatal patients in septic shock. *Crit Care Med*. 2009;37(2):666–8
6. Carcillo JA, Davis AL, Zaritsky A. Role of early fluid resuscitation in pediatric septic shock. *JAMA*. 1991;266(9):1242–5
7. Choong K, Bohn D, Fraser DD, et al. Vasopressin in pediatric vasodilatory shock: a multicenter randomized controlled trial. *Am J Respir Crit Care Med*. 2009;180(7):632–9
8. Chopra A, Kumar V, Dutta A. Hypertonic versus normal saline as initial fluid bolus in pediatric septic shock. *Indian J Pediatr*. 2011;78(7):833–7
9. Cronin L, Cook DJ, Carlet J, et al. Corticosteroid treatment for sepsis: a critical appraisal and meta-analysis of the literature. *Crit Care Med*. 1995;23(8):1430–9
10. Cruz AT, Perry AM, Williams EA, Graf JM, Wuestner ER, Patel B. Implementation of goal-directed therapy for children with suspected sepsis in the emergency department. *Pediatrics*. 2011;127(3): e758–66
11. De Backer D, Aldecoa C, Njimi H, Vincent J. Dopamine versus norepinephrine in the treatment of septic shock: a meta-analysis. *Crit Care Med*. 2011;13(6):1–6
12. De Backer D, Biston P, Devriendt J, et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010;362(9):779–89
13. Guyette F, Suffoletto B, Castillo JL, Quintero J, Callaway C, Puyana, JC. Prehospital serum lactate as a predictor of outcomes in trauma patients: a retrospective observational study. *J Trauma*. 2011;70(4):782–6

14. Guyette FX, Gomez H, Suffoletto B, et al. Prehospital dynamic tissue oxygen saturation response predicts in-hospital lifesaving interventions in trauma patients. *J Trauma Acute Care Surg.* 2012;72(4):930–5
15. Han YY, Carcillo JA, Dragotta MA, et al. Early reversal of pediatric-neonatal septic shock by community physicians is associated with improved outcome. *Pediatrics.* 2013;112(4):793–9
16. Hartholt KA, van Lieshout EM, Thies WC, Patka P, Schipper IB. Intraosseous devices: a randomized controlled trial comparing three intraosseous devices. *Prehosp Emerg Care.* 2010;14(1):6–13
17. Howell MD, David AM. Management of sepsis and septic shock. *JAMA.* 2017;317(8):847–8
18. Hunter CL, Silvestri S, Dean M, Falk JL, Papa L. End-tidal carbon dioxide is associated with mortality and lactate in patients with suspected sepsis. *Am J Emerg Med* (2013) 31, 64–71
19. Jansen TC, van Bommel J, Mulder PG, Rommes JH, Schieveld SJ, Bakker, J. The prognostic value of blood lactate levels relative to that of vital signs in the pre-hospital setting: a pilot study. *Crit Care.* 2008;12(6): R160
20. Kumar A, Roberts D, Wood KE, et al. Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Crit Care Med.* 2006;34(6):1589–96
21. Lampard JG, Lang E. Vasopressors for hypotensive shock. *Ann Emerg Med.* 2013;31(3):351–2
22. Larsen GY, Mecham N, Greenberg R. An emergency department septic shock protocol and care guideline for children initiated at triage. *Pediatrics.* 2011;127(6): e1585–92
23. Levy B, Bastien O, Karim B, et al. Experts' recommendations for the management of adult patients with cardiogenic shock. *Ann Intensive Care.* 2015;5(1):17
24. Lillis KA, Jaffe DM. Prehospital intravenous access in children. *Ann Emerg Med.* 1992;21(12):1430–4
25. Martin C, Papazian L, Perrin G, Saux P, Gouin F. Norepinephrine or dopamine for the treatment of hyperdynamic septic shock? *Chest.* 1993;103(6):1826–31
26. Martin C, Viviani X, Leone M, Thirion X. Effect of norepinephrine on the outcome of septic shock. *Crit Care Med.* 2000;28(8):2758–65
27. Mikkelsen ME, Miltiades AN, Gaieski DF, et al. Serum lactate is associated with mortality in severe sepsis independent of organ failure and shock. *Crit Care Med.* 2009;37(5):1670–7
28. Morimatsu H, Singh K, Uchino S, Bellomo R, Hart G. Early and exclusive use of norepinephrine in septic shock. *Resuscitation.* 2004;62(2):249–54
29. Nawrocki PS, Poremba M, Lawner BJ. Push dose epinephrine use in the management of hypotension during critical care transport. *Prehosp Emerg Care.* 2020;24(2):188–95. [//doi.org/10.1080/10903127.2019.1588443](https://doi.org/10.1080/10903127.2019.1588443).
30. Oliveira CF, Nogueira de Sá FR, Oliveira DS, et al. Time- and fluid-sensitive resuscitation for hemodynamic support of children in septic shock: barriers to the

implementation of the American College of Critical Care Medicine/Pediatric Advanced Life Support Guidelines in a pediatric intensive care unit in a developing world. *Pediatr Emerg Care*. 2008;24(12):810–5

31. Patel GP, Grahe JS, Sperry M, et al. Efficacy and safety of dopamine versus norepinephrine in the management of septic shock. *Shock*. 2010;33(4):375–80
32. Rhodes A, Evans LE, Alhazzani W, et al. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock: 2016. *Intensive Care Med*. Epub 2017 Jan 18
33. 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):647–55
34. Sebat F, Johnson D, Musthafa AA, et al. A multidisciplinary community hospital program for early and rapid resuscitation of shock in nontrauma patients. *Chest*. 2005;127(5):1729–43
35. Seymour CW, Band RA, Cooke CR, et al. Out-of-hospital characteristics and care of patients with severe sepsis: a cohort study. *J Crit Care*. 2010;25(4):553–62
36. Shapiro NI, Howell MD, Talmor D, et al. Implementation and outcomes of the multiple urgent sepsis therapies (MUST) protocol. *Crit Care Med*. 2006;34(4):1025–32
37. Sholl JM, Chung S, Prentiss S, Smith JM, Shah MI. An evidence-based guideline for pediatric prehospital shock management using GRADE methodology. Manuscript in preparation
38. Studnek JR, Artho MR, Garner CL Jr., Jones AE. The impact of emergency medical services on the ED care of severe sepsis. *Am J Emerg Med*. 2012;30(1):51–6
39. Trzeciak S, Dellinger RP, Chansky ME, et al. Serum lactate as a predictor of mortality in patients with infection. *Intensive Care Med*. 2007;33(6):970–7
40. Up To Date. Evaluation of and Initial approach to the adult patient with undifferentiated hypotension and shock. Accessed May 27, 2021
41. Up To Date. Initial management of shock in children. Accessed May 27, 2021
42. Van Beest PA, Mulder PJ, Oetomo SB, van den Broek B, Kuiper MA, Spronk PE. Measurement of lactate in a prehospital setting is related to outcome. *Eur J Emerg Med*. 2009;16(6):318–22

Sickle Cell Pain Crisis

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patient with known sickle cell disease experiencing a pain crisis

Exclusion Criteria

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

Patient Management

Assessment

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

- i. Abdominal pain, LUQ
 - ii. Splenic enlargement (examine with care)
 - iii. Hypotension, tachycardia
 - f. Severe anemia
 - i. Pallor
 - ii. Fatigue
 - iii. Dyspnea or dyspnea on exertion
 - iv. Shock
 - g. Infections
 - i. Pneumonia (cough, fever, sputum shortness of breath)
 - h. Priapism
 - i. Painful, prolonged erection in the absence of sexual activity
 - i. Venous thromboembolism
 - i. Calf pain, tenderness, swelling, chest/back pain especially with inspiration, and shortness of breath
7. Assess for signs of shock—if shock is present, treat per [Shock Guideline](#)

Treatment and Interventions

1. Medication Administration:
 - a. Provide analgesia per the [Pain Management including Procedural Sedation Guideline](#)
 - b. Start oxygen by nasal cannula if hypoxic
 - c. Start an IV and provide 10 mL/kg up to 250 ml normal saline bolus, may repeat as needed
 - d. Provide transport to an appropriate receiving facility
 - e. Reassess vital signs and response to therapeutic interventions throughout transport
2. Comfort Measures:
 - a. Keep patient warm and dry
 - b. Transport in a position of comfort unless clinical condition requires otherwise

Patient Safety Considerations

None noted

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914165Other

Key Documentation Elements

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

Performance Measures

- Assessment for life-threatening etiology
- Mitigation of pain per the [Pain Management including Procedural Sedation Guideline](#)

Reference

1. Cintho Ozahata M, Page GP, Guo Y, et al. Clinical and Genetic Predictors of Priapism in Sickle Cell Disease: Results from the Recipient Epidemiology and Donor Evaluation Study III Brazil Cohort Study. *J Sex Med* 2019; 16:1988
2. Mitchell BL. Sickle cell trait and sudden death—bringing it home. *J Natl Med Assoc*. 2007;99(3):300–5

RESUSCITATION



Cardiac Arrest (VF/VT/Asystole/PEA)

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients with cardiac arrest

Exclusion Criteria

1. Patients suffering cardiac arrest due to severe hypothermia [See [Hypothermia/Cold Exposure Guideline](#)]
2. Patients with identifiable Do Not Resuscitate (or equivalent such as POLST) order [See [Do Not Resuscitate Status/Advance Directive/Healthcare Power of Attorney \(POA\) Status Guideline](#)]
3. Patients in arrest due to traumatic etiology [See [General Trauma Management Guideline](#)]

Patient Management

Assessment

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

Treatment and Interventions

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

1. Initiate chest compressions in cases with no bystander chest compressions or take over compressions from bystanders while a second rescuer is setting up the AED or defibrillator
 - a. If adequate, uninterrupted bystander CPR has been performed or if the patient arrests in front of the EMS clinicians, immediately proceed with rhythm analysis and defibrillation, if appropriate
 - b. It is realistic for EMS clinicians to tailor the sequence of rescue actions to coincide the most likely cause of arrest
 - c. There is insufficient evidence to recommend for or against delaying defibrillation to provide a period of CPR for patients in VF/pulseless VT out-of-hospital cardiac arrest
 - d. For adults and children with unwitnessed cardiac arrest or for whom an AED is not immediately available, it is reasonable that CPR be initiated while the defibrillator equipment is being retrieved and applied and that defibrillation, if indicated, be attempted as soon as the device is ready for use

2. The settings for defibrillation will be the sequence 200, 300, 360 joules. If a defibrillation is successful, successive shocks will remain at the voltage that was previously successful
3. Chest compressions should resume immediately after defibrillation attempts with no pauses for pulse checks for 2 minutes regardless of the rhythm displayed on the cardiac monitor
4. All attempts should be made to prevent avoidable interruptions in chest compressions, such as precharging the defibrillator and hovering over the chest, rather than stepping away during defibrillations
5. If feasible, IV or IO access should be obtained. Administer epinephrine during the first or second round of compressions. Prioritize early administration of epinephrine for nonshockable rhythms
6. Consider use of antiarrhythmic for recurrent VF/Pulseless VT
 - a. The principal objective of antiarrhythmic drug therapy in shock-refractory VF and pulseless VT is to facilitate the restoration and maintenance of a spontaneous perfusing rhythm in concert with the shock termination of VF/VT; some antiarrhythmic drugs have been associated with increased rates of ROSC and hospital admission, but none have yet been proven to increase long-term survival or survival with good neurologic outcome
 - i. Amiodarone (5 mg/kg IV, max of 300 mg) may be considered for VF/pulseless VT that is unresponsive to CPR, defibrillation, and a vasopressor therapy. May repeat one dose at 5 mg/kg IV, max 150 mg, if refractory after fifth shock.
 - ii. Lidocaine (1 mg/kg IV) may be considered as an alternative to amiodarone for VF/pulseless VT that is unresponsive to CPR, defibrillation, and vasopressor therapy
 - iii. The routine use of magnesium for VF/pulseless VT is not recommended in adult patients unless it is refractory, polymorphic VT, or Torsades de pointes
 - b. There is inadequate evidence to support the routine use of lidocaine and beta-blockers after cardiac arrest by EMS. There is insufficient evidence to recommend for or against the routine initiation or continuation of other antiarrhythmic medications after ROSC from cardiac arrest
 - c. For Torsades de pointes, give magnesium sulfate 50 mg/kg g IV administered over 1–2 minutes. There is insufficient evidence to recommend for or against the routine administration during cardiac arrest
7. Consider reversible causes of cardiac arrest which include the following:
 - a. Hypothermia—additions to care include attempts at active rewarming [See [Hypothermia/Cold Exposure Guideline](#)]
 - b. The dialysis patient/known hyperkalemic patient—Additions to care include the following:
 - i. Calcium chloride 10% 1 g IV bolus over 2 minutes (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 sodium bicarbonate 1 mEq/kg IV
 - d. Hypovolemia. Additions to care include normal saline 2 L IV (or 20 mL/kg, repeated up to 3 times for **pediatrics**)

- e. If the patient is intubated at the time of arrest, assess for tension pneumothorax and misplaced ETT
- f. If tension pneumothorax suspected, perform needle decompression. May use Capnospot. Assess ETT, if misplaced, replace ETT
8. If at any time during this period of resuscitation the patient regains return of spontaneous circulation, treat per [Adult Post-ROSC \(Return of Spontaneous Circulation\) Care Guideline](#)
9. If resuscitation remains ineffective, consider termination of resuscitation [See [Termination of Resuscitative Efforts Guideline](#)]

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. Effective chest compressions and defibrillation are the most important therapies to the patient in cardiac arrest. Effective chest compressions are defined as:
 - a. A rate of greater than 100 and less than 120 compressions/minute
 - b. Depth of at least 2 inches (5 cm) and less than 2.4 inches (6 cm) for adults and children or 1.5 inches (4 cm) or 1/3 of chest depth for infants; adolescents who have entered puberty should receive the same depth of chest compressions as an adult
 - c. Allow for complete chest recoil (avoid leaning)
 - d. Minimize interruptions in compressions
 - e. Avoid rescuer fatigue by rotating rescuers at least every 2 minutes. Some EMS pit crew approaches use a clinician on either side of the chest, alternating compressions every minute or every 100 compressions to avoid fatigue
2. Avoid excessive ventilation and consider delayed airway management – If no advanced airway, consider:
 - a. BVM ventilation every 10–15 compressions with cycles of uninterrupted chest compressions. Upstroke ventilation between compressions. 30:2 ventilation to compression ratio for adults, and 15:2 for children when 2 rescuers are present
 - b. If an advanced airway is placed, ventilations should not exceed 10 breaths/minute (1 breath every 6 seconds or 1 breath every 10 compressions) in adults. **Pediatric Consideration:** For children with an advanced airway, 1 breath every 3–5 seconds is recommended (equivalent to 12–20 breaths/minute)
3. Quantitative end-tidal capnography (EtCO₂) should be used to monitor effectiveness of chest compressions
 - a. If EtCO₂ less than 10 mmHg during the initial phases of resuscitation, attempt to improve chest compression quality

- b. Consider additional monitoring with biometric feedback which may improve compliance with suggested [Resuscitation Section](#)
- 4. Chest compressions are usually the most rapidly applied therapy for the patient in cardiac arrest and should be initiated 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 (e.g., in order to place pads), chest compressions should be initiated while the defibrillator is being applied. There is no guidance on how long these initial compressions should be applied; however, it is reasonable to either complete between 30 seconds and 2 minutes of chest compressions in cases of no bystander chest compressions or to perform defibrillation as soon as possible after chest compressions initiated in cases of witnessed arrest
- 5. Chest compressions should be reinitiated immediately after defibrillation as pulses, if present, are often difficult to detect and rhythm and pulse checks interrupt compressions
- 6. Continue chest compressions between completion of AED analysis and AED charging
- 7. The effectiveness of chest compressions decreases when moving patients
 - a. Patients should therefore be resuscitated as close to the point at which they are first encountered and should only be moved if the conditions on scene are unsafe or do not operationally allow for resuscitation
 - b. Chest compressions are also less effective in a moving vehicle
 - c. It is also dangerous to EMS clinicians, patients, pedestrians, and other motorists to perform chest compressions in a moving ambulance
 - d. For these reasons and because in most cases the care provided by EMS clinicians is equivalent to that provided in emergency departments, resuscitation should occur on scene
- 8. IV or IO access without interrupting chest compressions
- 9. Administer epinephrine (0.1 mg/kg, maximum dose 1 mg) IV/IO during the first or second round of compressions
- 10. At present, the most effective mechanism of airway management is uncertain due to some systems managing the airway aggressively and others managing the airway with basic measures and both types of systems finding excellent outcomes. Regardless of the airway management style, consider the following principles:
 - a. Airway management should not interrupt chest compressions
 - b. Carefully follow ventilation rate and prevent hyperventilation
 - c. Consider limited tidal volumes
 - d. There is uncertainty regarding the proper goals for oxygenation during resuscitation
 - i. Current recommendations suggest using the highest flow rate possible through NRB or BVM
 - ii. This should not be continued into the post-resuscitation phase in which the goal should be an oxygen saturation (SpO₂) of 94–98%

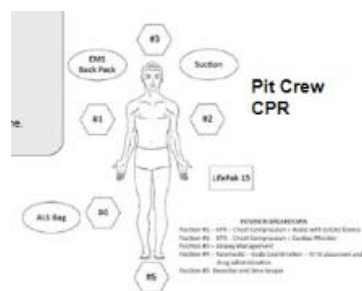
- e. **Pediatric Considerations:** Special attention should be applied to the pediatric population and airway management/respiratory support. Given that the most likely cause of cardiac arrest is respiratory, airway management may be considered early in the patient's care
 - i. However, the order of Circulation-Airway-Breathing is still recommended as the order of priority by the American Heart Association for pediatric resuscitation to ensure timely initiation of chest compressions to maintain perfusion, regardless of the underlying cause of the arrest
 - ii. In addition, conventional CPR is preferred in children, since it is associated with better outcomes when compared to compression-only CPR

11. Special Circumstances in Cardiac Arrest

- a. Trauma, treat per the [General Trauma Management Guideline](#)
- b. Pregnancy
 - i. The best hope for fetal survival is maternal survival
 - ii. Position the patient in the supine position with a second rescuer performing manual uterine displacement to the left to displace the gravid uterus and increase venous return by avoiding aorto-caval compression
 - iii. If manual displacement is unsuccessful, the patient may be placed in the left lateral tilt position at 30°. This position is less desirable than the manual uterine displacement as chest compressions are more difficult to perform in this position
 - iv. Chest compressions should be performed slightly higher on the sternum than in the non-pregnant patient to account for elevation of the diaphragm and abdominal contents in the obviously gravid patient
 - v. Defibrillation should be performed as in non-pregnant patients
- c. Arrests of respiratory etiology (including drowning). In addition to the above, consider early management of the patient's airway. Passive ventilation with a NRB is not indicated for these patients

12. Application of the "pit crew" model of resuscitation

- a. Ideally, clinicians 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.



- b. For efficient “pit crew” style care, the EMS agency medical director should establish the options that will be used by clinicians 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
- 13. The EMS agency must perform a Quality Improvement (QI) review of care and outcome, overseen by the agency medical director, for every patient that receives CPR
 - a. The QI should be coordinated with local receiving hospitals to include hospital admission, discharge, and condition information. This EMS agency QI can be accomplished by participation an organized cardiac arrest registry
 - b. The QI should be coordinated with local PSAP/dispatch centers to review opportunities to assure optimal recognition of possible cardiac arrest cases and provision of dispatch-assisted CPR (including hands-only CPR when appropriate)

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914011—Cardiac Arrest—Asystole
- 9914013—Cardiac Arrest—Hypothermia-Therapeutic
- 9914015—Cardiac Arrest—Pulseless Electrical Activity
- 9914017—Cardiac Arrest—Ventricular Fibrillation/Pulseless Ventricular Tachycardia)
- 9914055—General—Cardiac Arrest
- 9914087—Injury—Cardiac Arrest

Key Documentation Elements

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

Performance Measures

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

References

1. Atkins DL, Berger S, Duff JP, et al. Part 11: Pediatric Basic Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S519–25
2. Bobrow BJ, Clark LL, Ewy GA, et al. Minimally interrupted cardiac resuscitation by emergency medical services for out-of-hospital cardiac arrest. *JAMA*. 2008;299(10):1158–65
3. Brooks, Anderdon ML, Bruder E, et al. Part 6: alternative techniques and ancillary devices for cardiopulmonary resuscitation: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S436–43
4. De Caen R, Berg MD, Chameides L, et al. Part 12: Pediatric Advanced Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2) S526–42
5. Dorian P, Cass D, Schwartz B, Cooper R, Gelaznikas R, Barr A. Amiodarone as compared with lidocaine for shock-resistant ventricular fibrillation. *N Engl J Med*. 2002;346(12):884–90
6. Ewy GA. The cardiocerebral resuscitation protocol for treatment of out-of-hospital primary cardiac arrest. *Scand J Trauma Resusc Emerg Med*. 2012; 20:65
7. Garza AG, Gratton MC, Salomone JA, Lindholm D, McElroy J, Archer R. Improved patient survival using a modified resuscitation protocol for out-of-hospital cardiac arrest. *Circulation*. 2009;119(19):2597–605
8. Grunau B, Kime N, Leroux B, et al. Association of Intra-arrest Transport vs Continued On-Scene Resuscitation With Survival to Hospital Discharge Among Patients With Out-of-Hospital Cardiac Arrest. *JAMA*. 2020;324(11):1058-1067
9. Grunau B, Kawano T, Rea TD, et al. Emergency medical services employing intra-arrest transport less frequently for out-of-hospital cardiac arrest have higher survival and favorable neurological outcomes. *Resuscitation*. Sep 9, 2021
10. Hinchey PR, Myers JB, Lewis R, et al. Improved out-of-hospital cardiac arrest survival after the sequential implementation of 2005 AHA guidelines for compressions, ventilations, and induced hypothermia: the Wake County experience. *Ann Emerg Med*. 2010;56(4):348–357
11. Hopkins CL, Burk C, Moser S, Meersman J, Baldwin C, Youngquist ST. Implementation of pit crew approach and cardiopulmonary resuscitation metrics for out-of-hospital cardiac arrest improves patient survival and neurological outcome. *J Am Hear Assoc*. 2016;5

12. Hostler D, Everson-Stewart S, Rea TD, et al. Effect of real-time feedback during CPR. *BMJ*. 2011;342: d512
13. Huang CH, Yu PH, Tsai MS, et al. Acute hospital administration of amiodarone and/or lidocaine in shockable patients presenting with out-of-hospital cardiac arrest: a nationwide cohort study. *Int J Cardiol*. 2017; 227:292–8
14. Jacobs I, Hadkarni V, Bahr J, et al. Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. *Circulation*. 2004;110(21):3385–97
15. Kleinman ME, Brennan EE, Goldberger ZD, et al. Part 5: Adult Basic Life Support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;312(18 Suppl 2): S414–35
16. Kronick SL, Kurz MC, Lin S, et al. Part 4: systems of care and continuous quality improvement: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S397–413
17. Kudenchuk PJ, Brown SP, Daya M, et al. Amiodarone, lidocaine, or placebo in out-of-hospital cardiac arrest. *N Engl J Med*. 2016;374(18):1711–1722
18. Kudenchuk PJ, Cobb LA, Copass MK, et al. Amiodarone for resuscitation after out-of-hospital cardiac arrest due to ventricular fibrillation. *N Engl J Med*. 1999;341(12):871–878
19. Lavonas EJ, Drennan IR, Gabrielli A, et al. Part 10: cardiac arrest in special situations: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S501–18
20. Link MS, Berkow LC, Kudenchuk PJ, et al. Part 7: adult advanced cardiovascular life support: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S444–64
21. Neumar RW, Shuster M, Callaway CW, et al. Part 1: executive summary: 2015 American Heart Association guidelines update for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2) S315–67
22. Nichol G, Leroux B, Wang H, et al. Trial of continuous or interrupted chest compressions during CPR. *N Engl J Med*. 2015;373(23):2203–14
23. Sporer K, Jacobs M, Derevin L, Duval S, Pointer J. Continuous quality improvement efforts increase survival with favorable neurologic outcome after out-of-hospital cardiac arrest. *Prehospital Emerg Care*. 2017;21(1):1–6

Adult Post-ROSC (Return of Spontaneous Circulation) Care

Patient Care Goals

The immediate ROSC period is critical in stabilizing patients and preparing for transport. The goal is therefore to maximize survival and optimize neurologic and cardiovascular function following a return of spontaneous circulation by the following steps:

- Secure airway
- Obtain vascular access
- Maximize blood pressure
- Identify ST-elevation myocardial infarction (STEMI) or reversible causes of arrest Recognize pending re-arrest
- Consider appropriate destination choice

Patient Presentation

Inclusion Criteria

Patient returned to spontaneous circulation following cardiac arrest resuscitation

Exclusion Criteria

None noted

Patient Management

Assessment, Treatment, and Interventions

1. Perform general patient assessment attempting to identify cause of cardiac arrest.
2. Support life-threatening problems associated with airway, breathing, and circulation.
 - a. For example, most of the pediatric cardiac arrest occurs due to non-cardiac causes such as respiratory failure (hypoxemia) or shock (hypovolemia).
3. Monitor closely for recurrence of cardiac arrest using clinical and adjunctive criteria such as cardiac monitoring, EtCO₂ monitoring, and physical signs of perfusion
4. Administer oxygen as appropriate with a target of achieving 94–98% saturation. Do **not** hyper oxygenate.
5. Do **not** hyperventilate. Maintain a ventilation rate of 8–10 breaths per minute, targeting an EtCO₂ of 35–45 mmHg
6. For hypotension (SBP less than 90 mmHg or MAP less than 65 in adults) see [Shock Guideline](#)
7. Perform serial 12-lead EKGs to assess for evidence of reversible cause of arrest such as STEMI or electrolyte derangement (e.g., hyperkalemia)
8. Post-cardiac arrest patients with evidence or interpretation consistent with ST elevation myocardial infarction (STEMI/acute MI) should be transported preferably to a facility capable of emergent cardiac catheterization or, as a secondary option, to a STEMI receiving facility based upon local resources and system of care
9. Check blood glucose
 - a. If hypoglycemic, treat per [Hypoglycemia Guideline](#)
 - b. If hyperglycemic, notify hospital on arrival
10. If patient seizes, treat per [Seizures Guideline](#)

11. Consider transporting patients to an age-appropriate facility that offers specialized adult or pediatric post-resuscitation care

Patient Safety Considerations

1. Avoid hyperthermia (temperature greater than 37.5° C or 99.5° F) by avoiding excessive environmental heat exposure, warm blankets, etc.
 - a. Beyond interventions to prevent hyperthermia or fever, prehospital initiation of therapeutic hypothermia (targeted temperature management) is not routinely recommended

Notes/Educational Pearls

Key Considerations

1. Hyperventilation is a significant cause of hypotension and recurrence of cardiac arrest in the post resuscitation phase and must be avoided. Similarly, hypoventilation (suggested by an EtCO₂ greater than 40–45) contributes to worsening acidosis and may precipitate re-arrest
2. Most patients are comatose immediately after resuscitation and will require airway management and ventilatory assistance
3. Many patients experience “stunning” of the cardiac muscle after ROSC. Hypotension is common, and volume resuscitation or vasopressor support is often required. Refer to the [\[Shock Guideline\]](#) for further recommendations
4. Common noncardiac causes of post-resuscitation hypotension include hyperventilation, hypovolemia, and traumatic pneumothorax from chest compressions
5. The condition of post-resuscitation patients fluctuates rapidly and continuously requiring close monitoring. A significant percentage of post-ROSC patients will re-arrest
6. Current research has demonstrated that care of patients with ROSC at specialized centers is associated with both decreased mortality and improved neurologic outcomes
7. Maintain mechanical CPR device in place in preparation for re-arrest
8. A moderate number of adult post-ROSC patients may have transient ST-elevation on EKG. Consider performing serial EKGs. Post-ROSC patients should preferentially be transported to centers capable of managing STEMI, whenever possible

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914019—Cardiac Arrest—Post Resuscitation Care

Key Documentation Elements

- Immediate post-arrest rhythms, vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) and oxygen saturation
- Post-ROSC 12-lead EKG

Performance Measures

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

References

1. Aufderheide TP, Lurie KG. Death by hyperventilation: a common and life-threatening problem during cardiopulmonary resuscitation. *Crit Care Med*. 2004;32(suppl): S345–51
2. Bernard SA, Gray TW, Buist MD, et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. *N Engl J Med*. 2002; 346:557–63
3. Callaway CW, Donnino MW, Fink EL, et al. Part 8: Post cardiac arrest care: 2015 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2015;132(18 Suppl 2): S465–82
4. De Backer D et al. Comparison of dopamine and norepinephrine in the treatment of shock. *N Engl J Med*. 2010; 362:779–89
5. Garot P, Lefevre T, Eltchaninoff H, et al. Six-month outcome of emergency percutaneous coronary intervention in resuscitated patients after cardiac arrest complicating ST-elevation myocardial infarction. *Circulation*. 2007;115(11):1354–62
6. *Highlights of the 2020 American Heart Association's* https://cpr.heart.org/-/media/cpr-files/cpr-guidelines-files/highlights/hghlights_2020_ecc_guidelines_english.pdf. Accessed
7. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest. *JAMA*. 2014;311(1):45–52
8. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest: a randomized clinical trial. *JAMA*. 2014;311(1):45–52
9. Kim F, Olsufka M, Longstreth WT Jr., et al. Pilot randomized clinical trial of prehospital induction of mild hypothermia in out-of-hospital cardiac arrest patients with a rapid infusion of 4°C normal saline. *Circulation*. 2007;115(24):3064–70
10. Kliegel A, Janata A, Wandaller C, et al. Cold infusions alone are effective for induction of therapeutic hypothermia but do not keep patients cool after cardiac arrest. *Resuscitation*. 2007;73(1):46–53
11. Nielsen N, Wetterslev J, Cronberg T, et al. Targeted temperature management at 33 degrees C versus 36 degrees C after cardiac arrest. *N Engl J Med*. 2013;369(23):2197–206
12. Nolan JP, Neumar RW, Adrie C, et al. Post-cardiac arrest syndrome: epidemiology, pathophysiology, treatment, and prognostication. A scientific statement from the International Liaison Committee on Resuscitation; the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesia; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; the Council on Stroke. *Circulation*. 2008;79(3):350–79
13. Oddo M, Schaller MD, Feihl F, Ribordy V, Liaudet L. From evidence to clinical practice: effective implementation of therapeutic hypothermia to improve patient outcome after cardiac arrest. *Crit Care Med*. 2006;34(7):1865–73
14. Quintero-Moran B, Moreno R, Villarreal S, et al. Percutaneous coronary intervention for cardiac arrest secondary to ST-elevation acute myocardial infarction: influence of immediate paramedical/medical assistance on clinical outcome. *J Invasive Cardiol*. 2006;18(6):269–72
15. Vega RM, Kaur H, Edemekong PF. Cardiopulmonary Arrest in Children. [Updated 2020 Jul 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan
16. Vereczeki V, Martin E, Rosenthal RE, Hof PR, Hoffman GE, Fiskum G. Normoxic resuscitation after cardiac arrest protects against hippocampal oxidative stress, metabolic dysfunction, and neuronal death. *J Cereb Blood Flow Metab*. 2006;26(6):821–35
17. Virkkunen I, Yli-Hankala A, Silvast T. Induction of therapeutic hypothermia after cardiac arrest in prehospital patients using ice-cold Ringer's solution: a pilot study. *Resuscitation*. 2004;62(3):299–302

Determination of Death/Withholding Resuscitative Efforts

Patient Care Goals

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

Patient Presentation

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

Inclusion/Exclusion Criteria

1. Resuscitation should be started on all patients who are found apneic and pulseless unless the following conditions exist (does not apply to victims of lightning strikes, drowning, or hypothermia):
 - a. Medical cause or traumatic injury or body condition clearly indicating biological death (irreversible brain death), limited to:
 - i. Decapitation: Complete severing of the head from remainder of the patient's body
 - ii. Decomposition or putrefaction: the skin is bloated or ruptured, with or without soft tissue sloughed off. The presence of at least one of these signs indicated death occurred at least 24 hours previously
 - iii. Transection of the torso: The body is completely cut across below the shoulders and above the hips through all major organs and vessels. The spinal column may or may not be severed
 - iv. Incineration: 90% of body surface area with full thickness burns as exhibited by ash rather than clothing and complete absence of body hair with charred skin
 - v. Injuries incompatible with life (such as massive crush injury, complete exsanguination, severe displacement of brain matter)
 - vi. Futile and inhumane attempts as determined by agency policy/protocol related to "compelling reasons" for withholding resuscitation
 - vii. In blunt and penetrating trauma, if the patient is apneic, pulseless, and without other signs of life upon EMS arrival including, but not limited to spontaneous movement, EKG activity, or pupillary response
 - viii. Nontraumatic arrest with obvious signs of death including dependent lividity or rigor mortis
 - ix. Frozen (chest wall too stiff to compress or nose/mouth blocked by ice
 - OR**
 - b. A valid DNR order (form, card, bracelet) or other actionable medical order (e.g., Physician Orders for Life-Sustaining Treatment (POLST)/Medical Orders for Life-Sustaining Treatment (MOLST) form) is present, and it:
 - i. Conforms to the state specifications for color and construction
 - ii. Is intact: it has not been cut, broken, or shows signs of being repaired
 - iii. Displays the patient's name and, if required by state law or regulation, the physician's
2. Comfort one: If a person wishes to direct emergency medical service personnel to withhold resuscitation attempts when the person is in cardiopulmonary arrest, the person may

complete a standard form for an EMS cardiopulmonary resuscitation direct as provided by SDCL 34-12F.

If you are presented with the Comfort One form or encounter a patient wearing a Comfort One bracelet, South Dakota law requires that you follow the Comfort One/South Dakota EMS Cardiopulmonary Resuscitation Directive protocols

- a. Assist in maintenance of an open airway, excluding advanced airway procedures such as the insertion so supraglottic airway or endotracheal intubation
- b. Provide suction
- c. Provide oxygen
- d. Provide pain medication as directed by patient's physician, physician assistant, or nurse practitioner
- e. Control bleeding
- f. Provide comfort care
- g. Be supportive to patient and family

If someone else has already begun resuscitating a Comfort One patient prior to your arrival, you WILL WITHHOLD OR WITHDRAW

- a. Chest compressions
- b. Defibrillation
- c. Advanced airway procedures
- d. Assisted breathing
- e. Resuscitation medications

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 should be discontinued, and medical direction contacted as needed
3. If any of the findings are different than those described above, clinical death is not confirmed, and resuscitative measures should be immediately initiated or continued. The [Termination of Resuscitative Efforts Guideline](#) should then be implemented
4. Do Not Resuscitate (DNR) 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 contact medical direction
 - c. If there is documentation of a Do Not Intubate (DNI/MOLST/POLST) advanced directive, the patient should receive full treatment per protocols except for 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, contact medical direction

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 medical direction

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

None noted

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- Clinical/situational details that may be available from bystanders/caregivers
- Documentation of details surrounding decision to determine death
 - Time of contact with medical direction
 - Time of death determination
- Names/contact information for significant bystanders

Performance Measures

None noted

References

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

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

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 clinician to be valid
 - b. Do Not Resuscitate (DNR) order—identifies that CPR and intubation are not to be initiated if the patient is in arrest or peri-arrest. The interventions covered by this order and the details around when to implement them can vary widely
 - c. Advance directives—document that describes acceptable treatments under a variable number of clinical situations including some or all the following: what to do for cardiac arrest, whether artificial nutrition is acceptable, organ donation wishes, dialysis, and other parameters. The directives frequently do not apply to emergent or potentially transient medical conditions
 - d. As specified from state to state, in the absence of formal written directions (MOLST, POLST, DNR, advanced directives), and in the presence of a person with power of attorney for healthcare or healthcare proxy, that person may prescribe limits of treatment
2. One of the documents above is valid when it meets all 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, if required by state law or regulation, 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 medical direction 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 clinicians should provide standard appropriate treatment under existing protocols according to the patient's condition
 - a. If the patient has a MOLST or POLST, it may provide specific guidance on how to proceed in this situation
 - b. Directives should be followed as closely as possible and medical direction 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, medical direction should be contacted

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 medical direction

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

None noted

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

None noted

References

1. 'Do Not Attempt Resuscitation' in the Out-of-Hospital Setting. American College of Emergency Physicians; October 2003. ACEP Policy Statement
2. National Guidelines for Statewide Implementation of EMS "Do Not Resuscitate" (DNR) Programs National Association of Emergency Medical Services Directors and the National Association of Emergency Medical Services Physicians. *Prehos Disaster Med.* 1994;9(2):197–9

Termination of Resuscitative Efforts

Patient Care Goals

1. When there is no response to prehospital cardiac arrest treatment, it is acceptable and often preferable to cease futile resuscitation efforts in the field
2. In patients with cardiac arrest, prehospital resuscitation is initiated with the goal of returning spontaneous circulation before permanent neurologic damage occurs. In most situations, ALS clinicians are capable of performing an initial resuscitation that is equivalent to an in-hospital resuscitation attempt, and there is usually no additional benefit to emergency department resuscitation in most cases
3. CPR that is performed during patient packaging and transport is much less effective than CPR done at the scene. Additionally, EMS clinicians risk physical injury while attempting to perform CPR in a moving ambulance while unrestrained. In addition, continuing resuscitation in futile cases places other motorists and pedestrians at risk, increases the time that EMS crews are not available for another call, impedes emergency department care of other patients, and incurs unnecessary hospital charges. Lastly, return of spontaneous circulation is dependent on a focused, timely resuscitation. The patient in arrest should be treated as expeditiously as possible, including quality, uninterrupted CPR and timely defibrillation as indicated
4. When cardiac arrest resuscitation becomes futile, the patient's family should become the focus of the EMS clinicians. Families need to be informed of what is being done and that transporting all cardiac arrest patients to the hospital is not supported by evidence. This practice also 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.
5. Consider potential for organ donation if feasible

Patient Presentation

Patient in cardiac arrest

Inclusion Criteria

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

Exclusion Criteria

Consider continuing resuscitation for patients in cardiac arrest associated with medical conditions that may have a better outcome despite prolonged resuscitation, including hypothermia (although under certain circumstances, medical direction may order termination of resuscitation in these conditions)

Patient Management

Resuscitation may be terminated under the following circumstances:

1. Nontraumatic 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 (ALS)
 - i. No pulse
 - ii. No respirations
 - iii. No evidence of meaningful cardiac activity (e.g., asystole or wide complex PEA less than 60 BPM, no heart sounds)
 - c. ALS resuscitation is administered appropriate to the presenting and persistent cardiac rhythm
 - i. Resuscitation may be terminated for a non-perfusing rhythm if there is
 - 1. No return of spontaneous circulation after 20 minutes in the absence of hypothermia
 - AND**
 - 2. The EtCO₂ is less than 20 mmHg
 - d. There is no return of spontaneous pulse and no evidence of neurological function (non- reactive pupils, no response to pain, no spontaneous movement)
 - e. No evidence or suspicion of hypothermia
 - f. All EMS clinicians involved in the patient's care agree that discontinuation of the resuscitation is appropriate
 - g. May consider contacting medical direction 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 asystole on an EKG or cardiac monitor upon arrival of emergency medical services at the scene and bilateral chest decompression has been considered or performed.
 - 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
 - d. Cardiopulmonary arrest patients in whom mechanism of injury does not correlate with clinical condition, suggesting a nontraumatic 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. May consider contacting medical direction before termination of resuscitative efforts

Assessment

- 1. Pulse
- 2. Respirations
- 3. Neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#); purposeful movement, pupillary response]
- 4. Cardiac activity
- 5. vity (cardiac auscultation, cardiac monitoring, and/or, if available,ultrasonography)
- 6. Quantitative capnography

Treatment and Interventions

1. Focus on continuous, quality CPR that is initiated as soon as possible
2. Focus attention on the family and/or bystanders. Explain the rationale for termination
3. Consider support for family members such as other family, friends, clergy, faith leaders, or chaplains
4. For patients that are less than 18 years of age, consultation with medical direction is recommended

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations and Pertinent Assessment Findings

1. Recent evidence has shown that, to capture over 99% of potential survivors from medical cardiac arrest (especially VF and pulseless VT arrests), resuscitation should be continued for approximately 40 minutes. This does not imply, however, that all resuscitations should continue this long (e.g., asystolic rhythms)
2. In remote or wilderness situations, EMS clinicians should make every effort to contact medical direction, but resuscitation may be terminated in the field without contacting medical direction when the following have occurred:
 - a. There has been no return of pulse despite greater than 30 minutes of CPR (this does not apply in the case of hypothermia)
 - b. Transport to an emergency department will take greater than 30 minutes (this does not apply in the case of hypothermia)
 - c. EMS clinicians are exhausted, and it is physically impossible to continue the resuscitation
3. Logistical factors should be considered, such as collapse in a public place, family wishes, and safety of the crew and public
4. Survival and functional neurologic outcomes are unlikely if ROSC is not obtained by EMS. It is dangerous to crew, pedestrians, and other motorists to attempt to resuscitate a patient during ambulance transport
5. Quantitative EtCO₂ measurements of less than 10 mmHg or falling greater than 25% despite resuscitation indicates a poor prognosis and provide additional support for termination

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

1. American College of Emergency Physicians. Discontinuing resuscitation in the out-of-hospital setting. *Ann Emerg Med.* 2008;52(5):592
2. Cha WC, Lee EJ, Hwang SS. The duration of cardiopulmonary resuscitation in emergency departments after out-of-hospital cardiac arrest is associated with the outcome: A nationwide observational study. *Resuscitation.* 2015; 96:323–7
3. 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;26(3):148–50
4. Fallat ME, American College of Surgeons Committee on Trauma, American College of Emergency Physicians, National Association of EMS Physicians, American Academy of Pediatrics. Withholding or termination of resuscitation in pediatric out-of-hospital traumatic cardiopulmonary arrest. *Pediatrics.* 2014 Apr; 133(4): e1104–16
5. Goldberger ZD, Chan PS, Berg RA, et al. Duration of resuscitation efforts and survival after in-hospital cardiac arrest: an observational study. *Lancet.* 2012;380(9852):1473–81
6. Goto Y, Funada A, Goto Y. Duration of prehospital cardiopulmonary resuscitation and favorable neurological outcomes for pediatric out-of-hospital cardiac arrests: a nationwide, population-based cohort study. *Circulation.* 2016;(1):1–10
7. Hung SC, Mou CY, Hung HC, Lin IH, Lai SW, Huang JY. Chest compression fraction in ambulance while transporting patients with out-of-hospital cardiac arrest to the hospital in rural Taiwan. *Emerg Med J.* 2016; 0:1–4
8. Kim F, Nichol G, Maynard C, et al. Effect of prehospital induction of mild hypothermia on survival and neurological status among adults with cardiac arrest. *JAMA.* 2014;311(1):45–52
9. Matsuyama T, Kitamura T, Kiyohara K, et al. Impact of cardiopulmonary resuscitation duration on neurologically favourable outcome after out-of-hospital cardiac arrest: a population-based study in Japan. *Resuscitation.* 2017; 113:1–7

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

Resuscitation in Traumatic Cardiac Arrest

Patient Care Goals

1. Return of spontaneous circulation
2. Treatment and resolution of the underlying pathophysiology leading to the traumatic cardiac arrest
3. When appropriate, transport to the closest and most capable hospital within the defined trauma system

Patient Presentation

Inclusion Criteria

Patients suffering blunt or penetrating trauma with cardiac arrest after arrival of EMS clinicians or while under care of EMS clinicians (witnessed arrest or recent arrest with continued signs of life)

Exclusion Criteria

1. When the mechanism of injury does not correlate with the clinical condition, suggesting a nontraumatic cause of cardiac arrest, standard resuscitative measures should be followed. In such cases, refer to the [Resuscitation Section](#)
2. In victims of blunt or penetrating trauma with pulses or other signs of life on EMS clinician assessment refer to the [General Trauma Management Guideline](#)
3. In victims of blunt or penetrating trauma with rigor mortis, lividity, or evidence of injuries incompatible with life (including decapitation, hemicorporectomy). In such cases, refer to [Determination of Death/Withholding Resuscitative Efforts Guideline](#)
4. Resuscitation efforts may be withheld 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. In such cases, refer to the [Determination of Death/Withholding Resuscitative Efforts Guideline](#)
5. Resuscitation efforts may be withheld in victims of **penetrating** trauma found apneic, pulseless, and without other signs of life including pupillary reflexes, respiratory effort, spontaneous movement, response to pain, and electrical activity on EKG. In such cases, refer to the [Determination of Death/Withholding Resuscitative Efforts Guideline](#)

Patient Management

Assessment

1. Management of traumatic cardiac arrest requires a balance of rapid, focused evaluation followed by prompt treatment of reversible life threats, including management of massive hemorrhage, airway management, decompression of tension pneumothorax, and resuscitation
2. Assess for signs of life, including pulses, respiratory effort, and evaluation of other signs of life
3. Assess for evidence of massive hemorrhage
 - a. Including evidence of massive external hemorrhage
 - b. Evidence of pelvic injury (such as instability)
4. Assess the patient's airway
5. Assess the patient's respiratory effort, if present, or for evidence of tension pneumothorax
6. Assess vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment)

Treatment and Interventions

1. In blunt and penetrating trauma, if the patient is apneic, pulseless, and without other signs of life upon EMS arrival including, but not limited to spontaneous movement, EKG activity, or pupillary response—perform bilateral, rapid chest decompression. May use Capnospot.
2. If return of pulses, refer to [General Trauma Management Guideline](#).

Patient Safety Considerations

None noted

Notes/Educational Pearls

Key Considerations

1. Survival from traumatic cardiac arrest requires careful coordination between rapid prehospital assessment, EMS clinician treatment of reversible causes of traumatic cardiac arrest and transport that is rapid, but also allows maintenance of necessary therapies in a manner that is effective for patients as well as safe for EMS clinicians
2. Evidence for the benefit of CPR in traumatic cardiac arrest is limited. Treatment priorities should initially focus on control of massive hemorrhage (including management of pelvis fractures), airway management, and consideration of bilateral needle thoracostomy. If CPR is performed at all, it should be performed en route to the hospital but only if it can be performed in a safe and effective manner by EMS clinicians
3. Unless there is an immediate and correctable cause, patients suffering traumatic cardiac arrest have the best chance for survival when arrival time to a hospital is within minutes
4. If transport is initiated, consider the ACS-COT's Once the above treatments and interventions have been performed, patients should be transported to the closest appropriate hospital within the defined trauma system
5. In an effort to reduce on-scene time, consider IV/IO access and initiation of resuscitation during transport
6. Optimal choices for resuscitation are (in descending order as available) as follows: whole blood, balanced blood products (red blood cells (RBC), plasma), packed red blood cells alone, liquid, or freeze-dried plasma alone, no fluid resuscitation. Excessive crystalloid and colloid have little to no value and may in fact be harmful in hemorrhagic shock
7. Consider the duration of resuscitation and transport, contact online medical direction if available to discuss. If termination of resuscitation is advised, refer to the [Termination of Resuscitation Efforts Guideline](#)

Pertinent Assessment Findings

1. Evidence of injuries incompatible with life
2. Evidence of signs of life

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

None noted

Key Documentation Elements

- Mechanism of injury
- Primary survey findings
- Secondary survey findings
- Scene time
- Procedures performed and patient response

Performance Measures

- Scene time
- Appropriateness of procedures, including airway management, hemorrhage control, needle thoracostomy, intravenous access and resuscitation
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Weight value in kilograms or length-based weight entered for patients less than 15 years old when Type of Service Requested = 2205001—911 Response (Scene)*

References

1. Evans C, Quinlan D, Engels P, Sherbino J. Reanimating patients after traumatic cardiac arrest: a practical approach informed by best evidence. *Emerg Med Clin N Am.* 36 (2018) 19–40
2. Millin MG, Galvagno SM, Khandker SR, Malki A, Bulger EM. Withholding and termination of resuscitation of adult cardiopulmonary arrest secondary to trauma: resource document to the joint NAEMSP-ACSCOT position statements. *J Trauma Acute Care Surg.* 2013;75(3):459–467. doi: 10.1097/TA.0b013e31829cfaea
3. The Royal College of Emergency Medicine. Traumatic cardiac arrest in adults best practice guideline. Sept 2019. From the website: https://rcem.ac.uk/wp-content/uploads/2021/10/RCEM_Traumatic_Cardiac_Arrest_Sept2019_FINAL.pdf. Accessed

PEDIATRIC-SPECIFIC GUIDELINES



Brief Resolved Unexplained Event (BRUE) & Acute Events in Infants

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. **Suspected BRUE:** An event in an infant less than 1 year old reported by a bystander as sudden, brief (less than 1 minute), unexplained, and completely resolved upon EMS arrival that includes one or more of the following
 - a. Breathing change (absent, decreased, or irregular)
 - b. Color change (central cyanosis or pallor)
 - c. Marked change in muscle tone (hyper- or hypotonia)
 - d. Altered level of responsiveness (increased, irritability, or decreased)

Exclusion Criteria

1. Any signs or symptoms suggestive of underlying or acute illness or injury present upon EMS evaluation, such as:
 - a. Abnormal vital signs for age (including fever)
 - b. Vomiting
 - c. Signs of trauma
 - d. Noisy or labored breathing
2. Identifiable cause for the event, such as:
 - a. Gastric reflux (spitting up)
 - b. Swallowing dysfunction
 - c. Nasal congestion or excessive secretions from the nose and/or mouth
 - d. Periodic breathing of the newborn
 - e. Breath-holding spell
 - f. Change in tone associated with choking, gagging, crying, feeding
 - g. Seizure (e.g., eye deviation, nystagmus, tonic-clonic activity)
 - h. Hypoglycemia
 - i. Significant past medical history (e.g., congenital heart disease, pulmonary disease, VP shunt, or seizure disorder)
 - j. Need for IV medication administration
3. History or exam concerning for child abuse or neglect
4. Color change that involved only redness (e.g., in the face) or isolated hands/feet cyanosis

Patient Management

Assessment

1. History
 - a. History of circumstances and symptoms before, during, and after the event, including duration, interventions done, as well as patient color, tone, breathing, feeding, position, location, activity, and level of consciousness
 - b. Other concurrent symptoms (e.g., fever, congestion, cough, rhinorrhea, vomiting, diarrhea, rash, labored breathing, fussy, less active, poor sleep, poor feeding)
 - c. Prior history of BRUE (ever, including past 24 hours)
 - d. Past medical history (e.g., prematurity, prenatal/birth complications, gastric reflux, congenital heart disease, developmental delay, airway abnormalities, breathing problems, prior hospitalizations, surgeries, or injuries)
 - e. Family history of sudden unexplained death or cardiac arrhythmia in other children or young adults
 - f. Social history: those living at home, recent household stressors, exposures to toxins/drugs, sick contacts
 - g. Considerations for possible child abuse (i.e., multiple/changing versions of the story or reported mechanism of injury does not seem plausible, especially for child's developmental stage) [See [Abuse and Maltreatment Guideline](#)]
2. Exam
 - a. Full set of vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment)
 - b. General assessment:
 - i. Signs of respiratory distress or increased work of breathing (e.g., tachypnea, grunting or other abnormal breath sounds, nasal flaring, retracting, or head bobbing)
 - ii. Color, both central and peripheral (pallor, cyanosis, redness, or normal), capillary refill
 - iii. Mental status (alert, tired, lethargic, unresponsive, or irritable)
 - c. Head to toe exam, including:
 - i. Physical exam for signs of trauma or neglect
 - ii. Pupillary response and anterior fontanelle

Treatment and Interventions

1. Monitoring (all patients with possible BRUE)
 - a. Continuous cardiac monitor
 - b. Continuous pulse oximetry
 - c. Serial observations during transport for change in condition
 - d. Check point-of-care (POC) blood glucose and treat symptomatic hypoglycemia [See [Hypoglycemia Guideline](#)]

2. Airway
 - a. Give supplemental oxygen for signs of respiratory distress or hypoxemia—escalate from a nasal cannula to a simple face mask to a non-rebreather mask as needed [See [Airway Management Guideline](#)]
 - b. Suction excessive secretions from the nose and/or mouth (using bulb syringe or suction catheter) [See [Pediatric Respiratory Distress \(Bronchiolitis\) Guideline](#)]
3. Utility of IV placement and fluids
 - a. Routine IVs should **not** be placed on all suspected BRUE patients
 - b. IVs should be placed only for clinical concerns of shock or to administer IV medications
4. Transport the patient to the appropriate facility even if they appear well or have returned to their baseline

Patient Safety Considerations

1. Regardless of the patient's well appearance, all infants with a history of signs or symptoms suggestive of BRUE should be transported for further evaluation
 - a. By definition, infants who are not completely well-appearing at EMS evaluation do not meet the definition of possible BRUE and should be treated and transported according to local guidelines
2. Destination considerations
 - a. All patients should be transported to facilities with at least baseline pediatric readiness, i.e., appropriate equipment, resources, and trained staff capable of providing initial emergency care and stabilization to pediatric patients prior to hospital admission or interfacility transfer, if feasible
 - b. Consider transport to a facility with pediatric critical care capability for patients with any **high-risk criteria**:

- i. Less than 2 months of age
- ii. History of prematurity (less than or equal to 32 weeks gestation)
- iii. More than one BRUE, now or in the past

Notes/Educational Pearls

Key Considerations

1. BRUE is a group of symptoms, not a disease process
2. If the infant is not completely well upon EMS arrival, this excludes possible BRUE event:
 - a. Treat and transport according to local guidelines
3. Avoid using “BRUE”, “ALTE”, “SIDS” (sudden infant death syndrome), or “near-miss SIDS” terminology with parent/guardian
4. EMS clinicians play a unique and important role in obtaining an accurate history soon after the event and in observing, documenting, and reporting environmental, scene and social indicators that may point to an alternate diagnosis

5. High-risk patients with a possible BRUE have worse outcomes and may require emergency department (ED) or inpatient testing, intervention, and/or follow-up
6. The determination of a BRUE is made only after hospital evaluation, not in the field:
 - a. A few of these infants will die even after hospital evaluation and treatment
7. All patients should be transported to an ED
8. Contact medical direction if parent/guardian is refusing medical care and/or transport, especially if any [high-risk criteria](#) are present

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914197—Medical—Apparent Life-Threatening Event (ALTE)

Key Documentation Elements

- Document key aspect of history
 - The event:
 - Breathing (apnea or respiratory distress)
 - Color change (central and/or peripheral)
 - Change in muscle tone
 - Level of responsiveness
 - Event duration
 - Witnessed?
 - Preevent circumstances and history
 - Event associated with feeding or other activity
 - History of prematurity
 - Prior BRUE events (ever or in past 24 hours)
 - Past medical history, especially cardiac, respiratory, gastrointestinal, neurologic
 - Caregiver resuscitation efforts
 - Post-event symptoms and circumstances
- Document key aspects of the exam and assess for changes after each intervention:
 - Full set of vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment), temperature, and O₂ saturation
 - Respiratory effort
 - Mental status including pupillary reaction and pediatric Glasgow Coma Score (GCS) or AVPU
 - Color (central and peripheral) and capillary refill
 - Presence of signs of abuse, trauma, or neglect
- Document environmental and scene/social clues, especially those suggesting abuse, neglect, nonaccidental trauma, or unsafe sleeping practices

Performance Measures

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

References

Key Reference

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

Supplemental References

1. Alhaboob AA. Clinical Characteristics and Outcomes of Patients Admitted with Brief Resolved Unexplained Events to a Tertiary Care Pediatric Intensive Care Unit. *Cureus*. 2020;12(6): e8664
2. Al-Kindy H, Gelinas J, Hatzakis G, Cote A. Risk factors for extreme events in infant hospitalized for apparent life-threatening events. *J Pediatr*. 2009;154(3):332–7
3. Arane K, Claudius I, Goldman RD. Brief resolved unexplained event: new diagnosis in infants. *Can Fam Phys*. Jan 2017; 63:39–41
4. Bastin JP. Brief Resolved Unexplained Events in Infants. *JAAPA*. 2019;32(7):38–40
5. Benham-Terneus M, Clemente M. SIDS, BRUE, and Safe Sleep Guidelines. *Pediatr in Rev*. 2019;40(9):443–455
6. Brand DA, Fazzari MJ. Risk of Death in Infants Who Have Experienced a Brief Resolved Unexplained Event: A Meta-Analysis. *J Pediatr*. 2018; 197:63–67
7. Bonkowsky J, Guenther E, Filloux F, Srivastava R. Death, child abuse, and adverse neurologic outcome of infants after an apparent life-threatening event. *Pediatrics*. 2008;122(1):125–31
8. Colombo M, Katz ES, Bosco A, Melzi mL, Nosetti L. Brief resolved unexplained events: Retrospective validation of diagnostic criteria and risk stratification. *Pediatric Pulmonology*. 2019; 54:61–65
9. Delaroche AM, Mittal MK. But What Was “It”? Talking to Parents About BRUE. *Hosp Pediatr*. July 2019;9(7):566–568
10. Delaroche AM, Haddad R, Farooqi A, Sapién RE, Tieder JS. Outcome Prediction of Higher-Risk Brief Resolved Unexplained Events. *Hosp Pediatr*. April 2020;10(4):303-310
11. Gausche-Hill M, Eckstein M, Horeczko T, McGrath N, Kurobe A, et al. Paramedics Accurately Apply the Pediatric Assessment Triangle to Drive Management. *Prehosp Emerg Care*. 2014;18(4):52–530.
12. Gausche-Hill M, Schmitz C, Lewis RL. Pediatric Preparedness of US Emergency Departments: A 2003 Survey. *Pediatrics*. Dec 2007;120(6):1229–37
13. Gerber NL, Fawcett KJ, Weber EG, Patel R, Glick AF et al. Brief Resolved Unexplained Event: Not Just a New Name for Apparent Life-Threatening Event. *Pediatr Emerg Care*. 2020; May 28. doi: 10.1097/PEC.0000000000002069. Epub ahead of print. PMID: 32472924
14. Guenther E, Powers A, Srivastava R, Bonkowsky JL. Abusive head trauma in children presenting with an apparent life-threatening event. *J Pediatr*. 2010;157(5):821–5

15. Haddad R, Parker S, Farooqi A, Delaroche AM. Diagnostic Evaluation Low Yield for Patients with a Lower-Risk Brief Resolved Unexplained Event. *Global Pediatr Health*. February 2021; 8:1–7
16. Kaji A, Claudius I, Santillanes G, et al. Apparent life-threatening event: multicenter prospective cohort study to develop a clinical decision rule for admission to the hospital. *Ann Emerg Med*. 2013;61(4):379–87
17. Kaji A, Claudius I, Santillanes G, et al. Do infants less than 12 months of age with an apparent life-threatening event need transport to a pediatric critical care center? *Prehosp Emerg Care*. 2013; Vol 17(3):304–11
18. Meyer JS, Stensland EG, Murzycki J, Gulen CR, Evindar A, Cardoso MZ. Retrospective Application of BRUE Criteria to Patients Presenting with ALTE. *Hosp Pediatr*. 2018;8(12):740– 745
19. Middleton KR, Burt CW. Availability of pediatric services and equipment in emergency departments: United States, 2002–03. *Adv Data*. 2006; 367:1–16
20. Mittal M, Sun G, Baren JM. A clinical decision rule to identify infants with apparent life-threatening event who can be discharged from the emergency department. *Pediatric Emerg Care*. 2012; 28:599–605
21. Oglesbee SJ, Roberts MH, Sapién RE. Implementing lower-risk brief resolved unexplained events guidelines reduces admissions in a modelled population. *J Eval Clin Pract*. 2020; 26:343–356
22. Parker K, Pitetti R. Mortality and child abuse in children presenting with apparent life-threatening events. *Ped Emerg Care*. 2011;27(7):591–5
23. Prezioso G, Perrone S, Biasucci G, Pisi G, Fainardi V, et al. Management of Infants with Brief Resolved Unexplained Events (BRUE) and Apparent Life-Threatening Events (ALTE): A RAND/UCLA Appropriateness Approach. *MDPI Life*. 2021;11(171):<https://doi.org/10.3390/life11020171>
24. Ramgopal S, Noorbakhsh KA, Callaway CW, Wilson PM, Pitetti RD. Changes in the Management of Children with Brief Resolved Unexplained Events (BRUEs). *Pediatr*. October 2019;144(4): e20190375
25. Ramgopal S, Soung J, Pitetti RD. Brief Resolved Unexplained Events: An Analysis of an Apparent Life Threatening Event Database. *Acad Pediatr*. November-December 2019;19(8):963–968
26. Remick K, Gausche-Hill M, Joseph MM, Brown K, Snow SK et al. Pediatric Readiness in the Emergency Department. *Pediatrics*. November 2018;142(5): e20182459.
27. Stiell IG, Spaite DW, Field B, Nesbitt LP, Munkley D, Maloney J, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med*. 2007;356(21):2156–64
28. Stratton S, Taves A, Lewis R, Clements H, Henderson D, McCollough M. Apparent life-threatening events in infants: high-risk in the out-of-hospital environment. *Ann Emerg Med*. 2004; 43:711–7
29. Tieder JS, Altman RL, Bonkowsky JL, et al. Management of apparent life-threatening events in infants: a systematic review. *J Pediatr*. 2013; 163:94–9
30. Tieder JS. Weird Baby Things or Brief Resolved Unexplained Events? *Hosp Pediatr*. 2018;8(12):799–800

Pediatric Respiratory Distress (Bronchiolitis)

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Child less than 2 years of age typically with diffuse rhonchi and/or wheezing with a viral or other undifferentiated illness characterized by rhinorrhea, cough, fever, tachypnea, and/or respiratory distress

Exclusion Criteria

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

Patient Management

Assessment

1. History
 - a. Onset of symptoms
 - b. Concurrent symptoms (e.g., fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
 - c. Sick contacts
 - d. History of wheezing
 - e. Respiratory and other treatments given
 - f. Number of emergency department visits in the past year
 - g. Number of admissions in the past year
 - h. Number of intensive care unit (ICU) admissions ever (including pediatric ICU (PICU) and neonatal ICU (NICU))
 - i. History of prematurity
 - j. Family history of asthma, eczema, or allergies
 - k. Change in feeding patterns and/or number of wet diapers

2. Exam

- a. Full set of vital signs (pulse, blood pressure, respiratory rate, and neurologic status assessment) temperature, and O₂ saturation
- b. Air entry (normal vs. diminished)
- c. Breath sounds (wheezes, crackles, rales, rhonchi, diminished, clear)
- d. Signs of distress (grunting, nasal flaring, retracting, accessory muscle use)
- 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, mucous membranes (moist vs. tacky), fontanel (flat vs. sunken))

Treatment and Interventions

1. Pulse oximetry and end-tidal capnography (EtCO₂) should be routinely used as an adjunct to other forms of respiratory monitoring
2. Perform EKG only if 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 nonbreather mask as needed, to maintain normal oxygenation (goal SpO₂ 94-98%)
 - b. Suction the nose and/or mouth (via bulb or suction catheter) particularly if excessive secretions are present
4. Inhaled medications—nebulized epinephrine 5 mg (5 mL of 1 mg/mL solution) should be administered to children in severe respiratory distress with bronchiolitis in the prehospital setting if other treatments (e.g., suctioning, oxygen) fail to result in clinical improvement. If immediate reassessment after treatment does *not* demonstrate clinical improvement, airway management should be escalated as necessary (see *below* and refer to [Airway Management Guideline](#))
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. Otherwise, IV access is not routinely needed in bronchiolitis.
6. Steroids are not efficacious and should not be given
7. Improvement of oxygenation and/or respiratory distress with non-invasive airway adjuncts
 - a. Bag-valve-mask ventilation should be utilized in children with respiratory failure or impending respiratory failure
8. Supraglottic devices and intubation
 - a. Supraglottic devices and intubation should be utilized only if bag-valve-mask (BVM) 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. Insufficient data exist to recommend the use of inhaled steam or nebulized saline
3. Although albuterol and steroids have previously been a consideration, the most recent evidence does not demonstrate a benefit in routine use of albuterol or steroids for bronchiolitis
4. Ipratropium and other anticholinergic agents should not be given to children with bronchiolitis in the prehospital setting
5. Although 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.

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

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

Performance Measures

- Supplemental oxygen, high flow oxygen by nasal cannula (HFNC), time to administration of specified interventions in the protocol
- Rate of administration of accepted therapy (whether certain medications/interventions were given)
- Change in vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) temperature, O₂ saturation and capnography values)
- Time to administration of specified interventions in the protocol
- Number of advanced airway attempts
- Mortality

References

1. Abramo TJ, Wiebe RA, Scott SM, Primm PA, McIntyre D, Mydlyer T. Noninvasive capnometry in a pediatric population with respiratory emergencies. *Pediatr Emerg Care*. 1996;12(4):252–4
2. Al-Ansari K, Sakran M, Davidson BL, El Sayyed R, Mahjoub H, Ibrahim K. Nebulized 5% or 3% hypertonic or 0.9% saline for treating acute bronchiolitis in infants. *J Pediatr*. 2010;157(4): 630–4
3. Cambonie G, Milési C, Jaber S, et al. Nasal continuous positive airway pressure decreases respiratory muscles overload in young infants with severe acute viral bronchiolitis. *Intensive Care Med*. 2008;34(10):1865–72
4. Chavasse R, Seddon P, Bara A, McKean M. Short acting beta2-agonists for recurrent wheeze in children under two years old. *Cochrane Database Syst Rev*. 2002;(3):CD002873
5. Chowdhury MM, McKenzie SA, Pearson CC, et al. Heliox therapy in bronchiolitis: phase III multicenter double-blind randomized controlled trial. *Pediatrics*. 2013;131(4):661–9
6. Corneli HM, Zorc JJ, Mahajan P, et al. A multicenter, randomized, controlled trial of dexamethasone for bronchiolitis. *N Engl J Med*. 2007;357(4):331–9
7. Denver Metro Airway Study Group. A prospective multicenter evaluation of prehospital airway management performance in a large metropolitan region. *Prehosp Emerg Care*. 2009;13(3):304–10
8. Ehrlich PF, Seidman PS, Atallah O, Haque A, Helmkamp J. Endotracheal intubations in rural pediatric trauma patients. *J Pediatr Surg*. 2004;39(9):1376–80
9. Everard ML, Bara A, Kurian M, Elliot TM, Ducharme F. Anticholinergic drugs for wheeze in children under the age of two years. *Cochrane Database Syst Rev*. 2002;(1):CD001279
10. Freedman SB, Haladyn JK, Floh A, Kirsh JA, Taylor G, Thull-Freedman J. Pediatric myocarditis: emergency department clinical findings and diagnostic evaluation. *Pediatrics*. 2007;120(6): 1278–85
11. Gausche-Hill M, Lewis RJ, Stratton SJ, Haynes BE, Gunter CS, Goodrich SM, et al. Effect of out- of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA*. 2000;283(6):783–90
12. Grewal S, Ali S, McConnell DW, Vandermeer B, Klassen TP. A randomized trial of nebulized 3% hypertonic saline with epinephrine in the treatment of acute bronchiolitis in the emergency department. *Arch Pediatr Adolesc Med*. 2009;163(11):1007–12
13. Hartling L, Russell KF, Patel H, Klassen TP, Liang Y. Epinephrine for bronchiolitis. *Cochrane Database Syst Rev*. 2004;(1):CD003123
14. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med*. 1998;32(5):585–8
15. Ho J, Lindquist M. Time saved with the use of emergency warning lights and siren while responding to requests for emergency medical aid in a rural environment. *Prehosp Emerg Care*. 2001;5(2):159–62

16. Hunt RC, Brown LH, Cabinum ES, Whitley TW, Prasad NH, Owens JCF, et al. Is ambulance transport time with lights and siren faster than that without? *Ann Emerg Med.* 1995;25(4): 507–11
17. Javouhey E, Barats A, Richard N, Stamm D, Floret D. Non-invasive ventilation as primary ventilatory support for infants with severe bronchiolitis. *Intensive Care Med.* 2008;34(9):1608– 14
18. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med.* 2009;36(4):357–62
19. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med.* 1997;29(2):223–7
20. Lashkeri T, Howell JM, Place R. Capnometry as a predictor of admission in bronchiolitis. *Pediatr Emerg Care.* 2012;28(9):895–7
21. Liet JM, Ducruet T, Gupta V, Cambonie G. Heliox. Inhalation therapy for bronchiolitis in infants. *Cochrane Database Syst Rev.* 2010;(4):CD006915
22. Martinon-Torres F, Rodriguez-Nunez A, Martinon-Sanchez JM. Heliox therapy in infants with acute bronchiolitis. *Pediatrics.* 2002;109(1):68–73
23. Moses JM, Alexander JL, Agus MS. The correlation and level of agreement between end-tidal and blood gas PCO₂ in children with respiratory distress: a retrospective analysis. *BMC Pediatr.* 2009; 9:20
24. Mussman GM, Parker MW, Statile A, Sucharew H, Brady PW. Suctioning and length of stay in infants hospitalized with bronchiolitis. *JAMA Pediatr.* 2013;167(5):414–21
25. Ralston RL, Lieberthal H, Meissner HC, et al. Clinical practice guideline: the diagnosis, management, and prevention of bronchiolitis. *Pediatrics.* 2014;134: e1474–502
26. Skjerven HO, Hunderi JO, Brüggmann-Pieper SK, et al. Racemic adrenaline and inhalation strategies in acute bronchiolitis. *N Engl J Med.* 2013;368(24):2286–93
27. Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Hinsberg P. A prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med.* 1994;24(2):209–14
28. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med.* 2007;356(21):2156–64
29. Thia LP, McKenzie SA, Blyth TP, Minasian CC, Kozłowska WJ, Carr SB. Randomized controlled trial of nasal continuous positive airways pressure (CPAP) in bronchiolitis. *Arch Dis Child.* 2008;93(1):45–7
30. Umoren R, Odey F, Meremikwu MM. Steam inhalation or humidified oxygen for acute bronchiolitis in children up to three years old. *Cochrane Database Syst Rev.* 2011;(1):CD006435
31. Wang HE, Mann NC, Mears G, Jacobson K, Yealy DM. Out-of-hospital airway management in the United States. *Resuscitation.* 2011;82(4):378–85
32. Zhang L, Mendoza-Sassi RA, Wainwright C, Klassen TP. Nebulized hypertonic saline solution for acute bronchiolitis in infants. *Cochrane Database Syst Rev.* 2008 Oct 8;(4):CD006458

Pediatric Respiratory Distress (Croup)

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

1. History
 - a. Onset of symptoms (history of choking)
 - b. Concurrent symptoms (fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
 - c. Sick contacts
 - d. Treatments given
 - e. Personal history of asthma, wheezing, or croup in past
2. Exam
 - a. Full set of vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) temperature, and O₂ saturation
 - b. Presence of stridor at rest or when agitated
 - c. Description of cough
 - d. Other signs of distress (grunting, nasal flaring, retracting, use of accessory muscles)
 - e. Color (pallor, cyanosis, normal)
 - f. Mental status (alert, tired, lethargic, unresponsive)

Treatment and Interventions

1. Monitoring
 - a. Pulse oximetry and EtCO₂ should be routinely used as an adjunct to other forms of respiratory monitoring
2. Airway
 - a. Give supplemental oxygen. Escalate from a nasal cannula to a simple face mask to a nonbreather mask to SPO₂ 94-98%
 - b. Suction the nose and/or mouth (via bulb or suction catheter) if excessive secretions are present
3. Inhaled medications should be administered to all children with croup in respiratory distress with signs of stridor at rest—these medications should be repeated at this dose with unlimited frequency for ongoing respiratory distress
 - a. Epinephrine 5 mg (5 mL of 1 mg/mL solution) nebulized (may repeat in 20 minutes as needed)
 - b. Humidified oxygen or mist therapy is **not** indicated
4. 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
5. Improvement of oxygenation and/or respiratory distress with non-invasive airway adjuncts
 - a. Continuous positive airway pressure (CPAP) should be administered for severe respiratory distress
 - b. BVM ventilation should be utilized in children with respiratory failure
6. Supraglottic devices and intubation—should be utilized only if BVM 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, accessory muscle use)
2. Decreased oxygen saturation
3. Skin color
4. Neurologic status assessment
5. Reduction in work of breathing after treatment
6. Improved oxygenation after breathing

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

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

8. Gausche M, Lewis RJ, Stratton SJ, et al. Effect of out-of-hospital pediatric endotracheal intubation on survival and neurological outcome. *JAMA*. 2000;283(6):783–90
9. Grosz AH, Jacobs IN, Cho C, Schears GJ. Use of helium-oxygen mixture to relieve upper airway obstruction in a pediatric population. *Laryngoscope*. 2001;111(9):1512–4
10. *Guideline for the Diagnosis and Management of Croup*. Alberta, ON, Canada: Alberta Medical Association; 2015. <https://actt.albertadoctors.org/CPGs/Lists/CPGDocumentList/croup-guideline.pdf> Accessed
11. Ho J, Casey B. Time saved with use of emergency warning lights and sirens during response to requests for emergency medical aid in an urban environment. *Ann Emerg Med*. 1998;32(5):585–8
12. Hunt RC, Brown LH, Cabinum ES, et al. Is ambulance transport time with lights and siren faster than that without? *Ann Emerg Med*. 1995;25(4):507–11
13. Keahey L, Bulloch B, Becker AB, Pollack CV, Clark S, Camargo CA. Initial oxygen saturation as a predictor of admission in children presenting to the emergency department with acute asthma. *Ann Emerg Med*. 2002;40(3):300–7
14. Kline-Krammes S, Reed C, Giuliano JS Jr., et al. Heliox in children with croup: a strategy to hasten improvement. *Air Med J*. 2012;31(3):131–7
15. Kunkel NC, Baker MD. Use of racemic epinephrine, dexamethasone, and mist in the outpatient management of croup. *Pediatr Emerg Care*. 1996;12(3):156–9
16. Kuzma K, Sporer KA, Michael GE, Youngblood GM. When are prehospital intravenous catheters used for treatment? *J Emerg Med*. 2009;36(4):357–62
17. Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med*. 1997;29(2):223–7
18. Moses JM, Alexander JL, Agus MSD. The correlation and level of agreement between end-tidal and blood gas pCO₂ in children with respiratory distress: A retrospective analysis. *BMC Pediatr*. 2009; 9:20
19. Neto GM, Kentab O, Klassen TP, Osmond MH. A randomized controlled trial of mist in the acute treatment of moderate croup. *Acad Emerg Med*. 2002;9(9):873–9
20. Russell KF, Liang Y, O'Gorman K, Johnson DW, Klassen TP. Glucocorticoids for croup. *Cochrane Database Syst Rev*. 2011 Jan 19;(1):CD001955.
21. Scolnik D, Coates AL, Stephens D, Da Silva Z, Lavine E, Schuh S. Controlled delivery of high vs low humidity vs mist therapy for croup in emergency departments: a randomized controlled trial. *JAMA*. 2006;295(11):1274–80
22. Spaite DW, Valenzuela TD, Criss EA, Meislin HW, Hinsberg PA. prospective in-field comparison of intravenous line placement by urban and nonurban emergency medical services personnel. *Ann Emerg Med*. 1994;24(2):209–14
23. Stiell IG, Spaite DW, Field B, et al. Advanced life support for out-of-hospital respiratory distress. *N Engl J Med*. 2007;356(21):2156–64
24. Stoney PJ, Chakrabarti MK. Experience of pulse oximetry in children with croup. *J Laryngol Otol*. 1991;105(4):295–8
25. Vorwerk C, Coats T. Heliox for croup in children. *Cochrane Database Syst Rev*. 2012;(10):CD006822
26. Warner GS. Evaluation of the effect of prehospital application of continuous positive airway pressure therapy in acute respiratory distress. *Prehosp Disast Med*. 2010;25(1):87–91
27. Westley CR, Cotton EK, Brooks JG. Nebulized racemic epinephrine by IPPB for the treatment of croup: a double-blind study. *Am J Dis Child*. 1978;132(5):484–7

Neonatal Resuscitation

Patient Care Goals

1. Plan for resources based on number of anticipated patients (e.g., mother and newborn or multiple births)
2. Provide routine care to the newly born infant
3. Perform a neonatal assessment
4. Rapidly identify newly born infants requiring resuscitative efforts
5. Provide appropriate interventions to minimize distress in the newly born infant
6. Recognize the need for additional resources based on patient condition and/or environmental factors

Patient Presentation

Inclusion Criteria

Newly born infants

Exclusion Criteria

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

Patient Management

Assessment

1. History
 - a. Date and time of birth
 - b. Onset of symptoms
 - c. Prenatal history (prenatal care, substance abuse, multiple gestation, maternal illness)
 - d. Birth history (maternal fever, presence of meconium, maternal bleeding, difficult delivery (e.g., shoulder dystocia, prolapsed or nuchal cord, breech))
 - 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 (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 (**A**ppearance, **P**ulse, **G**rimace, **A**ctivity, **R**espiratory 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 resuscitative efforts are initiated or if supplemental oxygen is administered

Treatment and Interventions

1. If immediate resuscitation is required and the newborn is still attached to the mother, clamp the cord in two places and cut between the clamps. If no resuscitation is required, warm/dry/stimulate the newborn, and then cut/clamp the cord after 60 seconds or the cord stops pulsating
2. **Dry, warm, 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 signs of respiratory distress with airway obstruction, suction mouth then nose; routine suctioning is not recommended
4. Apply cardiac monitor, if available
5. If heart rate greater than 100 BPM
 - 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. **Ventilate:** BVM ventilation with room air at 40–60 breaths per minute
 1. Positive pressure ventilation (PPV) with bag-mask device may be initiated with room air (21% oxygen) in term and late preterm babies; otherwise use 100% oxygen
 2. Goal: SPO₂ at 10 minutes is 85–95%
 - ii. Consider endotracheal intubation per local guidelines
6. **Evaluate:** If heart rate less than 100 BPM
 - a. Initiate BVM ventilation with room air at 40–60 breaths per minute for 90 seconds with room air
 - i. Primary indicator of effective ventilation is improvement in heart rate
 - ii. Evaluate heart rate every 30 seconds
 - iii. 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; can control rate and volume by saying “squeeze, release” – squeeze the bag just until chest rise is indicated then release to allow for exhalation
 - b. If no improvement after 90 seconds, change oxygen delivery to 30% FiO₂ (fraction of inspired oxygen) if blender available, otherwise 100% FiO₂ until heart rate normalizes
 - c. Consider endotracheal intubation or supraglottic airway per local guidelines if BVM ventilation is ineffective
7. **Resuscitate:** If heart rate less than 60 BPM:
 - a. Ensure effective ventilations with supplementary oxygen and adequate chest rise
 - b. If no improvement after 30 seconds, initiate chest compressions — two-thumb-encircling-hands technique is preferred
 - c. Coordinate chest compressions with positive pressure ventilation (3:1 ratio, 90 compressions and 30 breaths per minute)

- d. Consider endotracheal intubation or supraglottic airway per local guidelines
- e. Administer epinephrine (0.1 mg/mL) 0.01 mg/kg IV/IO (preferable if access obtained) or 0.1 mg/kg via the ETT (if unable to obtain access) q 3–5 min if heart rate remains less than 60 BPM
8. Consider checking a blood glucose for ongoing resuscitation, maternal history of diabetes, ill appearing or unable to feed
9. Administer 40 ml of normal saline IV/IO for signs of shock or post-resuscitative care and repeat as time allows

Patient Safety Considerations

1. Hypothermia is common in newborns— worsens outcomes of nearly all post-natal complications
 - a. Ensure heat retention by drying the infant thoroughly, covering the head, and wrapping the baby in dry cloth
 - b. When it does not encumber necessary assessment or required interventions, “kangaroo care” (i.e., placing the infant skin-to-skin directly against mother’s chest and wrapping them together) is an effective warming technique
 - c. Newborn infants are prone to hypothermia which may lead to hypoglycemia, hypoxia, and lethargy. Aggressive warming techniques should be initiated including drying, swaddling, and warm blankets covering body and head. When available, radiant warmers or other warming adjuncts are suggested for babies who require resuscitation, especially for preterm babies. Check blood glucose and follow [Hypoglycemia Guideline](#) as appropriate
2. During transport, neonate should be appropriately secured (e.g., secured to mother with approved neonatal restraint system, car seat or isolette) and mother should be appropriately secured

Notes/Educational Pearls

Key Considerations

1. Approximately 10% of newly born infants require some assistance to begin breathing at birth and 1% require resuscitation to support perfusion
2. Most newborns require only drying, warming, and stimulating to help them transition from fetal respiration to newborn respiration. The resuscitation sequence can be remembered as ***Dry, Warm, and Stimulate—Ventilate—Evaluate—and Resuscitate***

Table 1. Assessments that are used to initiate BMV and chest compressions

		INTERVENTION INDICATED		
		Blow-by Oxygen	Bag-Mask-Ventilation (BVM)	BVM and Chest compressions
ASSESSMENT	Heart Rate (BPM)	> 100	60–100	< 60
	Respiratory Distress/Apnea	No	Yes	
	Central Cyanosis Present	Yes	Yes/No	

3. Deliveries complicated by maternal bleeding (placenta previa, vas previa, or placental abruption) place the infant at risk for hypovolemia secondary to blood loss
4. Low birth weight infants are at high-risk for hypothermia due to heat loss
5. Measuring the pulse oximetry on the right hand provides the most accurate oxygen saturation (SpO₂) in infants that are transitioning from fetal to normal circulation. At 60 seconds, 60% is the target with an increase of 5% every minute until 5 minutes of life when pulse oximetry is 80–85%

Table 2. Projected Pulse Oximetry in Infants Over Time	
Time Since Birth	Projected Increase in Pulse Oximeter Over Time
1 minute	60–65%
2 minutes	65–70%
3 minutes	70–75%
4 minutes	75–80%
5 minutes	80–85%
10 minutes	85–90%

6. Both hypoxia and excess oxygen administration can result in harm to the infant. If prolonged oxygen use is required, titrate to maintain an SPO₂ of 85–95%
7. While not ideal, a larger facemask than indicated for patient size may be used to provide BVM ventilation if an appropriately sized mask is not available. Avoid pressure over the eyes as this may result in bradycardia
8. Increase in heart rate is the most reliable indicator of effective resuscitative efforts
9. A multiple gestation delivery may require additional resources and/or clinicians
10. There is no evidence to support the routine practice of administering sodium bicarbonate for the resuscitation of newborns

11. **APGAR** scoring is not critical during the resuscitation, although it may be prognostic after 20 minutes if the **APGAR** Score remains “0” despite resuscitation

Table 3. APGAR Score			
Sign	0	1	2
Appearance:	Blue, Pale	Body pink, Extremities blue	Completely pink
Pulse:	Absent	Slow (less than 100)	≥ 100
Grimace:	No response	Grimace	Cough or Sneeze
Activity:	Limp	Some flexion	Active motion of extremities
Respirations:	Absent	Slow, Irregular	Good, Crying
Source: The Apgar Score. www.acog.org			

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 newly born infant transitioning to extrauterine life—this must be differentiated from central cyanosis

Quality Improvement

Associated NEMIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914133—Medical—Newborn/Neonatal Resuscitation

Key Documentation Elements

- Historical elements
 - Prenatal complications
 - Delivery complications
 - Date and time of birth
 - Estimated gestational age
- Physical exam findings
 - Heart rate
 - Respiratory rate
 - Respiratory effort
 - Appearance
 - **APGAR** score at 1 minute and 5 minutes

Performance Measures

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

References

1. Aziz K, Lee HC, Escobedo, MB et al. Part 5: Neonatal Resuscitation: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2020; 142; S524–S550
2. Vali P, Chandrasekharian P, Rawat M, et al. Evaluation of timing and route of epinephrine administration in a neonatal model of asphyxia arrest. *J Am Heart Assoc* 2017;6: e004402
3. Weiner GM, Zaichkin J. Textbook of neonatal resuscitation (NRP), 7th Ed. Elk Grove Village, IL: *American Academy of Pediatrics*; 2016
4. Welsford M, Nichiyama C, Shortt C, et al. Room air for initiating term newborn resuscitation: A systematic review and meta-analysis. *Pediatrics* 2019; 143

OB/GYN



Childbirth

Patient Care Goals

1. Obtain necessary history to plan for birth and resuscitation of the newborn
2. Recognize imminent birth
3. Plan for resources based on number of anticipated patients (e.g., mother and child or multiple births)
4. Assist with uncomplicated delivery of term newborn
5. Recognize complicated delivery situations (e.g., nuchal or prolapsed umbilical cord, breech delivery, shoulder dystocia) and plan for management and appropriate transport destination
6. Apply appropriate techniques when an obstetric complication exists

Patient Presentation

Inclusion Criteria

Imminent delivery with crowning

Exclusion Criteria

1. Vaginal bleeding in any stage of pregnancy [See [Obstetrical/Gynecological Conditions Guideline](#)]
2. Emergencies in first or second trimester of pregnancy [See [Obstetrical/Gynecological Conditions Guideline](#)]
3. Seizure from eclampsia [See [Obstetrical/Gynecological Conditions Guideline](#) and [Eclampsia/Pre-Eclampsia Guideline](#)]

Patient Management

Assessment

1. Signs of imminent delivery:
 - a. Crowning or other presentation in vaginal opening
 - b. Urge to push
 - c. Urge to move bowels
 - d. Mother's sense of imminent delivery
2. Signs of active labor:
 - a. Contractions
 - b. Membrane rupture
 - c. Bloody show

Treatment and Interventions

1. If patient in labor but no signs of imminent delivery, transport to appropriate receiving facility
2. Delivery should be controlled to allow a slow controlled delivery of infant. This will prevent injury to mother
 - a. Support the infant's head as needed and apply gentle counterpressure to help prevent the head from suddenly popping out

3. Check for nuchal cord (i.e., around the baby's neck)
 - a. If present, slip it over the head
 - b. If unable to free the cord from the neck, double clamp the cord and cut between the clamps
4. Do **not** routinely suction the infant's airway (even with a bulb syringe) during delivery
5. Grasping the head with hand over the ears, gently guide head down to allow delivery of the anterior shoulder
6. Gently guide the head up to allow delivery of the posterior shoulder
7. Slowly deliver the remainder of the infant
8. After 1 minute, clamp cord about 5–6 inches from the abdomen with two clamps; cut the cord between the clamps
 - a. If resuscitation is needed, the baby can still benefit from a 1-minute delay in cord clamping. Start resuscitation immediately after birth and then clamp and cut the cord at 1 minute
 - b. While cord is attached, take care to ensure the baby is not significantly higher positioned than the mother to prevent blood from flowing backwards from baby to placenta
9. Dry, warm, and stimulate infant, wrap in towel and place on maternal chest unless resuscitation needed
10. Resuscitation takes priority over recording APGAR scores. Record APGAR scores at 1 and 5 minutes once neonate is stabilized
11. 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) The placenta will deliver spontaneously, often within 5–15 minutes after the infant is delivered
 - a. Do not force the placenta to deliver; do not pull on the umbilical cord
 - b. Contain all tissue in plastic bag and transport
12. After delivery, massaging the uterus (fundal massage—should be located at about the umbilicus) and allowing the infant to nurse will promote uterine contraction and help control bleeding
 - a. Estimate maternal blood loss
 - b. Treat mother for hypovolemia as needed
13. Transport infant secured to mother with approved neonatal restraint system, in car seat or isolette unless resuscitation is needed
14. Keep infant warm during transport
15. Most deliveries proceed without complications—If complications of delivery occur, apply high flow oxygen to mother and expedite transport to the appropriate receiving facility. Maternal resuscitation is critical for best fetal outcome. Contact medical direction and/or closest appropriate receiving facility for direct medical oversight and to prepare the receiving team. The following are recommendations for specific complications:

- 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 (i.e., McRoberts' maneuver)
 - ii. Apply firm suprapubic pressure to attempt to dislodge shoulder. This often requires two EMS clinicians to perform and allows for delivery in up to 75% of cases
 - iii. Attempt to angle baby's head as posteriorly as possible but NEVER pull
 - iv. Continue with delivery as normal once the anterior shoulder is delivered
- b. Prolapsed umbilical cord
 - i. Placed gloved hand into vagina and gently lift head/body off the cord
 - 1. Assess for pulsations in cord, if no pulses are felt, lift the presenting part off the cord
 - 2. Wrap the prolapsed cord in moist sterile gauze
 - 3. Maintain until relieved by hospital staff
 - ii. If previous techniques are not successful, mother should be placed in prone knee-chest position or extreme Trendelenburg with hips elevated
- c. Breech birth
 - i. Place mother supine, allow the buttocks, feet, and trunk to deliver spontaneously, then support the body while the head is delivered
 - ii. If needed, put the mother in a kneeling position which may assist in the delivery of the newborn
 - iii. Assess for presence of prolapsed cord and treat as above
 - iv. If head fails to deliver, place gloved hand into vagina with fingers between infant's face and uterine wall to create an open airway. Place your index and ring fingers on the baby's cheeks forming a "V" taking care not to block the mouth and allowing the chin to be tilted toward the chest flexing the neck
 - v. When delivering breech, you may need to rotate the baby's trunk clockwise; or sweep the legs from the vagina
 - vi. Once the legs are delivered support the body to avoid hyperextension of the head; keep the fetus elevated off the umbilical cord
 - vii. NEVER pull on the body, especially a preterm or previable baby—just support the baby's body while mother pushes when she feels the urge to
- d. The presentation of an arm or leg through the vagina is an indication for immediate transport to hospital
- e. Nuchal cord
 - i. After the head has been delivered, palpate the neck for a nuchal cord, if present, slip over the head
 - ii. If the loop is too tight to slip over the head, attempt to slip the cord over the shoulders and deliver the body through the loop
 - iii. The cord can be doubly clamped and cut between the clamps; the newborn should be delivered promptly

- f. Excessive bleeding during active labor may occur with placenta previa or placental abruption
 - i. Obtain history from patient—known previa, recent pre-eclampsia symptoms, hypertension history, recent trauma, drug use especially cocaine
 - ii. Placenta previa most likely will prevent delivery of infant vaginally
 - iii. Place large bore IV and administer IV fluids as indicated
 - iv. If available, transfusion or the administration of whole blood as indicated
 - v. C-Section most likely needed—transport emergently
- g. Postpartum hemorrhage
 - i. Obtain history from patient—history of prenatal or delivery complications, recent trauma, prescription anticoagulants, drug use especially cocaine
 - ii. Perform fundal massage
 - iii. Initiate IV fluid resuscitation
 - iv. Consider administration of tranexamic acid (TXA) at 2 grams over 10 minutes
- h. Maternal cardiac arrest
 - i. Apply manual pressure to displace uterus from midline
 - ii. Treat per the [Cardiac Arrest Guideline \(VF/VT/Asystole/PEA\)](#) for resuscitation care (defibrillation and medications should be given for same indications and doses as if nonpregnant patient)
 - iii. Transport as soon as possible if infant is estimated to be over 24 weeks gestation (perimortem Cesarean section, also known as resuscitative hysterotomy) at receiving facility is most successful if started within 5 minutes of maternal cardiac arrest)

Patient Safety Considerations

1. Supine Hypotension Syndrome:
 - a. If mother has hypotension before delivery, place patient in left lateral recumbent position or manually displace gravid uterus to the left in supine position
 - b. Knee-chest position may create safety issues during rapid ambulance transport
2. Do **not** routinely suction the infant's airway (even with a bulb syringe) during delivery
3. Newborns are very slippery, take care not to drop the infant
4. Dry, warm and stimulate all newborns to facilitate respirations and prevent hypothermia
5. Do not pull on the umbilical cord while the placenta is delivering
6. 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. Due date (calculate gestational age in weeks)
 - i. If unknown gestational age, rough estimated gestational age with palpation of the uterine fundus at the umbilicus is 20 weeks
 - f. Last menstrual period
 - i. Only ask for estimated last menstrual period (first day of last period) if patient has not had prenatal care/ultrasound and does not know their due date.
 - g. Prenatal care
 - h. Number of expected babies (multiple gestations)
 - i. Drug use and maternal medication use
 - j. Any known pregnancy complications—hypertension, gestational diabetes, placenta previa, premature labor, history of fetal demise, fetal anomalies/birth defects, etc.
 - k. Signs of imminent delivery (e.g., crowning, urge to push, urge to move bowels, mother feels delivery is imminent)
 - l. Location where patient receives care (considered a preferred destination if time delay is not an issue and based on local protocols)
2. Notify medical direction/receiving facility if:
- a. Antepartum hemorrhage
 - b. Postpartum hemorrhage
 - c. Breech presentation
 - d. Limb presentation
 - e. Complicated nuchal cord (around neck)—unable/difficult to reduce
 - f. Prolapsed umbilical cord
 - g. Shoulder dystocia
 - h. Maternal cardiac arrest
 - i. If anticipated transport time is greater than 30 minutes
3. Some light bleeding/bloody show (blood-tinged mucus/fluid) is normal with any childbirth
- a. Large quantities of blood/clots or profuse bleeding are abnormal

Table 1. APGAR Score

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

Quality Improvement**Associated NEMSIS Protocol(s) (eProtocol.01)***(for additional information, go to www.nemsis.org)*

- 9914133—Medical—Neonatal/Newborn Resuscitation
- 9914155—OB/GYN—Childbirth/Labor/Delivery
- 9914161—OB/GYN—Pregnancy Related Disorders
- 9914163—OB/GYN—Postpartum Hemorrhage

Key Documentation Elements

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

Performance Measures

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

References

1. Beaird DT, Ladd M, Kahwail CI. EMS Prehospital Deliveries. *Stat Pearls*. 12-27-2020
2. Flanagan B, Lord B, Barnes M. Is unplanned out-of-hospital birth managed by paramedics 'infrequent', 'normal' and 'uncomplicated'? *BMC Pregnancy Childbirth*. 2017 Dec 22;17(1):436
3. Piaggio G, Carvalho JF, Althabe F. Prevention of postpartum haemorrhage: a distributional approach for analysis. *Reprod Health*. 2018 Jun 22;15(Suppl 1):97
4. Sheldon WR, Blum J, Vogel JP, Souza JP, Gülmezoglu AM, Winikoff B., WHO Multicountry Survey on Maternal and Newborn Health Research Network. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. *BJOG*. 2014 Mar;121 Suppl 1:5–13
5. Stallard T, Burns B. Emergency delivery and perimortem C-section. *Emerg Med Clin N Am*. 2003; 21:679–93
6. WHO, United Nations Population Fund, UNICEF. *Pregnancy, Childbirth, Postpartum and Newborn Care: A guide for essential practice (3rd edition)*. Geneva, Switzerland: WHO Press; 2015

Eclampsia/Pre-Eclampsia

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Female patient, more than 20-weeks' gestation, presenting with hypertension and evidence of end organ dysfunction including renal insufficiency, liver involvement, neurological, or hematological involvement
2. May occur up to 6 weeks postpartum but is rare after 48 hours post-delivery
 - a. Often the presenting symptom of postpartum pre-eclampsia is headache or SOB
3. Severe features of pre-eclampsia include:
 - a. Severe hypertension (SBP *greater than* 160, DBP *greater than* 110)
 - b. Headache
 - c. Confusion/altered mental status
 - d. Vision changes including blurred vision, spots/floaters, loss of vision (these symptoms are often a precursor to seizure)
 - e. Right upper quadrant or epigastric pain
 - f. Shortness of breath/Pulmonary edema
 - g. Ecchymosis suggestive of low platelets (bruising, petechiae)
 - h. Vaginal bleeding suggestive of placental abruption
 - i. Focal neurologic deficits suggesting hemorrhagic or thromboembolic stroke
4. Eclampsia
 - a. Any pregnant patient who is seizing should be assumed to have eclampsia and treated as such until arrival at the hospital
 - b. Seizure in any late term pregnancy or postpartum patient
5. Eclampsia/pre-eclampsia can be associated with abruptio placenta and fetal loss

Exclusion Criteria

None noted

Patient Management

Assessment

1. Obtain history
 - a. Gestational age in weeks or recent post-partum
 - b. Symptoms suggestive of end organ involvement such as headache, confusion, visual disturbances, seizure, epigastric pain, right upper quadrant pain, nausea/vomiting, stroke symptoms, shortness of breath
 - c. Previous history of hypertension or known pre-eclampsia
2. Monitoring
 - a. Vital signs including repeat blood pressures every 10 min
3. Secondary survey pertinent to obstetric issues
 - a. Constitutional: vital signs, skin color
 - b. Abdomen: distension, tenderness, and uterine rigidity
 - c. Genitourinary: visible bleeding
 - d. Neurologic: mental status, focal deficits

Treatment and Interventions

1. Severe hypertension (SBP *greater than* 160 or DBP *greater than* 110) lasting more than 15 min with associated preeclampsia symptoms
 - a. Severely elevated blood pressures must be treated to reduce the risk of maternal stroke
 - b. However, goal blood pressure should be roughly 140/90 to maintain uterine perfusion and to keep fetus well-oxygenated
 - c. Goal BP is approximately 140/90 to reduce stroke risk but maintain uterine perfusion
 - i. Labetalol 20 mg IV over 2 minutes
 1. May repeat every 10 minutes X 2 doses for persistent severe hypertension with preeclampsia symptoms
 2. Goal is to reduce MAP by 20–25% initially
 3. Ensure that HR is *greater than* 60 BPM prior to administration
 - d. Magnesium sulfate: 4 g IV over 5-10 min, followed by 2 g/hr
 - e. Reassess vital signs every 10 minutes during transport
2. Seizure management associated with pregnancy greater than 20-weeks gestation
 - a. Active seizure: Administer midazolam per [Seizures Guideline](#) (Caution: respiratory depression). Once seizure has ceased, administer 4 g magnesium sulfate IV over 5–10 minutes to prevent further seizure activity
 - b. If patient is postictal upon arrival, administer 4 g magnesium sulfate over 5–10 minutes to prevent further seizure activity
3. [Seizures Guideline](#), IV fluids:
 - a. Normal Saline bolus as needed, max dose 250 ml.

4. Administer high flow oxygen as indicated
5. Disposition
 - a. Transport emergently to closest appropriate receiving facility—notify en route if possible so the receiving team can prepare
 - b. Patients in second or third trimester of pregnancy should be transported on left side or with uterus manually displaced to left to ensure adequate uterine perfusion

Patient Safety Considerations

1. Magnesium toxicity (progression)
 - a. Hypotension followed by
 - b. Loss of deep tendon reflexes followed by
 - c. Somnolence, slurred speech followed by
 - d. Respiratory paralysis followed by
 - e. Cardiac arrest
2. Treatment of magnesium toxicity
 - a. Stop magnesium drip
 - b. Give calcium chloride—1 g IV/IO over 5 minutes, ensure IV patency and do not exceed 1 mL per minute. in cases of pending respiratory arrest
 - c. Support respiratory effort

Notes/Educational Pearls

Key Considerations

1. Delivery of the placenta is the only definitive management for pre-eclampsia and eclampsia
2. Early treatment of severe pre-eclampsia with magnesium for seizure prophylaxis and antihypertensive significantly reduces the rate of eclampsia. Use of magnesium encouraged if signs of severe pre-eclampsia present to prevent seizure
3. Patients with a history of chronic hypertension may have superimposed preeclampsia
4. Although less frequent, eclampsia, including eclampsia-related seizures, can occur in postpartum patients

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMESIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemesis.org)

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

Key Documentation Elements

Document full vital signs and physical exam findings

Performance Measures

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

References

1. American College of Obstetricians and Gynecologists Committee on Obstetric Practice Emergent Therapy for Acute-onset, Severe Hypertension During Pregnancy and the Postpartum Period. Committee opinion no 767: *Obstet Gynecol*. 2019;133(2): 174–180
2. American College of Obstetricians and Gynecologists Committee on Obstetric Practice Magnesium sulfate use in obstetrics. Committee opinion no 652: *Obstet Gynecol*. 2016;127(1): e52–3
3. American College of Obstetrics and Gynecologists Task Force on Hypertension in Pregnancy. Report of the American College of Obstetricians and Gynecologists' task force on hypertension in pregnancy. *Obstet Gynecol*. 2013;122(5):1122–31
4. Cuero M, Varelas P. Neurologic complications in pregnancy. *Crit Care Clin*. 2016;32(1):43–59
5. Emergent therapy for acute-onset, severe hypertension during pregnancy and the postpartum period. ACOG Committee Opinion No. 767. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2019;133: e174–80
6. Gestational Hypertension and Preeclampsia. ACOG Committee Opinion No. 222. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2020; 135: e237–60
7. Mol BW, Roberts CT, Thangaratinam S, Magee LA, de Groot CJ, Hofmeyr GJ. Pre-eclampsia. *Lancet*. 2016;387(10022):999–1011
8. Olson-Chen C, Seligman N. Hypertensive Emergencies in Pregnancy. *Crit Care Clin*. 2016;32(1):29–41

Obstetrical and Gynecological Conditions

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Female patient with vaginal bleeding in any trimester
2. Female patient with pelvic pain or possible ectopic pregnancy
3. Consider pregnancy in any female between the ages of 10–60 years of age

Exclusion Criteria

1. Childbirth and active labor [See [Childbirth Guideline](#)]
2. Postpartum hemorrhage [See [Childbirth Guideline](#)]

Differential Diagnosis

1. Abruptio placenta: Most frequently occurs in third trimester of pregnancy; placenta prematurely separates from the uterus causing intrauterine bleeding
 - a. Lower abdominal pain, uterine rigidity (often not present until abruption is advanced)
 - b. Vaginal bleeding—this symptom may not occur in cases of concealed abruption
 - c. Clinical index of suspicion for abruption (history of trauma, maternal hypertension, maternal drug use especially cocaine)
 - d. Shock, with minimal or no vaginal bleeding
2. Placenta previa: Placenta covers part or all of the cervical opening
 - a. Generally, late second or third trimester
 - b. Painless vaginal bleeding, unless in active labor
 - c. For management during active labor [See [Childbirth Guideline](#)]
3. Ectopic pregnancy
 - a. First trimester
 - b. Abdominal/pelvic pain with or without minimal bleeding
 - c. Shock is possible even with minimal or no vaginal bleeding
4. Spontaneous abortion (miscarriage)
 - a. Generally, first trimester
 - b. Intermittent pelvic pain (uterine contractions) with vaginal bleeding/passage of clots or tissue

Patient Management

Assessment

1. Obtain history
 - a. Obstetrical history [See [Childbirth Guideline](#)]
 - b. Abdominal pain—onset, duration, quality, radiation, provoking, or relieving factors
 - c. Vaginal bleeding—onset, duration, quantity (pads saturated)
 - d. Syncope/lightheadedness
 - e. Nausea/vomiting
 - f. Fever or history of recent 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, skin color
 - b. Abdomen: Distension, tenderness, peritoneal signs
 - c. Genitourinary: Visible vaginal bleeding
 - d. Neurologic: Mental status

Treatment and Interventions

1. If signs of shock or orthostasis:
 - a. Position patient supine or in the left lateral recumbent position if third trimester and keep patient warm
 - b. Place large bore IV
 - c. Volume resuscitation: 250 ml NS bolus, repeat as needed
 - d. Reassess vital signs and response to fluid resuscitation
 - e. Save all possible tissue so that the receiving team can assess
2. Disposition—transport emergently to closest appropriate receiving facility—notify en route if possible so the receiving team may prepare

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 intraabdominal hemorrhage from ectopic pregnancy or antepartum hemorrhage from spontaneous abortion, placental abruption, or placenta previa

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

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

Document full vital signs and physical exam findings

Performance Measures

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

References

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

RESPIRATORY



Airway Management

Patient Care Goals

1. Maintain a patent airway
2. Provide effective oxygenation and adequate ventilation using the least invasive possible method to achieve those goals paired with pulse oximetry and end-tidal capnography (EtCO₂) data
3. Anticipate, recognize, and alleviate respiratory distress
4. Provide necessary interventions quickly and safely to patients with the need for respiratory support
5. Anticipate, identify, and plan for a potentially difficult airway
6. Optimize the patient for any advanced airway attempts

Patient Presentation

Inclusion Criteria

1. Patients with signs of severe respiratory distress/respiratory failure
2. Patients with evidence of hypoxemia or hypoventilation with medical or traumatic etiology
3. Patients with tracheostomies (See [Tracheostomy Management Guideline](#))
4. Patients with acute foreign body airway obstruction

Exclusion Criteria

1. Chronically ventilated patients
2. Newborn patients

Patient Management

Implement emergent interventions and monitoring [Refer to [Universal Care Guideline](#)]

Assessment

1. History—assess for:
 - a. Time of onset of symptoms
 - b. Associated symptoms and triggers for dyspnea (e.g., exertion, exercise, lying flat)
 - c. History of asthma or other breathing disorders
 - d. Choking or other evidence of upper airway obstruction
 - e. History of trauma
 - f. Prior similar episodes (e.g., prior intubation, prior ICU stay, prior airway surgery including tracheostomy, anaphylaxis, angioedema). If prior episodes, what has helped in the past (meds, interventions) home interventions for symptoms (e.g., increased home oxygen, nebulizer)
 - g. Severity of shortness of breath, sensation of dyspnea

2. Physical Examination—assess for:
 - a. Abnormal respiratory pattern, rate and/or effort
 - b. Use of accessory muscles
 - c. Ability to speak words/sentences
 - d. Quality of air exchange, including depth of respiration and equality of breath sounds
 - e. Abnormal breath sounds (e.g., wheezing, rhonchi, rales, or stridor)
 - f. Cough
 - g. Skin color (cyanosis or pallor), presence of diaphoresis
 - h. Mental status, including anxiety
 - i. Airway obstruction with foreign body or swelling (e.g., angioedema, posterior pharyngeal, and laryngeal infections)
 - j. Signs of a difficult airway (short jaw or limited jaw thrust or mobility, small thyromental space, upper airway obstruction, large tongue, obesity, large tonsils, large neck, craniofacial abnormalities, excessive facial hair, tracheostomy scar or evidence of other neck/facial surgery, and trismus)
 - k. Signs of fluid overload (e.g., ascites, peripheral edema)
 - l. Traumatic injuries impairing upper and lower airway anatomy and physiology:
 - i. Facial injuries
 - ii. High spine injury (affecting phrenic nerve/intercostals)
 - iii. Neck injury (expanding hematoma, tracheal injury)
 - iv. Chest wall injury (bruising), including rib and sternal fracture, paradoxical chest motion, subcutaneous air, and sucking chest wound

Monitoring

1. Patients with significant respiratory distress should have continuous pulse oximetry and waveform capnography monitoring for both assessment and for guiding therapy
2. Pulse oximetry is indicated to assess oxygenation
3. Quantitative waveform capnography:
 - a. For assessment and monitoring of ventilatory status in patients with significant respiratory distress
 - b. To assist in decision-making for patients with respiratory difficulty of unclear cause (e.g., bronchospasm vs. pulmonary edema) and to help direct therapy
 - c. To evaluate acid-base status in critically ill patients

Treatment and Interventions

1. Generally, the approach is to implement the interventions below in an escalating fashion to meet the patient care goals above
2. **Administer oxygen if needed** for air hunger or respiratory distress and titrate to a target SPO₂ of 94–98%. Depending on patient presentation, this may be accomplished with nasal cannula, nonrebreather, BVM, and NIV

- a. Even in apneic patients, starting passive oxygenation while escalating interventions are implemented may be useful
 - b. During CPR, maximal oxygen supplementation should be provided
 - c. Consider humidified oxygen for patients with tracheostomy (See [Tracheostomy Management Guideline](#))
3. **Open and maintain patent airway.** If needed,
- a. Provide head tilt/chin lift, or jaw thrust if concern for potential spinal injury
 - b. Suction airway: for significantly contaminated airways, consider utilizing a **suction assisted laryngeal airway decontamination (SALAD)** technique
 - c. Oropharyngeal airways (OPA) or nasopharyngeal airways (NPA) can be placed if needed to maintain a patent airway and make BVM ventilation more effective
 - i. OPA are used for patients without gag reflex
 - ii. NPA are used for patients with gag reflex
 - d. Patient positioning can significantly impact respiratory mechanics. Patients with severe bronchospasm should be left in the position of comfort (perhaps tripod) whenever possible. Elevating the head or padding (shoulders, occiput) can assist with opening airway and respiratory mechanics. This can both improve the ability to ventilate and limit aspiration
 - e. For patients with **tracheostomy** in respiratory distress, see [Tracheostomy Management Guideline](#)
4. Use **bag-valve-mask (BVM) ventilation** in the setting of respiratory failure or arrest. Whenever possible, the patient's head should be elevated up to 30 degrees
- a. Two-person, ventilation is preferred
 - b. Continuous wave-form capnography monitoring should be placed in line
 - i. In patients without primary pulmonary pathology (i.e., acute respiratory distress syndrome (ARDS), COPD), maintain EtCO₂ of no less than 35 and up to 40 mmHg. Patients with specific disease processes such as acute acid-base disorders (i.e., DKA, lactic acidosis due to severe sepsis or trauma), acute respiratory failure due to primary pulmonary pathology, or post-cardiac arrest will have different EtCO₂ parameters due to their underlying disease
 - ii. In patients with severe head injury with signs of herniation (unilateral dilated pupil or decerebrate posturing), modest hyperventilation to EtCO₂ no less than 30 mmHg may be considered for a brief time
 - c. Tidal volume
 - i. Ventilate with just enough volume to see chest rise, approximately 6–8 mL/kg ideal body weight
 - ii. Over-inflation (e.g., excessive tidal volume) and overventilation (e.g., excessive minute ventilation) are both undesirable and potentially harmful

- d. Rate
 - i. **Adult:** 10–12 breaths/minute
 - ii. **Child:** 20–30 breaths/minute
 - iii. **Infant:** 20–30 breaths/minute
- e. Continuously monitor EtCO₂ to guide tidal volume and minute ventilation
- 5. **Noninvasive ventilation (NIV)** should be considered early for severe respiratory distress or impending respiratory failure
 - a. NIV options include continuous positive airway pressure (CPAP), bilevel positive airway pressure (BiPAP), bilevel nasal CPAP, and high flow oxygen by nasal cannula (HFNC)
 - b. NIV can also be used to improve oxygenation pre-intubation in some patients with respiratory failure
- 6. **Supraglottic airways (SGA):** SGA may be first line for ventilation management. Consider the use of an appropriately sized SGA
- 7. **Endotracheal intubation**
 - a. When less-invasive methods are ineffective or inappropriate, may utilize endotracheal intubation. Other indications may include potential airway obstruction, severe inhalation burns, multiple traumatic injuries, altered mental status with loss of normal protective airway reflexes
 - b. Optimize patient for first-pass success with pre-procedure resuscitation, preoxygenation, positioning, sedatives and paralytics as indicated by patient presentation
 - i. For Medication Assisted Airway Management (MAAM)
 - Sedation: ketamine 2 mg/kg IV/IO
 - Etomidate 0.3 mg/kg IV/IO, utilized during ketamine shortage (Not stocked currently)
 - midazolam may be considered, if neither ketamine or Etomidate are available
 - Paralytic: rocuronium 1 mg/kg
 - Within 10 minutes of intubation
 - Midazolam 2-5 mg IV/IO
 - Fentanyl 50 mcg IV/IO
 - May be repeated as needed
 - ii. A bougie may be a helpful adjunct to successful airway placement, especially when video laryngoscopy is unavailable and the glottic opening is difficult to visualize with direct laryngoscopy
 - iii. For experienced EMS clinicians, video laryngoscopy may enhance intubation success rates and should be used when available
 - c. Monitor clinical signs, pulse oximetry, cardiac rhythm, blood pressure, and waveform capnography for the intubated patient

- d. For adults, the largest tube size possible should be placed in the patient to limit difficulty with mechanical ventilation and high airway pressures. Absent significant airway swelling or underlying anatomic abnormalities, initial tube size (internal diameter in millimeters) for adult females should be 7.5, adult males 8.0. For pediatrics, cuffed tubes are now recommended

8. **Post-intubation management**

- a. Inflate endotracheal tube cuff with minimum air to seal airway.
- b. Confirm placement of advanced airway (endotracheal tube, SGA) with waveform capnography (most reliable), absent gastric sounds, and bilateral breath sounds
- c. Secure tube manually. Once proper position is confirmed, secure the tube with tape, twill, or commercial device
 - i. Note measurement of tube at incisors or gum line and assess frequently for tube movement/displacement using continuous waveform capnography and visual inspection
 - ii. Cervical collar and/or cervical immobilization device may help reduce neck movement and risk of tube displacement
- d. Continuously monitor correct airway placement with waveform capnography during treatment and transport, paying particular attention to reassessing after each patient movement
- e. Additional pain management should be administered 10-minutes post intubation, see pain management guideline.
- f. Manual ventilation (see above for rate and tidal volume guidance)

- 9. **Mechanical Ventilation** should be considered following advanced airway placement, if available. See [Mechanical Ventilation \(Invasive\) Guideline](#).

- 10. When patients cannot be oxygenated/ventilated effectively using the above interventions, or when conventional airway approaches are impossible, surgical airway management is a reasonable option if the clinician has competency in the procedure and risk of death for not escalating airway management seems to outweigh the risk of procedural complication.
- 11. Transport to the closest appropriate hospital for airway stabilization when respiratory failure cannot be successfully managed in the prehospital setting.

Patient Safety Considerations

- 1. Suctioning to limit aspiration is a priority, since it is associated with development of hospital acquired pneumonia and related increases in ICU stay and mortality.
- 2. Avoid excessive pressures or tidal volumes during BVM ventilation. The goal is to avoid barotrauma as well as overventilation and related reduction of venous return/preload/cardiac output.
- 3. Routine use of sedation is not recommended for treatment of anxiety in patients on NIV. Anxiety should be presumed due to hypoxia or inadequate minute ventilation and treated primarily with ventilatory support.
- 4. Endotracheal intubation should only be used if less invasive methods do not meet patient care goals.

5. Once a successful SGA placement or intubation has been performed, obstruction or displacement of the tube can have further negative effects on patient outcome. Tubes should be secured with either a commercial tube holder or tape.
6. Meticulous attention should be paid to avoiding hypoxia and hypotension during intubation attempts to limit patient morbidity and mortality.
7. Waveform capnography should be placed prior to the first breath through an invasive airway to confirm placement.
8. Medication Assisted Airway Management (MAAM) should be reserved for specialized clinicians on operating within a comprehensive program with adequate resources, ongoing training and quality assurance measures, and close EMS physician oversight.
9. Once initiated and patient is tolerating mask, DO NOT discontinue CPAP/BiPAP until patient is on the emergency department stretcher and hospital CPAP/BiPAP is immediately available for patient to be switched over, or physician is at bedside and requesting CPAP/BiPAP be discontinued. Breaking the mask seal causes a significant decrease in airway pressures and may lead to abrupt decompensation due to atelectasis and alveolar collapse.
10. If patient deteriorates on CPAP/BiPAP (e.g., worsened mental status, increasing EtCO₂, vomiting), remove CPAP/BiPAP and escalate airway management options as above.
11. If an endotracheal tube becomes dislodged, SGA should be strongly considered.
12. Pediatric airway management requires appropriately sized tools and adjuncts based on patient size/age. A method for determining appropriate sizing should be available to all EMS clinicians.
 - a. Skill in BVM ventilation and NIV application should be emphasized in pediatrics.
 - b. SGA are reasonable primary and secondary adjuncts if needed.
 - c. Pediatric endotracheal intubation has unclear benefit in the prehospital setting.
 - d. Pediatric endotracheal tube placement and maintenance requires significant training to achieve and maintain competency.

Notes/Educational Pearls

Key Considerations

1. Oxygen is a drug with an appropriate dose range and undesirable effects from both too much and too little supplementation. Effective oxygenation meets the oxygen saturation (SpO₂) target set for that specific patient in the context of their acute and chronic medical condition(s). Permissive hypoxia (SPO₂ ≥ 90%) may be appropriate in patients with COPD or other complex respiratory pathology.
2. Adequate ventilation provides sufficient minute ventilation to meet the patient's acute respiratory and metabolic needs and is generally titrated to an EtCO₂ goal.
3. Paramedics are less likely to attempt endotracheal intubation in children than adults with cardiac arrest and are more likely to be unsuccessful when intubating children. Complications such as malposition of the ET tube or aspiration can be nearly three times as common in children as compared to adults.
4. Continuous waveform capnography 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 placement of all advanced

airways. It can also be helpful in the respiratory distress patient without an invasive airway to assess for causes of respiratory distress, adequacy of ventilation, progression toward respiratory failure, monitoring of BVM ventilation, as well as numerous other applications that provide insight into acute metabolic and infectious disease processes. Continuous waveform capnography.

- a. Should be used for patients with invasive airways for
 - i. initial verification of correct airway placement
 - ii. continuous evidence of correct tube placement
 - iii. to adjust ventilatory rate
 - 1. to maintain EtCO₂ 35–45 in most patients
 - 2. to appropriately but not excessively hyperventilate patients with signs of herniation only to maintain EtCO₂ 30–35 (no lower than 30)
 - 3. to gradually decrease EtCO₂ in chronically and acutely severely hypercarbic patients including post-arrest
 - b. Is strongly encouraged in patients in cardiac arrest
 - i. to monitor quality of CPR
 - ii. as an early indicator of ROSC (rapid increase of 10–15 in EtCO₂)
 - iii. to assist in evaluating prognosis for survival
 - c. Should be used in spontaneously breathing patients who are
 - i. on NIV
 - ii. in severe respiratory distress (e.g., receiving epinephrine, magnesium therapy)
 - d. In spontaneously breathing patients, waveform capnography can help with assessment of critically ill patients, for example
 - i. assessment of adequacy of ventilation and change in ventilatory status in response to treatment
 - ii. differentiating between severe bronchospasm (shark fin waveform) and other causes of respiratory distress (normal waveform, pulmonary edema)
 - iii. hypotension due to sepsis or unclear cause (metabolic acidosis with/without compensatory respiratory alkalosis)
 - iv. status epilepticus to evaluate ventilatory and acid/base status
 - v. evaluation for acidosis in patients with altered mental status and potential diabetic ketoacidosis (metabolic acidosis)
5. Bag-valve-mask (BVM) ventilation (for cardiac arrest patients see [Cardiac Arrest Guideline](#)).
- a. Appropriately sized masks should completely cover the nose and mouth and maintain an effective seal around the cheeks and chin
 - b. Ventilations should be delivered with only sufficient volume to achieve chest rise. Overventilation is undesirable
 - i. In children, ventilating breaths should be delivered over one second, with a two second pause between breaths

- c. Ventilation rate
 - i. Adult
 - 1. Support spontaneous respirations if the patient is hypoventilating
 - 2. For apnea, provide one breath every 6 seconds adjusting based on pulse oximetry and digital capnometry or capnography (with the goal of 35–45 mmHg)
 - ii. Pediatric—infant/child
 - 1. Support spontaneous respirations if the patient is hypoventilating
 - 2. For apnea, provide 1 breath every 2–3 seconds adjusting based on pulse oximetry and digital capnometry or capnography (with the goal of 35–45 mmHg)
6. Noninvasive ventilation (NIV) (e.g., CPAP or BiPAP).
- a. NIV goals of therapy will vary based on patient presentation and history. More support than is needed to relieve symptoms or “normal” is not necessarily better in these patients. Goals of care may include:
 - i. Decreased air hunger
 - ii. SPO_2 of $\geq 94\%$. Chronic COPD patients tolerate hypoxia better, and an SPO_2 of 90% may relieve their symptoms and be adequate
 - iii. Normalization of respiratory rate (decreased tachypnea)
 - iv. Normalization of EtCO_2 . This means a downward trend in a patient with increased EtCO_2 . Patients who have end stage COPD may have chronically elevated EtCO_2 as high as 50s–60s, and thus tolerate elevated EtCO_2 better so normalization may not be a good target
 - b. The key to successful use of NIV in a patient who has not used it before is coaching and explanation of the process and reassurance of the patient.
 - c. For any patient on NIV, focus on maintaining a continuous mask seal is essential to maximizing the positive impact of PEEP, particularly at higher levels. Breaking the circuit or removing the mask should be meticulously avoided, as the significant atelectasis will occur which will take time to reverse.
 - d. Nebulized medications may be administered through a CPAP or BiPAP mask. A specialized T-connector with a spring valve assembly is required to allow maintenance of positive airway pressure.
7. Orotracheal/Endotracheal intubation (ETI).
- a. Checklist use and use of protocolized interventions to optimize the patient physically and physiologically have been shown to both improve success rates of orotracheal intubation as well as decrease peri-intubation complications. Preparation should also include a promptly available plan for alternate airway placement if ETI unsuccessful.
 - b. Approximate depth of insertion = (3) x (endotracheal tube size).
 - c. In addition to preoxygenation, apneic oxygenation (high-flow oxygen by nasal cannula) may prolong the period before hypoxia during an intubation attempt.

- d. Positive pressure ventilation after intubation can decrease preload and subsequently lead to hypotension.
 - e. Significant attention should be paid to adequate preoxygenation to avoid peri-intubation hypoxia and hypoxic cardiac arrest.
 - f. Routine use of cricoid pressure is not recommended in pediatric or adult intubation.
 - g. Prompt suctioning of soiled airways before intubation attempt may improve first pass success and limit morbidity and mortality.
 - h. Confirm successful placement with waveform capnography. Less optimal methods of confirmation include bilateral chest rise, bilateral breath sounds, and maintenance of adequate oxygenation. Color change on EtCO₂ is less accurate than clinical assessment, and wave-form capnography is superior. Misting observed in the tube is not a reliable method of confirmation. Re-visualization with video laryngoscopy, when available, may assist in confirming placement when unclear due to capnography failure or conflicting information.
 - i. Video laryngoscopy may be a useful tool for endotracheal intubation in the hands of a practiced clinician.
8. Manual vs. Mechanical ventilation: If mechanical ventilation is available, it is preferred to manual ventilation due to the increased consistency of tidal volume and ventilatory rate, and its ability to limit risk of overventilation. [See [Mechanical Ventilation \(Invasive\) Guideline](#)].
 9. For patients being transferred from a hospital ventilator to a transport ventilator, the patient's current ventilator settings are generally a reasonable starting point if the patient is being adequately oxygenated and ventilated based on pulse oximetry and capnography.
 10. Currently, there is limited experience with high-flow nasal cannula in the EMS environment, so evidence-informed recommendations are not included in this guideline.
 11. Anxiety should be presumed due to hypoxia or inadequate minute ventilation and treated primarily with ventilatory support. Routine use of sedation is not recommended for treatment of anxiety in patients on NIV.

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org).

- 9914001—Airway
- 9914133—Medical—Newborn/Neonatal Resuscitation

Key Documentation Elements

- Initial vital signs and physical exam.
- Interventions attempted including the method of airway intervention, the size of equipment used, and the number of attempts to achieve a successful result.

- Indications for advanced airway management.
- Subsequent vital signs and physical exam to assess for change after the interventions.
- Occurrence of peri-intubation hypoxia (less than 90% SPO₂), bradycardia (per age), hypotension (SBP less than 90mmHg or lowest age-appropriate SBP) or cardiac arrest. The peri-intubation period encompasses the time from sedative administration to up to 10 minutes post any invasive airway attempt.
- Post-intubation with advanced airway, EtCO₂ value and capnograph should be documented immediately after airway placement, with each patient movement (e.g., into and out of ambulance), and at the time of patient transfer in the ED.
- Recordings of video laryngoscopy may be useful for quality improvement purposes.

Performance Measures

- Percentage of clinicians that have received hands-on airway training (simulation or nonsimulation-based) for basic and advanced airway adjuncts and skills within the past year.
- Percentage of patients with initial hypoxia who improve to target saturation of 94–98% by arrival at hospital.
- Percentage of patients with respiratory chief complaints for whom both oxygen saturation (SpO₂) and respiratory rate are measured and documented.
- Rate of NIV use in respiratory distress (COPD, congestive heart failure (CHF)) patients with GCS 15.
- Documentation of PEEP use with assisted ventilation.
- Percentage of patients with advanced airway placement with capnographic verification of correct placement within 1 minute.
- Percentage of patients with advanced airway placement who have documentation of waveform capnography for both initial confirmation and repeated verification of placement during transport and at hospital arrival.
- Percentage of intubated patients with endotracheal tube verified in proper position upon turnover to receiving facility.
- Rate of advanced airway (ETT or SGA) success without hypoxia or hypotension.
- First pass success rate and number of intubation attempts.
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org).
 - *Respiratory—01: Respiratory Assessment*

References

1. Cabrini L, Landoni G, Baiardo Redaelli M, Saleh O, Votta CD, Fominskiy E, et al. Tracheal intubation in critically ill patients: a comprehensive systematic review of randomized trials. *Crit Care*. 2018;22(1):6
2. Carney N, Cheney T, Totten AM, Jungbauer R, Neth MR, Weeks C, et al. AHRQ Comparative Effectiveness Reviews. Prehospital Airway Management: A Systematic Review. Rockville (MD): Agency for Healthcare Research and Quality (US); 2021
3. Driver BE, Prekker ME, Klein LR, Reardon RF, Miner JR, Fagerstrom ET, et al. Effect of Use of a Bougie vs Endotracheal Tube and Stylet on First-Attempt Intubation Success Among Patients With Difficult Airways Undergoing Emergency Intubation: A Randomized Clinical Trial. *JAMA*. 2018;319(21):2179–89
4. “The Epic Project: Impact of Implementing the EMS Traumatic Brain Injury Treatment Guidelines - Full Text View.” The EPIC Project: Impact of Implementing the EMS Traumatic Brain Injury Treatment Guidelines - Full Text View - ClinicalTrials.gov. <https://www.clinicaltrials.gov/ct2/show/NCT01339702> . Accessed March 11 2022.
5. Fan E, Del Sorbo L, Goligher EC, Hodgson CL, Munshi L, Walkey AJ, et al. An Official American Thoracic Society/European Society of Intensive Care Medicine/Society of Critical Care Medicine Clinical Practice Guideline: Mechanical Ventilation in Adult Patients with Acute Respiratory Distress Syndrome. *Am J Respir Crit Care Med*. 2017;195(9):1253–63
6. Fan E, Brodie D, Slutsky AS. Acute Respiratory Distress Syndrome: Advances in Diagnosis and Treatment. *JAMA*. 2018;319(7):698–710
7. Fawcett VJ, Warner KJ, Cuschieri J, Copass M, Grabinsky A, Kwok H, et al. Pre-hospital aspiration is associated with increased pulmonary complications. *Surg Infect (Larchmt)*. 2015;16(2):159–64
8. Fouche P, Stein C, Simpson P, Carlson J, Md MS, Doi S. Nonphysician Out-of-Hospital Rapid Sequence Intubation Success and Adverse Events: A Systematic Review and Meta-Analysis. *Ann Emerg Med*. 2017;70(4):449–59e20
9. George BP, Vakkalanka JP, Harland KK, Faine B, Rewitzer S, Zepeski A, et al. Sedation Depth is Associated with Increased Hospital Length of Stay in Mechanically Ventilated Air Medical Transport Patients: A Cohort Study. *Prehosp Emerg Care*. 2020;24(6):783–92
10. Gerber L, Botha M, Laher AE. Modified Two-Rescuer CPR With a Two-Handed Mask-Face Seal Technique Is Superior To Conventional Two-Rescuer CPR With a One-Handed Mask-Face Seal Technique. *J Emerg Med*. 2021
11. Gok PG, Ozakin E, Acar N, Karakilic E, Kaya FB, Tekin N, et al. Comparison of Endotracheal Intubation Skills With Video Laryngoscopy and Direct Laryngoscopy in Providing Airway Patency in a Moving Ambulance. *J Emerg Med*. 2021;60(6):752–9
12. Hope Kilgannon J, Hunter BR, Puskarich MA, Shea L, Fuller BM, Jones C, et al. Partial pressure of arterial carbon dioxide after resuscitation from cardiac arrest and neurological outcome: A prospective multi-center protocol-directed cohort study. *Resuscitation*. 2019;135:212–20
13. Ilia S, van Schelven PD, Koopman AA, Blokpoel RGT, de Jager P, Burgerhof JGM, et al. Effect of Endotracheal Tube Size, Respiratory System Mechanics, and Ventilator Settings on Driving Pressure. *Pediatr Crit Care Med*. 2020;21(1):e47–e51
14. Jarvis JL, Gonzales J, Johns D, Sager L. Implementation of a Clinical Bundle to Reduce Out-of- Hospital Peri-intubation Hypoxia. *Ann Emerg Med*. 2018

15. Kopsaftis Z, Carson-Chahhoud KV, Austin MA, Wood-Baker R. Oxygen therapy in the prehospital setting for acute exacerbations of chronic obstructive pulmonary disease. *Cochrane Database of Systematic Reviews*. 2020(1)
16. Kornas RL, Owyang CG, Sakles JC, Foley LJ, Mosier JM. Evaluation and Management of the Physiologically Difficult Airway: Consensus Recommendations From Society for Airway Management. *Anesth Analg*. 2021;132(2):395–405
17. Krisciunas GP, Langmore SE, Gomez-Taborda S, Fink D, Levitt JE, McKeethan J, et al. The Association Between Endotracheal Tube Size and Aspiration (During Flexible Endoscopic Evaluation of Swallowing) in Acute Respiratory Failure Survivors. *Crit Care Med*. 2020;48(11):1604–11
18. Kupas DF, Kauffman KF, Wang HE. Effect of airway-securing method on prehospital endotracheal tube dislodgment. *Prehosp Emerg Care*. 2010;14(1):26–30
19. Losek JD, Bonadio WA, Walsh-Kelly C, Hennes H, Smith DS, Glaeser PW. Prehospital pediatric endotracheal intubation performance review. *Pediatr Emerg Care*. 1989;5(1):1–4
20. Le Conte P, Terzi N, Mortamet G, Abroug F, Carteaux G, Charasse C, et al. Management of severe asthma exacerbation: guidelines from the Societe Francaise de Medecine d'Urgence, the Societe de Reanimation de Langue Francaise and the French Group for Pediatric Intensive Care and Emergencies. *Ann Intensive Care*. 2019;9(1):115
21. Levy M. NAEMSP Airway Compendium Project. 2021
22. Marjanovic N, Flacher A, Drouet L, Gouhinec AL, Said H, Vigneau JF, et al. High-Flow Nasal Cannula in Early Emergency Department Management of Acute Hypercapnic Respiratory Failure Due to Cardiogenic Pulmonary Edema. *Respir Care*. 2020;65(9):1241-9
23. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142(16_suppl_2):S366–s468
24. Powell EK, Hinckley WR, Stolz U, Golden AJ, Ventura A, McMullan JT. Predictors of Definitive Airway Sans Hypoxia/Hypotension on First Attempt (DASH-1A) Success in Traumatically Injured Patients Undergoing Prehospital Intubation. *Prehospital Emergency Care*. 2020;24(4):470–7
25. Schober P, Biesheuvel T, de Leeuw MA, Loer SA, Schwarte LA. Prehospital cricothyrotomies in a helicopter emergency medical service: analysis of 19,382 dispatches. *BMC Emerg Med*. 2019;19(1):12
26. Topjian AA, Raymond TT, Atkins D, Chan M, Duff JP, Joyner BL, Jr., et al. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142(16_suppl_2):S469– s523
27. Vissers G, Soar J, Monsieurs KG. Ventilation rate in adults with a tracheal tube during cardiopulmonary resuscitation: A systematic review. *Resuscitation*. 2017;119:5–12
28. Wang HE, Schmicker RH, Daya MR, et al. Effect of a strategy of initial laryngeal tube insertion vs endotracheal intubation on 72-hour survival in adults with out-of-hospital cardiac arrest: A randomized clinical trial. *JAMA*. 2018;320(8):769–78
29. Wetsch WA, Schneider A, Schier R, Spelten O, Hellmich M, Hinkelbein J. In a difficult access scenario, supraglottic airway devices improve success and time to ventilation. *Eur J Emerg Med*. 2015;22(5):374–6

Respiratory Distress (includes Bronchospasm, Pulmonary Edema)

Patient Care Goals

1. Assure adequate oxygenation and ventilation
2. Recognize impending respiratory failure
3. Promptly identify and intervene for patients who require escalation of therapy
4. Deliver appropriate therapy by differentiating likely cause of respiratory distress
5. Alleviate respiratory distress

Patient Presentation

Inclusion Criteria

1. Patients aged 2 and older with respiratory distress due to disease processes including:
 - a. Asthma exacerbation
 - b. Chronic obstructive pulmonary disease (COPD) exacerbation
 - c. Wheezing/bronchospasm from suspected pulmonary infection (e.g., pneumonia, acute bronchitis)
 - d. Pulmonary edema of cardiac (i.e., heart failure) or noncardiac etiology

Exclusion Criteria

1. Respiratory distress related to acute trauma.
2. Respiratory distress due to a presumed underlying cause that includes one of the following:
 - a. Anaphylaxis
 - b. Bronchiolitis (wheezing in patients less than 2 years of age)
 - c. Croup
 - d. Epiglottitis
 - e. Foreign body aspiration
 - f. Submersion/drowning
 - g. Lower airway obstruction from malignancy (very rare)

Patient Management

Assessment

1. History
 - a. Onset of symptoms
 - b. Concurrent symptoms (e.g., fever, cough, rhinorrhea, tongue/lip swelling, rash, labored breathing, foreign body aspiration)
 - c. Usual triggers of symptoms (e.g., cigarette smoke, change in weather, upper respiratory infections, exercise)
 - d. Sick contacts
 - e. Treatments prior to EMS: Oxygen, inhaler, nebulizer, other treatments, chronic or recent steroids

- f. Hospitalizations: Number of emergency department visits in the past year, number of hospital admissions in the past year, number of ICU admissions (ever), previously intubated (ever)
 - g. Family history of asthma, eczema, or allergies
2. Exam
- a. Full set of vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment), temperature, and O₂ saturation. Consider temperature and waveform capnography
 - b. Air entry (normal vs. diminished, prolonged expiratory phase)
 - c. Breath sounds (wheezes, crackles, rales, rhonchi, diminished, clear)
 - d. Skin color (pallor, cyanosis, mottling, normal) and temperature (febrile, diaphoretic)
 - e. Mental status (alert, tired, lethargic, unresponsive)
 - f. Signs of distress include:
 - i. Apprehension, anxiety, combativeness
 - ii. Hypoxia (less than 90% oxygen saturation)
 - iii. Intercostal/subcostal/supraclavicular retractions, accessory muscle use
 - iv. Grunting, stridor, inability to speak full sentences
 - v. Nasal flaring
 - vi. Cyanosis

Treatment and Interventions

- 1. Airway: See [Airway Management Guideline](#) for additional specifics
 - a. Give supplemental oxygen for dyspnea to a target of 94–98% saturation. Escalate from a nasal cannula as needed to reach this goal
 - b. BVM ventilation should be utilized in children with respiratory failure
 - c. Noninvasive ventilation (NIV) should be administered for severe respiratory distress via BVM, continuous positive airway pressure (CPAP) or bi-level positive airway pressure (BiPAP)
 - d. If indicated, bronchodilators should be administered in line with NIV
- 2. Monitoring
 - a. Pulse oximetry and EtCO₂ should be routinely used as adjuncts to other forms of monitoring in patients with respiratory complaints
 - b. Continuous cardiac monitoring may be indicated in patients with respiratory distress associated with suspected acute or decompensated congestive heart failure (CHF) or dysrhythmia
 - c. 12-lead EKG may be indicated to assess for dysrhythmia or ischemia, particularly in patients with risk factors for coronary artery disease and/or presentation consistent with CHF
- 3. IV Access and Fluids—IV access should be placed when IV medication administration is indicated, or when there are clinical concerns of dehydration so that IV fluids can be administered

4. Suspected bronchospasm, asthma, COPD:
 - a. Inhaled Medications
 - i. While albuterol 2.5 mg nebulized is usually sufficient for mild wheezing without clinical distress, 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). Repeat at this dose with unlimited frequency for ongoing respiratory distress
 - ii. Consider Duoneb 3 mL SVN, if albuterol is ineffective.
 - b. Steroids should be administered in the prehospital setting
 - i. IV steroid options for critically ill patients include:
 1. Methylprednisolone (2 mg/kg, maximum dose 125 mg) IV/IM
 - c. Magnesium sulfate (40 mg/kg IV, maximum dose of 2 g) over 10–15 minutes should be administered for severe bronchoconstriction and concern for impending respiratory failure. Consider decreased dose of 1 g IV for geriatric patients.
 - d. Epinephrine (0.01 mg/kg of 1 mg/mL solution IM, maximum dose of 0.3 mg) should only be administered for impending respiratory failure as adjunctive therapy when there are no clinical signs of improvement with the above treatments.
5. Adults with suspected pulmonary edema due to acute heart failure or fluid overload (such as dialysis noncompliance):
 - a. Restoration of adequate oxygenation and ventilation should precede or be accomplished simultaneously with other medication therapies below:
 - i. CPAP/BiPAP: See [Airway Management Guideline](#) for goals of care and escalation of interventions
 - b. SBP less than 100 mmHg
 - i. IV fluid bolus 250–500 mL
 - ii. Consider vasopressor: Norepinephrine 1 mcg/minute and titrate as needed to MAP > 65 or SBP > 120
 - c. SBP less than 160 mmHg
 - i. Nitroglycerin
 1. 0.4 mg SL, can repeat every 5 minutes for SBP greater than 100 mmHg
 - d. SBP ≥ 160 mmHg or MAP greater than 120
 - i. Nitroglycerin
 1. 0.8 mg SL, can repeat every 5 minutes for SBP greater than 100 mmHg
 2. If transport time > 15 minutes, consider Nitroglycerin patch 0.4 mg/hr.

6. Suspected pulmonary edema due to other noncardiogenic causes (such as irritant inhalation, abrupt opioid withdrawal). Provide supportive care to promote adequate oxygenation.
 - a. Inhaled Medications
 - i. While albuterol 2.5 mg nebulized is usually sufficient for mild wheezing without clinical distress, albuterol 5 mg nebulized (or 6 puffs metered dose inhaler) should be administered to patients in respiratory distress with signs of bronchospasm (e.g., known asthmatics, quiet wheezers). Repeat at this dose with unlimited frequency for ongoing respiratory distress.
 - ii. Consider Duoneb 3 mL SVN, if albuterol is ineffective.

Patient Safety Considerations

1. Normal EtCO₂ (35–45 mmHg) with tachypnea and respiratory distress is an indicator of impending respiratory failure
2. The use of nitrates should be avoided in any patient who has used a phosphodiesterase inhibitor within the past 48 hours. Examples are sildenafil, vardenafil and tadalafil, which are used for erectile dysfunction and pulmonary hypertension. Also avoid use in patients receiving intravenous epoprostenol or treprostenil which are used for pulmonary hypertension
3. Invasive airways do not improve bronchospasm. The airway should be managed in the least invasive way possible. Supraglottic devices and endotracheal intubation should be considered only if BVM ventilation fails
4. Positive pressure ventilation in the setting of bronchoconstriction, either via a supraglottic airway or intubation, increases the risk of air trapping which can lead to pneumothorax and cardiovascular collapse. These interventions should be reserved for situations of respiratory failure

Notes/Educational Pearls

1. The combination of ipratropium with albuterol may decrease the need for hospital admission in certain patients
2. Magnesium sulfate may cause hypotension that will usually respond to a fluid bolus
3. Patient with acute heart failure and hypotension have high mortality.
4. When assessing for cause of respiratory distress, CHF tends to be associated with lower levels of EtCO₂ compared to COPD. EtCO₂ values that are extremely low and high are markers of poor outcomes and need for intubation or ICU admission

Key Considerations

1. Nebulizer droplets can carry viral particles and other airborne pathogens, so additional PPE should be considered, including placement of a surgical mask over the nebulizer (if feasible) to limit droplet spread
2. Factors that have been shown to be associated with increased mortality from asthma include:
 - a. Severe asthma as evidenced by at least one of the following:
 - i. Prior near-fatal asthma (e.g., ICU admission or intubation/mechanical ventilation)
 - ii. Prior admissions for asthma or repeated ED visits, particularly if in the last year
 - iii. Heavy use of beta-agonist medications, or requiring three or more classes of asthma medication

- b. Together with one or more behavioral or psychosocial contributors:
 - i. Medication noncompliance
 - ii. Alcohol or drug abuse
 - iii. Obesity
 - iv. Psychosis, depression, other psychiatric illness, or major tranquilizer use
 - v. Employment or income difficulties
 - vi. Severe domestic, marital, or legal stressors
- 3. Acute heart failure is a common cause of pulmonary edema—other causes include:
 - a. Opioid overdose
 - b. High altitude exposure
 - c. Kidney failure or dialysis noncompliance
 - d. Lung damage caused by gases or severe infection
- 4. Nitroglycerin reduces left ventricular filling pressure primarily via venous dilation. At higher doses the drug variably lowers systemic afterload and increases stroke volume and cardiac output
- 5. Pulmonary edema is more commonly a problem of volume distribution than total body fluid overload, so administration of diuretics such as furosemide provide no immediate benefit for most patients and can cause significant harm. Inducement of inappropriate diuresis can lead to increased morbidity and mortality in patients with other disease processes such as pneumonia and sepsis
- 6. 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 and blood pressure
- 7. If available and trained, ultrasound is useful to distinguish pulmonary edema from other causes of respiratory distress (including pneumothorax)
- 8. Pulmonary edema due to irritant gas inhalation (i.e., chlorine) generally is best managed by supportive care and escalation of airway interventions as above once the patient is appropriately decontaminated. Early poison center consultation should be strongly considered for guidance
- 9. Pulmonary edema due to high altitude should be managed as described in [Altitude Illness Guideline](#)

Pertinent Assessment Findings

- 1. Severe respiratory distress may manifest with hypoxia, altered mentation, diaphoresis, or inability to speak more than 2–3 words
- 2. In the setting of severe bronchoconstriction, wheezing may not be heard. Patients with known asthma with severe dyspnea should be empirically treated, even if wheezing is absent
- 3. A “shark fin” on waveform capnography suggests significant bronchospasm and obstructive physiology

4. Etiology of respiratory distress:
 - a. Bronchospastic etiology (e.g., asthma, COPD) is suggested by:
 - i. Wheezing on auscultation
 - ii. “Shark fin” waveform capnograph or prolonged expiratory phase
 - iii. History of asthma/COPD
 - b. Fluid overload etiology (e.g., CHF, pulmonary edema) is suggested by:
 - i. Jugular venous distention
 - ii. Rales on auscultation
 - iii. Peripheral edema
 - iv. History of CHF, diuretic therapy, dialysis noncompliance, hypertension

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914137—Pulmonary Edema/CHF
- 9914139—Respiratory Distress/Asthma/COPD/Croup/Reactive Airway

Key Documentation Elements

Document key aspects of the exam at baseline and after each intervention:

- Respiratory rate
- Oxygen saturation
- EtCO₂/waveform shape
- Use of accessory muscles
- Breath sounds and quality
- Mental status
- Response to interventions

Performance Measures

- Use of pulse oximetry and capnography for patients with moderate-severe respiratory distress (RR greater than age-appropriate normal, SPO₂ less than 90%)
- Percentage of patients with abnormal pulse oximetry, respiratory rate, EtCO₂ value with normalization on final set of vital signs
- Time to administration of oxygen in hypoxic patients
- Time to bronchodilator administration in patients with wheezing
- Percentage of asthma/COPD patients receiving steroids and bronchodilators
- Time to improved SPO₂ and/or decreased respiratory rate
- Normalizing change in vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) temperature, O₂ saturation, and capnography values with treatment
- Time to initiation of noninvasive positive pressure ventilation
- Number of CPAP/BiPAP patients who require intubation
- Documentation of blood pressure reassessment in patients receiving nitrates

References

1. Albertson TE, Sutter ME, Chan AL. The acute management of asthma. *Clin Rev Allergy Immunol.* 2015;48(1):114–25
2. Amnuaypattanapon K, Limjindaporn C, Srivilaithon W, Dasanadeba I. Characteristics and outcomes of treatment in status asthmaticus patients at emergency department. *Asian Pac J Allergy Immunol.* 2019;37(2):87–93
3. Brzezińska-Pawłowska OE, Rydzewska AD, Łuczyńska M, Majkowska-Wojciechowska B, Kowalski ML, Makowska JS. Environmental factors affecting seasonality of ambulance emergency service visits for exacerbations of asthma and COPD. *J Asthma.* 2016;53(2):139–45
4. Clemency BM, Thompson JJ, Tundo GN, Lindstrom HA. Prehospital high-dose sublingual nitroglycerin rarely causes hypotension. *Prehospital and disaster medicine.* 2013;28(5):477–81
5. Cronin JJ, McCoy S, Kennedy U, An Fhailí SN, Wakai A, Hayden J, et al. A Randomized Trial of Single-Dose Oral Dexamethasone Versus Multidose Prednisolone for Acute Exacerbations of Asthma in Children Who Attend the Emergency Department. *Ann Emerg Med.* 2016;67(5):593–601.e3
6. D'Amato G, Vitale C, Lanza M, Sanduzzi A, Molino A, Mormile M, et al. Near fatal asthma: treatment and prevention. *Eur Ann Allergy Clin Immunol.* 2016;48(4):116–22
7. Fenwick R. Management of acute heart failure in the emergency department. *Emerg Nurse.* 2015;23(8):26–35
8. Gartner BA, Fehlmann C, Suppan L, Niquille M, Rutschmann OT, Sarasin F. Effect of noninvasive ventilation on intubation risk in prehospital patients with acute cardiogenic pulmonary edema: a retrospective study. *European journal of emergency medicine: Official Journal of the European Society for Emergency Medicine.* 2020;27(1):54–8
9. Govier P, Coulson JM. Civilian exposure to chlorine gas: A systematic review. *Toxicol Lett.* 2018;293:249–52
10. Hensel M, Strunden MS, Tank S, Gagelmann N, Wirtz S, Kerner T. Prehospital non-invasive ventilation in acute respiratory failure is justified even if the distance to hospital is short. *The American journal of emergency medicine.* 2019;37(4):651–6
11. Hsu J, Chen J, Mirabelli MC. Asthma Morbidity, Comorbidities, and Modifiable Factors Among Older Adults. *J Allergy Clin Immunol Pract.* 2018;6(1):236–43.e7
12. Hunter CL, Silvestri S, Ralls G, Papa L. Prehospital end-tidal carbon dioxide differentiates between cardiac and obstructive causes of dyspnoea. *Emergency medicine journal : EMJ.* 2015;32(6):453–6
13. Hyun Cho W, Ju Yeo H, Hoon Yoon S, Lee S, SooJeon D, Seong Kim Y, et al. High-Flow Nasal Cannula Therapy for Acute Hypoxemic Respiratory Failure in Adults: A Retrospective Analysis. *Intern Med.* 2015;54(18):2307–13
14. Jones BP, Paul A. Management of acute asthma in the pediatric patient: an evidence-based review. *Pediatric emergency medicine practice.* 2013;10(5):1–23; quiz-4
15. Kenyon N, Zeki AA, Albertson TE, Louie S. Definition of critical asthma syndromes. *Clin Rev Allergy Immunol.* 2015;48(1):1–6
16. Laursen CB, Hänselmann A, Posth S, Mikkelsen S, Videbæk L, Berg H. Prehospital lung ultrasound for the diagnosis of cardiogenic pulmonary oedema: a pilot study. *Scand J Trauma Resusc Emerg Med.* 2016;24:96
17. Luiz T, Kumpch M, Grüttner J, Madler C, Viergutz T. Prehospital CPAP Therapy by Emergency Physicians in Patients with Acute Respiratory Failure due to Acute Cardiogenic

Pulmonary Edema or Acutely Exacerbated COPD. In vivo (Athens, Greece). 2016;30(2):133–9

18. Mac Donncha C, Cummins N, Hennelly D, Hannigan A, Ryan D. An observational study of the utility of continuous positive airway pressure ventilation for appropriate candidates in prehospital care in the Midwest region. *Irish journal of medical science*. 2017;186(2):489-94
19. Nagurka R, Bechmann S, Gluckman W, Scott SR, Compton S, Lamba S. Utility of initial prehospital end-tidal carbon dioxide measurements to predict poor outcomes in adult asthmatic patients. *Prehospital emergency care: official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2014;18(2):180–4
20. Nassif A, Ostermayer DG, Hoang KB, Claiborne MK, Camp EA, Shah MI. Implementation of a Prehospital Protocol Change For Asthmatic Children. *Prehospital emergency care: official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2018;22(4):457–65
21. Patrick C, Ward B, Anderson J, Rogers Keene K, Adams E, Cash RE, et al. Feasibility, Effectiveness and Safety of Prehospital Intravenous Bolus Dose Nitroglycerin in Patients with Acute Pulmonary Edema. *Prehospital emergency care: official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2020;24(6):844–50
22. Pollock M, Sinha IP, Hartling L, Rowe BH, Schreiber S, Fernandes RM. Inhaled short-acting bronchodilators for managing emergency childhood asthma: an overview of reviews. *Allergy*. 2017;72(2):183–200
23. Ramgopal S, Mazzarini A, Martin-Gill C, Owusu-Ansah S. Prehospital management of pediatric asthma patients in a large emergency medical services system. *Pediatr Pulmonol*. 2020;55(1):83–9
24. Raun LH, Ensor KB, Campos LA, Persse D. Factors affecting ambulance utilization for asthma attack treatment: understanding where to target interventions. *Public Health*. 2015;129(5):501–8
25. Society BT. British guideline on the management of asthma: A national clinical guideline. London, England: *Scottish Intercollegiate Guidelines Network*; 2019
26. Strnad M, Prosen G, Borovnik Lesjak V. Bedside lung ultrasound for monitoring the effectiveness of prehospital treatment with continuous positive airway pressure in acute decompensated heart failure. *European journal of emergency medicine: official journal of the European Society for Emergency Medicine*. 2016;23(1):50–5
27. Turker S, Dogru M, Yildiz F, Yilmaz SB. The effect of nebulised magnesium sulphate in the management of childhood moderate asthma exacerbations as adjuvant treatment. *Allergol Immunopathol (Madr)*. 2017;45(2):115–20
28. Williams TA, Finn J, Fatovich D, Perkins GD, Summers Q, Jacobs I. Paramedic Differentiation of Asthma and COPD in the Prehospital Setting Is Difficult. *Prehospital emergency care: official journal of the National Association of EMS Physicians and the National Association of State EMS Directors*. 2015;19(4):535–43
29. Wilson SS, Kwiatkowski GM, Millis SR, Purakal JD, Mahajan AP, Levy PD. Use of nitroglycerin by bolus prevents intensive care unit admission in patients with acute hypertensive heart failure. *The American journal of emergency medicine*. 2017;35(1):126-31
30. Zellner T, Eyer F. Choking agents and chlorine gas—History, pathophysiology, clinical effects and treatment. *Toxicol Lett*. 2020;320:73–9

Mechanical Ventilation (Invasive)

Patient Care Goals

1. Maintain adequate oxygenation
2. Maintain adequate minute ventilation and capnography targets based on patient pathophysiology
3. Prevent or limit risk of short- and long-term invasive airway and ventilator-associated complications including barotrauma, pneumothorax, aspiration, and over ventilation

Patient Presentation

Inclusion Criteria

Adult patients with invasive airway requiring mechanical ventilation

Exclusion Criteria

1. Interfacility transfer patients with established vent settings
2. Patients with suspected untreated pneumothorax or large airway injury
3. Patients in cardiac arrest

Patient Management

Assessment

1. Confirm airway placement with ventilation and auscultation over epigastrium and assess for symmetric bilateral lung sounds
2. Verify that airway (ETT, SGA) is securely held in place (by holder or other method)
3. Assess oxygen delivery and confirm that FiO₂ meets patients' needs and maintains desired oxygen saturation (SpO₂)
 - a. If oxygen will be needed during transport calculate the duration of supply needed (O₂ tank time (min) = tank pressure (psi) x tank conversion factor/flow rate (L/min)
4. Assess blood pressure to assure SBP greater than 90 mmHg or resuscitate to SBP ≥90 mmHg or MAP ≥65 mmHg
5. Assess mental status, level of consciousness, Richmond Agitation Sedation Scale (RASS), or similar sedation score

Treatment and Interventions

1. Set up ventilator and circuit, program initial ventilator settings as below. Suggested general guidelines for adults with EMS initiation of mechanical ventilation:
 - a. Consider and modify based on any underlying acute or chronic lung pathology (COPD, asthma, CHF)
 - b. Volume mode is generally preferred initially in adults
 - c. Select an appropriate ventilator mode: Assist Control (AC) is acceptable for most patients

i. Initial settings

Tidal volume	6–8 mL/kg ideal body weight	Go to ARDSNET table of height and Predicted Body Weight and Tidal volumes. Use 6–8 mL/kg as a starting point. Patients with known acidosis should start with 9 mL/kg
Respiratory rate	12–14 (or 8–12) breaths/min	Adjust for target minute ventilation based on EtCO ₂

ii. Set the heat moisture exchange (HME) at circuit Y

iii. Plateau pressure (PPlat) goal is less than 30 cmH₂O

Patient Safety Considerations

1. Ventilators have different capabilities and features. Users must be familiar with the device they use and must be properly educated on its use and application in the specific population being treated
2. Ensure that all vent alarms are set appropriately, and patient is continually monitored with pulse oximetry and waveform capnography:
3. During transport of a critically ill patient only necessary adjustments should be made to the ventilator. Focus on maintaining adequate oxygenation, minute volume and patient comfort
4. An increase in the respiratory rate shortens the expiratory time. If changing rate, also check the I:E ratio (the proportions of each breath cycle devoted to the inspiratory and expiratory phases) and adjust the inspiratory time if necessary
5. Assure patient does not have auto-PEEP

Notes/Educational Pearls

Key Considerations

1. It is important to understand the patient's underlying pulmonary status to choose the appropriate type of ventilation (volume or pressure) and mode (AC or SIMV most common):
 - a. Volume control ventilation is generally preferred initially in adults with compliant lungs (PPlat less than 30) because of better control of minute ventilation.
 - b. Pressure control ventilation can be used in patients with noncompliant lungs and elevated PPlat.
 - c. Assist Control (AC) mode is acceptable for most patients and provides best control of minute ventilation. Synchronized Intermittent Mandatory Ventilation (SIMV) is an alternative option

Pertinent Assessment Findings

1. Perform a pre-ventilator use inspection including a circuit check on the ventilator prior to placing it on a patient
2. Assess values during transport, including:
 - a. Peak inspiratory pressure (PIP) Compare against baseline value to monitor for compliance changes or obstruction in the circuit
 - b. Respiratory rate. Compare with baseline value, rapid increases could indicate leaks. Over breathing may require vent setting adjustment
 - c. Exhaled tidal volume. Compare against baseline, if extreme fluctuations, check for leaks in circuit and in ET tube

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

None noted

Key Documentation Elements

Documentation of ventilator settings and monitored values should include:

1. Ventilator Settings: Volume or pressure breaths; mode; respiratory rate; inspiratory time; tidal volume or pressure, PEEP, FiO₂; sensitivity
2. Patient Values (baseline and repeated): Peak inspiratory pressure (PIP); exhaled tidal volume; respiratory rate; I:E ratio; minute volume; EtCO₂; SPO₂

Performance Measures

None noted

Adult Male Patients							
Height	IBW kg	Lung-Protective		Resuscitative		Metabolic	
		6 ml/kg		10 ml/kg		8 ml/kg	
		Vt	Initial f	Vt	Initial f	Vt	Initial f
5'0"	50	300	12	500	12	400	20
5'1"	52	314	12	523	12	418	20
5'2"	55	328	12	546	12	437	20
5'3"	57	341	12	569	12	455	20
5'4"	59	355	12	592	12	474	20
5'5"	62	369	12	615	12	492	20
5'6"	64	383	12	638	12	510	20
5'7"	66	397	12	661	12	529	20
5'8"	68	410	12	684	12	547	20
5'9"	71	424	12	707	12	566	20
5'10"	73	438	12	730	12	584	20
5'11"	75	452	12	753	12	602	20
6'0"	78	466	12	776	12	621	20
6'1"	80	479	12	799	12	639	20
6'2"	82	493	12	822	12	658	20
6'3"	85	507	12	845	12	676	20
6'4"	87	521	12	868	12	694	20
6'5"	89	535	12	891	12	713	20
6'6"	91	548	12	914	12	731	20
Source: NIH-NHLBI ARDS Network							

Adult Female Patients							
Height	IBW kg	Lung-Protective		Resuscitative		Metabolic	
		6 ml/kg		10 ml/kg		8 ml/kg	
		Vt	Initial f	Vt	Initial f	Vt	Initial f
5'0"	46	273	12	455	12	364	20
5'1"	48	287	12	478	12	382	20
5'2"	50	301	12	501	12	401	20
5'3"	52	314	12	524	12	419	20
5'4"	55	328	12	547	12	438	20
5'5"	57	342	12	570	12	456	20
5'6"	59	356	12	593	12	474	20
5'7"	62	370	12	616	12	493	20
5'8"	64	383	12	639	12	511	20
5'9"	66	397	12	662	12	530	20
5'10"	69	411	12	685	12	548	20
5'11"	71	425	12	708	12	566	20
6'0"	73	439	12	731	12	585	20
6'1"	75	452	12	754	12	603	20
6'2"	78	466	12	777	12	622	20
6'3"	80	480	12	800	12	640	20
6'4"	82	494	12	823	12	658	20
6'5"	85	508	12	846	12	677	20
6'6"	87	521	12	869	12	695	20
Source: NIH-NHLBI ARDS Network							

References

1. NIH-NHLBI ARDS Network. Predicted Body Weight and Tidal Volume Charts. 2014
2. Schauf, M. Respiratory emergencies, Airway Management and Ventilation. In: Pollak AN (Ed): Critical Care Transport Second Edition. Jones & Bartlett Learning, Burlington, MA 2018

Tracheostomy Management

Patient Care Goals

1. Meet airway management goals in a patient with a tracheostomy
 - a. Assure patent airway, understand how to troubleshoot tracheostomy in a patient with respiratory distress
 - b. Assure adequate oxygenation and ventilation

Patient Presentation

Inclusion Criteria

Any adult or pediatric patient with an existing tracheostomy *greater than 7* days post placement and a mature stoma tract

Exclusion Criteria

Adult or pediatric patient with tracheostomy *less than 7* days post placement (i.e., no mature stoma tract)

Patient Management

Assessment

1. Evaluate patient respiratory status as per [Airway Management Guideline](#).
2. In a patient with respiratory distress, evaluate for DOPE:
 - a. **Dislodgement or misplaced tracheostomy** (e.g., decannulation)
 - i. Assess for subcutaneous air in the neck which may indicate the tracheostomy is not in the trachea
 - ii. Directly visualize the tracheostomy and the stoma (i.e., remove anything obstructing direct view of stoma including clothing/bandages/sponges etc.) to assure it remains properly seated in the stoma
 - b. **Obstruction or secretions in tracheostomy**
 - i. Assure tracheostomy is patent. Especially in pediatric tracheostomy patients with significant respiratory distress, plugging or dislodgement/decannulation of the tracheostomy is the problem until proven otherwise
 - ii. Auscultate breath sounds, consider potential for plugging of large airways in patients with significant respiratory distress
 - c. **Pneumothorax**
 - d. **Equipment connection problems**
3. As with any patient with respiratory distress, appropriate monitoring with pulse oximetry and waveform capnography should be provided as per [Airway Management Guideline](#).

Treatment and Troubleshooting Interventions

1. In patient with **mild respiratory distress and adequate oxygenation:**
 - a. **Suctioning/clearing obstruction:**
 - i. If the patient is not on a ventilator, remove any cap, filter, or speaking valve that may be connected to the tracheostomy
 - ii. Provide passive oxygenation with high flow oxygen over nose/mouth and stoma to avoid hypoxia during procedure
 - iii. Remove inner cannula if present
 - iv. If needed, use 1–3 mL sterile saline directly into the tracheostomy to loosen secretions and help clear obstruction
 - v. Pass appropriately sized suction catheter through tracheostomy
 - vi. Once obstruction is cleared, assist ventilations as needed with BVM to tracheostomy tube, provide passive oxygenation or return patient to ventilator if patient on chronic ventilator via tracheostomy
2. In patient with **significant/severe respiratory distress and/or inadequate oxygenation:**
 - a. If patient on ventilator, remove from vent and attempt BVM ventilation
 - b. **Suctioning/clearing obstruction:**
 - i. If the patient is not on a ventilator, remove any cap, filter, or speaking valve that may be connected to the tracheostomy
 - ii. Provide passive oxygenation with high flow oxygen over nose/mouth and stoma to avoid hypoxia during procedure
 - iii. Remove inner cannula if present
 - iv. Attempt to pass appropriately sized suction catheter through tracheostomy
 - v. If needed, use 1–3 mL sterile saline directly into the tracheostomy to loosen secretions and help clear obstruction
 - vi. If suction catheter will not pass, the tracheostomy needs to be changed emergently due to obstruction. (See [below](#))
 - vii. Once obstruction is cleared, assist ventilations as needed with BVM to tracheostomy tube, provide passive oxygenation or return patient to ventilator if patient on chronic ventilator via tracheostomy tube
 - c. **Emergent tracheostomy change:** Determine size of tracheostomy needed from imprint on existing tracheostomy flange/collar. If no replacement tracheostomy is available, an endotracheal tube of the same size or smaller may be used.
 - i. Ventilate or provide passive oxygenation during procedure. Attempt to ventilate from the upper airway or direct high flow O₂ to stoma during attempts.
 - ii. Deflate cuff (if present)
 - iii. Remove ties and obstructed tracheostomy
 - iv. Immediately replace with new (lubricated) tracheostomy, remove obturator, and begin BVM ventilation. Never use force. For difficult replacement, the following strategies can be attempted:
 - a. Reposition patient with neck extended

- b. Ensure proper lubrication and reattempt approach at a 90-degree angle from long axis of neck (i.e., from the side) to enter the stoma and then rotate back along the long axis to complete insertion
 - c. Attempt reinsertion with a smaller sized tracheostomy or endotracheal tube
- v. Confirm correct placement with waveform capnography, breath sounds, oxygen saturation, chest rise
- vi. Secure tracheostomy with tracheostomy ties or tube with appropriate holder
- 3. Cuff may need to be inflated to provide adequate oxygenation and ventilation when positive pressure ventilation is required. However, cuff should never be inflated if positive pressure ventilation is not being performed, or in patients with a Passy-Muir (teal colored) speaking valve in place.

Patient Safety Considerations

- 1. Especially in pediatric tracheostomy patients with significant respiratory distress, plugging or dislodgement of the tracheostomy is the problem until proven otherwise. Signs and symptoms of respiratory distress, cyanosis, ventilator alarms sounding, decreased level of consciousness, decreased SpO₂ or cardiac arrest in patients with a tracheostomy, as well as bradycardia in pediatric tracheostomy patients should be presumed due to a tracheostomy obstruction.
- 2. Laryngectomy patients and some patients with congenital or surgical airway abnormalities cannot be orally intubated. Patients with tracheostomy alone (e.g., for mechanical ventilation) and no airway abnormalities should be able to be orally intubated.
- 3. For recent tracheostomy patients who present with bleeding from the tracheostomy in the early (up to 3 weeks) postoperative period, a tracheoinnominate arterial bleed is an uncommon and life-threatening complication (0.7% incidence and a 90% mortality rate).
 - a. 50% of these patients present initially with a smaller sentinel bleed/hemoptysis which appears to have stopped.
 - b. Inflation of the tracheostomy balloon to the maximum is a potential temporizing measure until definitive care can be provided, even overinflation may be needed. If the tracheostomy is uncuffed, it can be replaced with a cuffed endotracheal tube and the balloon maximally inflated
 - c. Any patient in the early postoperative period (within a month of surgery) with hemoptysis or bleeding from a tracheostomy should be transported for evaluation, even if bleeding has stopped
- 4. Prompt tracheostomy replacement is important. Delays allow for narrowing of the stoma and can make recannulation more difficult.

Notes/Educational Pearls

Key Considerations

- 1. Tracheostomy tube components
 - a. Outer cannula: The tracheostomy size is stamped on the collar
 - b. Inner cannula: Not found in all tracheostomies
 - i. Not commonly used in pediatric patients
 - ii. Removed by gently twisting a quarter turn to the left and pulling out

- c. Balloon cuff: Protects lower airway from secretions/blood from above, allows for better mechanical ventilation
 - d. Collar: Includes imprint of tube size and attachment for umbilical tape/tracheostomy ties
 - e. Obturator: Stiffens and provides shape to tracheostomy tube to facilitate insertion. Must be removed for ventilation
2. To determine the appropriate size suction catheter, double the size of the tracheostomy (number on collar of tracheostomy tube)
 3. A bougie may aid in the placement of an endotracheal tube into a mature stoma
 4. An inner cannula may be required to ventilate through the tracheostomy tube
 5. Uncuffed and fenestrated cuffed tracheostomy tubes may not protect the patient from aspiration
 6. If transporting a patient with a tracheostomy either in an emergency or routine transport, the patient's home tracheostomy equipment (e.g., "Go bag") should accompany them. The equipment that needs to be at the bedside to ensure safety includes appropriately sized French suction catheters, operating suction system, and spare tracheostomy tubes. Sterile saline, sterile gloves and water-soluble medical lubrication packets should also be available. Most tracheostomy patients will maintain a kit with these supplies to travel with
 7. Inadvertent tracheostomy decannulation incidence is the second most frequent life-threatening pediatric tracheostomy complication, occurring at rates of 0.35–15%, with the vast majority occurring more than 7 days postoperatively
 8. Tracheostomy obstruction can occur for several reasons, including mucus plugging, abnormal/excess granulation tissue, tracheomalacia causing collapse of the tracheal wall around the tube
 9. Do not replace a heat moisture exchange (HME) filter cap if soiled or wet as it can impede airflow

Pertinent Assessment Findings

1. Adequate oxygenation without respiratory distress suggests that the tracheostomy is patent and functioning correctly
2. Inadequate oxygenation and ventilation, respiratory distress, air hunger in a patient with a tracheostomy should first be presumed to be due to tracheostomy obstruction
3. Neck or chest crepitus on palpation suggests tracheostomy misplacement outside the trachea

Quality Improvement

Associated NEMIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914001—Airway
- 9914003—Airway—Failed
- 9914005—Airway—Obstruction/Foreign Body

Key Documentation Elements

- For any tracheostomy patient with respiratory distress, visual verification of correct location of tracheostomy in the stoma and auscultation of breath sounds
- Continuous pulse oximetry and preferably continuous waveform capnography (or if unavailable, repeated capnometry measurements) should be documented for every patient. [eAirway.03: 4003015]

Performance Measures

None noted

References

1. Bontempo LJ, Manning SL. Tracheostomy Emergencies. *Emergency medicine clinics of North America*. 2019;37(1):109–19
2. Dawson, D. (2014). Essential principles: tracheostomy care in the adult patient. *Nurs Crit Care*, 19(2), 63–72. doi:10.1111/nicc.12076
3. Doherty, C., Neal, R., English, C., Cooke, J., Atkinson, D., Bates, L., . . . McGrath, B. A. (2018). Multidisciplinary guidelines for the management of paediatric tracheostomy emergencies. *Anaesthesia*, 73(11), 1400–1417. doi:10.1111/anae.14307
4. Fernandez-Bussy S, Mahajan B, Folch E, Caviedes I, Guerrero J, Majid A. Tracheostomy Tube Placement: Early and Late Complications. *J Bronchology Interv Pulmonol*. 2015;22(4):357–64
5. Fuller C, Wineland AM, Richter GT. Update on Pediatric Tracheostomy: Indications, Technique, Education, and Decannulation. *Curr Otorhinolaryngol Rep*. 2021:1–12
6. Hess DR, Altobelli NP. Tracheostomy tubes. *Respiratory care*. 2014;59(6):956–71; discussion 71–3
7. Kligerman MP, Saraswathula A, Sethi RK, Divi V. Tracheostomy Complications in the Emergency Department: A National Analysis of 38,271 Cases. *ORL J Otorhinolaryngol Relat Spec*. 2020;82(2):106–14
8. Kohn, J., McKeon, M., Munhall, D., Blanchette, S., Wells, S., & Watters, K. (2019). Standardization of pediatric tracheostomy care with “Go-bags”. *Int J Pediatr Otorhinolaryngol*, 121, 154–156. doi:10.1016/j.ijporl.2019.03.022
9. Mehta, K., Schwartz, M., Falcone, T. E., & Kavanagh, K. R. (2019). Tracheostomy Care Education for the Nonsurgical First Responder: A Needs-Based Assessment and Quality Improvement Initiative. *OTO Open*, 3(2), 2473974x19844993. doi:10.1177/2473974x19844993
10. Muller RG, Mamidala MP, Smith SH, Smith A, Sheyn A. Incidence, Epidemiology, and Outcomes of Pediatric Tracheostomy in the United States from 2000 to 2012. *Otolaryngol Head Neck Surg*. 2019;160(2):332–8
11. Prickett, K., Deshpande, A., Paschal, H., Simon, D., & Hebbar, K. B. (2019). Simulation-based education to improve emergency management skills in caregivers of tracheostomy patients. *Int J Pediatr Otorhinolaryngol*, 120, 157–161. doi:10.1016/j.ijporl.2019.01.020
12. Sandler ML, Ayele N, Ncogoza I, Blanchette S, Munhall DS, Marques B, et al. Improving Tracheostomy Care in Resource-Limited Settings. *Ann Otol Rhinol Laryngol*. 2020;129(2):181–90
13. Sterni LM, Collaco JM, Baker CD, Carroll JL, Sharma GD, Brozek JL, et al. An Official American Thoracic Society Clinical Practice Guideline: Pediatric Chronic Home Invasive Ventilation. *American journal of respiratory and critical care medicine*. 2016;193(8):e16–e35
14. Volsko TA, Parker SW, Deakins K, Walsh BK, Fedor KL, Valika T, et al. AARC Clinical Practice Guideline: Management of Pediatric Patients With Tracheostomy in the Acute Care Setting. *Respiratory care*. 2021;66(1):144–55
15. Walsh BK, Crotwell DN, Restrepo RD. Capnography/Capnometry During Mechanical Ventilation: 2011. *Respiratory care*. 2011;56(4):503–9
16. Watters KF. Tracheostomy in Infants and Children. *Respiratory care*. 2017;62(6):799–825

TRAUMA



General Trauma Management

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Patients of all ages who have sustained an injury due to mechanical trauma, including:
 - a. Blunt injury
 - b. Penetrating injury
 - c. Blast
 - d. Burns

Exclusion Criteria

Not an acute traumatic injury

Patient Management

Initial Assessment

1. Primary survey (Use “**MARCH**” algorithm)
 - a. **Massive Hemorrhage**
 - i. Initial visual and body sweep to assess for penetrating wounds and severe life-threatening hemorrhage [See [Extremity Trauma/External Hemorrhage Management Guideline](#)]
 - b. Airway
 - i. Assess airway patency by asking the patient basic questions to assess for stridor and ease of air movement
 - ii. Look for injuries that may lead to airway obstruction including unstable facial fractures, expanding neck hematoma, blood or vomitus in the airway, facial burns/inhalation injury
 - iii. Evaluate mental status for ability to protect airway (patients with a Glasgow Coma Score (GCS) less than or equal to “8” are more likely to require airway protection)
 - c. Respiratory/Breathing
 - i. Assess respiratory rate and pattern
 - ii. Assess for tracheal deviation
 - iii. Assess symmetry of chest wall movement
 - iv. Listen bilaterally on lateral chest wall for breath sounds

- d. Circulation
 - i. Assess blood pressure and heart rate
- e. Head injury/Hypothermia
- c. Perform initial neurologic status assessment of GCS/AVPU (**A**lert, **V**erbal, **P**ainful, **U**nconscious) and pupillary size and responsiveness [See [Appendix IV. Neurologic Status Assessment](#) and [Head injury Guideline](#)]
 - i. Assess for gross motor movement of extremities
 - ii. Evaluate for clinical signs of traumatic brain injury with herniation including
 - 1. Unequal pupils
 - 2. Lateralizing motor signs
 - 3. Posturing
 - iii. Prevent hypothermia

Immediate Treatment and Interventions

1. Massive or exsanguinating hemorrhage control
 - a. First stop severe external and extremity hemorrhage with extremity tourniquets or appropriate wound packing with hemostatic gauze. Be sure to roll patient and examine the back as well. [See [Extremity Trauma/External Hemorrhage Management Guideline](#)].
 - b. Utilize junctional tourniquets if needed for junctional area hemorrhage
2. Airway
 - a. If impending airway obstruction or altered mental status resulting in inability to maintain airway patency, immediately ensure patent airway. [See [Airway Management Guideline](#) and [Spinal Care Guideline](#)]
 - b. Consider airway adjuncts as appropriate avoiding nasal airway adjuncts in patents with oral or other facial injuries. [See [Airway Management Guideline](#)]
3. Respiratory/Breathing
 - a. If absent or diminished breath sounds in a hypotensive trauma patient, especially those with chest trauma and/or tracheal deviation, consider tension pneumothorax and perform needle decompression of side without breath sounds or side opposite tracheal deviation; may need second or third needle decompression on same side if there is a rush of air but patient again has symptoms. May use Capnospot with needle decompression.
 - b. For open chest wound, place semi-occlusive dressing
 - c. Monitor oxygen saturation (SpO₂) and, if indicated, provide supplemental oxygen to maintain SPO₂ greater than 94% and respiratory support if needed. [See Respiratory Section]
4. Circulation
 - a. If pelvis is unstable, place pelvic binder or sheet to stabilize pelvis
 - b. Establish IV access if needed (large bore preferred)
 - c. Fluid resuscitation

i. Adults

1. If SBP greater than 90 mmHg and heart rate less than 120 BPM, no IV fluids required
2. If SBP less than 90 mmHg or HR greater than 120 BPM, initiate resuscitation to a MAP of 65:
 - a. Consider 250 mL bolus of IV fluid, repeat as needed for persistent signs and symptoms of shock
 - i. If signs and symptoms of shock persist after a total of 2 L bolus, contact online medical direction
 - b. Trauma resuscitation target SBP 90 mmHg (palpable radial pulse or alert mental status)
 - c. Reassess SBP after bolus given
3. Head injury: target SBP greater than 110 mmHg. Hypotension should be avoided to maintain cerebral perfusion

ii. Pediatrics

1. If patient demonstrates tachycardia for age with signs of poor perfusion (low BP, greater than 2-second capillary refill, altered mental status, hypoxia, weak pulses, pallor, or mottled/cool skin), give 20 mL/kg bolus and reassess. Repeat as needed for persistent signs and symptoms of shock.
 - a. If signs and symptoms of shock persist after a total of 60 mL/kg bolus, contact online medical direction
 2. Target normal BP for age [See [Appendix V. Abnormal Vital Signs](#)]
 - d. Tranexamic acid (TXA) at 2 grams over 10 minutes administration may be considered within three hours of injury and signs of hemorrhagic shock.
5. Disability/Head/Hypothermia
- a. If clinical signs of traumatic brain injury [See [Head injury Guideline](#)]
 - b. Avoid/treat hypothermia
 - i. Remove wet clothing
 - ii. Cover patient to warm and/or prevent further heat loss
6. **NOTE:** Patients with major hemorrhage, hemodynamic instability, penetrating torso trauma, or signs of traumatic brain injury often require rapid surgical intervention. Minimize scene time (goal is under 10 minutes) and initiate rapid transport to the appropriate facility based on [EMS System Destination Policy](#).
7. Repeat primary assessment or secondary assessment should be conducted en route to the trauma center

8. Decisions regarding trauma activation and transport destination should be based on the EMS System Destination Policy
 - a. Notify receiving trauma center of trauma alert. Provide early notification (prior to transport) if possible
 - b. Identify criteria from the [National Guideline for the Field Triage of Injured Patients](#)
 - c. Receiving trauma center will determine level of activation. EMS does not need to specify activation level

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. Last meal
 - v. Events leading up to the injury
 - b. Secondary survey: Head to toe physical exam including reassessment of interventions from primary survey
 - i. Head/Face
 - a. Palpate head and scalp and face and evaluate for soft tissue injury or bony crepitus indicating injury to skull or facial bones
 - b. Assess for globe injury and subjective change in vision
 - c. See [Facial/Dental Trauma Guideline](#)
 - ii. Neck
 - a. Contusions
 - b. Abrasions
 - c. Hematomas
 - d. Jugular vein distention (JVD)
 - e. Tracheal deviation
 - f. Palpate for crepitus
 - g. Spinal assessment per [Spinal Care Guideline](#)
 - iii. Chest—See [Initial Treatment](#)
 - a. Palpate for instability/crepitus
 - b. Listen to breath sounds
 - c. Inspect for penetrating or soft tissue injuries
 - iv. Abdomen
 1. Palpate for tenderness
 2. Inspect for penetrating or soft tissue injuries
 3. Cover eviscerated abdominal contents with moist dressings

- v. Pelvis
 - 4. Inspect for penetrating or soft tissue injuries
 - 5. Palpate once for instability by applying medial pressure on the iliac crests bilaterally
- vi. Back
 - 6. Maintain spinal alignment. Refer to [Spinal Care Guideline](#)
 - 7. Inspect for penetrating or soft tissue injuries
- vii. Neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)]
 - 8. Serial assessment of mental status
 - 9. Gross exam of motor strength and sensation in all four extremities
- viii. Extremities
 - 10. Assess for fracture/deformity—See [Extremity Trauma/External Hemorrhage Management Guideline](#)
 - 11. Assess peripheral pulses/capillary refill
- c. Additional treatment considerations
 - i. Maintain spine precautions per the [Spinal Care Guideline](#)
 - ii. Splint obvious extremity fractures per the [Extremity Trauma/External Hemorrhage Management Guideline](#)
 - iii. Provide pain medication per the [Pain Management Guideline](#)

Patient Safety Considerations

- 1. Life-threatening injuries identified on primary survey should be mitigated immediately with rapid transport to a trauma center
- 2. Monitor patient for deterioration over time with serial vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) and repeat neurologic status assessment [See [Appendix IV. 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. [See [Head Injury Guideline](#)]
- 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 first control of massive hemorrhage using **MARCH** (Massive hemorrhage, Airway, Respiratory/Breathing, Circulation, Head injury/Hypothermia)

2. Target scene time less than 10 minutes for unstable patients or those likely to need surgical intervention
3. Clinician training should include the [National Guideline for the Field Triage of Injured Patients](#)
4. Frequent reassessment of the patient is important:
 - a. If patient develops difficulty with ventilation, reassess breath sounds for development of tension pneumothorax
 - b. If extremity hemorrhage is controlled with pressure dressing or tourniquet, reassess for evidence of continued hemorrhage
 - c. If mental status declines, reassess **ABCs** (**A**irway, **B**reathing, **C**irculation) and repeat neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)]
5. Use structured communication tool for patient handoff to higher level care such as **AT-MIST**:
 - a. **A**ge
 - b. **T**ime of incident or onset of symptoms
 - c. **M**echanism
 - d. **I**njuries noted
 - e. **S**ymptoms/**S**igns
 - f. **T**reatments provided
6. EMS Trauma Activation Guideline
 - a. EMS will notify receiving trauma center of trauma alert. Provide early notification (prior to transport) if possible
 - b. Identify criteria from the [National Guideline for the Field Triage of Injured Patients](#)
 - c. Receiving trauma center will determine level of activation. EMS does not need to specify level

Traumatic Arrest: Withholding and Termination of Resuscitative Efforts

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

1. Decapitation
2. Hemi corpectomy
3. Signs of rigor mortis or dependent lividity
4. All other injuries, see [Termination of Resuscitation](#).

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914207—Injury—General Trauma Management

Key Documentation Elements

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

Performance Measures

- Monitor scene time for unstable patients
- Monitor appropriateness of procedures
- Monitor appropriate airway management
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

References

1. American College of Surgeons Committee on Trauma; American College of Emergency Physicians Pediatric Emergency Medicine Committee; National Association of EMS Physicians; American Academy of Pediatrics Committee on Pediatric Emergency Medicine, Fallat ME. Withholding, or termination of resuscitation in pediatric out-of-hospital traumatic cardiopulmonary arrest. *Pediatrics*. 2014;133(4): e1104
2. 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
3. Cullinane DC, Schiller HJ, Zielinski MD, et al. Eastern Association for the Surgery of Trauma practice management guidelines for hemorrhage in pelvic fracture—update and systematic review. *J Trauma*. 2011;71(6):1850–68
4. Deakin CD et al. Accuracy of the Advanced Trauma Life Support Guidelines for Predicting Systolic Blood Pressure Using Carotid, Femoral, and radial Pulses: Observational Study. *BMJ* 2000. PMID: 10987771
5. *Guidelines for the Field Triage of Injured Patients: Recommendations of the National Expert Panel on Field Triage, 2011*. Washington, DC: Centers for Disease Control and Prevention. Morbidity and Mortality Weekly Report; 2012;61(RR01):1–20
6. *Guidelines for the Management of Severe Traumatic Brain Injury*, 4th Edition. Brain Trauma Foundation, September 2016. Available at <https://braintrauma.org/guidelines/guidelines-for-the-management-of-severe-tbi-4th-ed#>. Accessed
7. Jason F Naylor, SP, Andrew D Fisher, SP, Michael D April, MC, Steven G Schauer, MC, An analysis of radial pulse strength to recorded blood pressure in the Department of Defense Trauma Registry, *Military Medicine*, 2020;185(11-12):e1903–e1907, <https://doi.org/10.1093/milmed/usaa197>

8. Millin M, Galvagno SM, Khandker SR, et al. Withholding and termination of resuscitation of adult cardiopulmonary arrest secondary to trauma: Resource document to the joint NAEMSP- ACS (COT) position statements. *J Trauma Acute Care Surg*. 2013;75(3):459-67
9. Morrison C, Carrick M, Norman M, et al. Hypotensive resuscitation strategy reduces transfusion requirements and severe postoperative coagulopathy in trauma patients with hemorrhagic shock: preliminary results of a randomized controlled trial. *J Trauma*. 2011;70(3):652-63
10. *Prehospital Trauma Life Support, 9th Edition*. Burlington, MA: Jones & Bartlett; 2020
11. Poulton TJ et al. ATLS Paradigm Fails. *Ann Emerg Med* 1988. PMID: 3337405
12. Spaite DW, Bobrow BJ, Keim SM, et al. Association of Statewide Implementation of the Prehospital Traumatic Brain Injury Treatment Guidelines With Patient Survival Following Traumatic Brain Injury. The Excellence in Prehospital Injury Care (EPIC) Study. *JAMA Surg*. 2019;154(7): e191152
13. Tactical Combat Casualty Care (TCCC) Guidelines for Medical Personnel, 05 November 2020. Available at <https://deployedmedicine.com/content/40>. Accessed
14. Tactical Emergency Casualty Care (TECC) Guidelines for BLS/ALS Medical Providers. Current as of March 2019. Available at <https://www.c-tecc.org/images/4-2019-TECC-ALS-BLS-Guidelines.pdf>. Accessed
15. The CRASH-2 Collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant hemorrhage (CRASH-2): a randomized, placebo-controlled trial. *Lancet*. 2010; 376:23-32
16. Topijian et al. Part 4: Pediatric Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142: S469-S523
17. Truhlar A, Deakin C, Soar J, et al. European resuscitation council guidelines for resuscitation 2015: section 4. Cardiac arrest in special circumstances. *Resuscitation*. 2015; 95:148-201

Blast Injuries

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Patients exposed to explosive force. Injuries may include any or all the following:
 - a. Blunt trauma
 - b. Penetrating trauma
 - c. Burns
 - d. Pressure-related injuries (barotrauma)
 - e. Toxic chemical contamination
 - f. Chemical, biological, radiological, nuclear, and explosive devices, or agents

Exclusion Criteria

None noted

Patient Management

Assessment

1. Hemorrhage Control
 - a. Assess for and stop severe hemorrhage [See [Extremity Trauma/External Hemorrhage Management Guideline](#)]
2. Airway
 - a. Assess airway patency
 - b. Consider possible thermal or chemical burns to the airway
3. Breathing
 - a. Evaluate the adequacy of respiratory effort, oxygenation, quality of lung sounds, and chest wall integrity
 - b. Consider possible pneumothorax or tension pneumothorax (because of penetrating/blunt trauma or barotrauma)
 - c. Continually reassess for blast lung injury
4. Circulation
 - a. Look for evidence of hemorrhage
 - b. Assess BP, pulse, skin color/character, and distal capillary refill for signs of shock

5. Disability
 - a. Assess patient responsiveness (e.g., **AVPU**) and level of consciousness (e.g., **GCS**) [See [Appendix IV: Neurologic Status Assessment](#)]
 - b. Assess pupils
 - c. Assess gross motor movement of extremities
6. Exposure
 - a. Rapid evaluation of entire skin surface, including back (log roll), to identify blunt or penetrating injuries

Treatment and Interventions

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

Patient Safety Considerations

1. Ensuring scene safety is especially important at the scene of an explosion
 - a. Always consider the possibility of subsequent explosions

- b. Structural safety, possible toxic chemical contamination, the presence of poisonous gasses, and other hazards might cause a delay in patient extraction
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 a 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. Consider injuries due to barotrauma.
 - a. Tension pneumothorax
 - i. Hypotension or other signs of shock associated with decreased or absent breath sounds, jugular venous distension, and/or tracheal deviation.
 - b. Tympanic membrane perforation resulting in deafness which may complicate the evaluation of their mental status and their ability to follow commands.
5. Primary transport to a trauma or burn center is preferable, whenever possible.

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914045—Exposure—Explosive/Blast Injury

Key Documentation Elements

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

Performance Measures

- Airway assessment and early and aggressive management
- Appropriate IV fluid management
- Transport to trauma or burn center
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

References

1. Explosions and Blast Injuries; A Primer for Clinicians. CDC.gov. www.cdc.gov/masstrauma/preparedness/primer.pdf. Accessed
2. Mathews ZR, Koyfman A. Blast Injuries. *J Emerg Med*. 2015 Oct;49(4):573–87. doi: 10.1016/j.jemermed.2015.03.013. Epub 2015 Jun 10. PMID: 26072319.
3. Plurad DS. Blast injury. *Mil Med*. 2011 Mar;176(3):276–82. doi: 10.7205/milmed-d-10-00147. PMID: 21456353.

Burns

Patient Care Goals

Minimize tissue damage and patient morbidity from burns

Patient Presentation

1. Patient may present with:
 - a. Airway—stridor, hoarse voice
 - b. Mouth and nares—redness, blisters, soot, singed hairs
 - c. Breathing rapid, shallow, wheezes, rales
 - d. Skin—Estimate Total Burn Surface Area (TBSA) and depth (partial vs. full thickness)
 - e. Associated trauma—blast, fall, assault

Inclusion Criteria

Patients sustaining thermal burns

Exclusion Criteria

Electrical, chemical, and radiation burns [See [Toxins and Environmental Section](#)]

Special Transport Considerations

1. Transport to most appropriate trauma center when there is airway or respiratory involvement, or when significant trauma or blast injury is suspected.
2. Consider air ambulance transportation for long transport times or airway management needs beyond the scope of the responding ground medic.
3. Consider transport directly to burn center if partial or full thickness burns (TBSA) greater than 10% and/or involvement of hands/feet, genitalia, face, and/or circumferential burns.

Scene Management

1. Assure crew safety:
 - a. Power off
 - b. Electrical lines secure
 - c. Gas off
 - d. No secondary devices
 - e. Hazmat determinations made
 - f. Proper protective attire including breathing apparatus may be required

Patient Management

Assessment

1. Circumstances of event—Consider:
 - a. Related trauma in addition to the burns
 - b. Inhalation exposures such as carbon monoxide (CO) and cyanide (CN)
 - c. Pediatric or elder abuse
2. Follow **ABCs** (**A**irway, **B**reathing, **C**irculation) of resuscitation per the [General Trauma Management Guideline](#)

3. If evidence of possible airway burn, consider aggressive airway management
4. Consider spinal precautions for those that qualify per the [Spinal Care Guideline](#)
5. Estimate TBSA burned and depth of burn
 - a. Use “Rule of 9’s” [See burn related tables in [Appendix III. Burn and Burn Fluid Charts](#)]
 - b. First-degree/superficial burns (skin erythema only) are not included in TBSA calculations
6. Document pain scale

Treatments and Interventions

1. Stop the burning
 - a. Remove wet clothing (if not stuck to the patient)
 - b. Remove jewelry
 - c. Leave blisters intact
2. Minimize burn wound contamination
 - a. Cover burns with dry dressing or clean sheet
 - b. Do not apply gels or ointments
3. Monitor SPO₂, EtCO₂ and cardiac monitor
4. High flow supplemental oxygen for all burn patients rescued from an enclosed space
5. Establish IV access, avoid placement through burned skin
6. Evaluate respiratory status in patients with circumferential thoracic burns due to the risk for ventilatory compromise and potential need for escharotomy
7. Evaluate distal circulation in circumferentially burned extremities due to increased risk of circulatory compromise and potential need for escharotomy
8. Consider early management of pain and nausea/vomiting
9. Initiate fluid resuscitation—Use lactated Ringer’s or normal saline
 - a. If patient in shock:
 - i. Consider other cause, such as trauma or cyanide toxicity
 - ii. Administer IV fluid per the [Shock Guideline](#)
 - b. If patient not in shock:
 - i. Begin fluids based on estimated TBSA [See [Appendix III. Burn and Burn Fluid Charts](#) as appropriate to patient weight]
 - ii. Pediatric patients weighing less than 40 kg, use length-based tape for weight estimate and follow
 - c. Fluid recommendations for burned individuals:
 - i. If burn is great than 10% of BSA, start a 500 mL bolus
 - ii. If transport time is delayed or extended, call medical control for fluid direction
10. Prevent systemic heat loss and keep the patient warm

Special Treatment Considerations

1. If blast mechanism, treat per the [Blast Injury Guideline](#).
2. Airway burns can rapidly lead to upper airway obstruction and respiratory failure. After performing the appropriate airway management measures, the administration of nebulized epinephrine, bronchodilators, nebulized n-acetylcystine, and nebulized heparin, if available, can be considered to reduce edema of the laryngeal and pulmonary tissues and airway occlusion from secretions and blood.
3. Have a high index of suspicion for cyanide poisoning in a patient with depressed GCS, respiratory difficulty, and cardiovascular collapse in the setting of an enclosed-space fire. Give the antidote (hydroxocobalamin), if available, in this circumstance.
4. Particularly in enclosed-space fires, carbon monoxide toxicity is a consideration and pulse oximetry may not be accurate [See [Carbon Monoxide/Smoke Inhalation Guideline](#)].
5. For specific chemical exposures (cyanide, hydrofluoric acid, other acids, and alkali) [See [Topical Chemical Burn Guideline](#)].
6. Consider decontamination and notification of receiving facility of potentially contaminated patient (e.g., methamphetamine (meth) lab incident).
7. Burns that involve significant sloughing or loss of skin can result in uncontrolled heat loss. These patients should be monitored closely for the development of hypothermia and appropriate preventative measures should be taken.

Notes/Educational Pearls

1. Onset of stridor and change in voice are sentinel signs of potentially significant airway burns, which may rapidly lead to airway obstruction or respiratory failure.
2. If the patient is in shock within one hour of burn, it is not from the burn. Evaluate the patient carefully for associated trauma or cyanide toxicity.
3. If the patient is not in shock, the fluid rates recommended above will adequately maintain patient's fluid volume.
4. Pain management is critical in acute burns.
5. End-tidal capnography (EtCO₂) monitoring may be particularly useful to monitor respiratory status in patients receiving significant doses of narcotic pain medication.
6. Cardiac monitor is important in electrical burns and chemical inhalations.
7. TBSA is calculated only based on percent of second- and third-degree burns—First degree/superficial burns are not included in this calculation.

Quality Improvement

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

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914085—Injury—Burns-Thermal

Key Documentation Elements

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

Performance Measures

- Patient transported to most appropriate hospital, preferably a burn center
- Pain scale documented and pain appropriately managed
- Airway assessment and management appropriately documented
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

References

1. American Burn Association. Advanced Burn Life Support (ABLS) Handbook; 2011
2. Chung K, Salinas J, Renz E, et al. Simple derivation of the initial fluid rate for the resuscitation of severely burned adult combat casualties: in Silico validation of the rule of ten. *J Trauma*. 2010;69 Suppl 1: S49–54
3. Dries DJ, Endorf FW. Inhalation injury: epidemiology, pathology, treatment strategies. *Scand J Trauma Resusc Emerg Med*. 2013; 21:31
4. Endorf FW, Gamelli RL. Inhalation injury, pulmonary perturbations, and fluid resuscitation. *J Burn Care Res*. 2007; 28(1):80-83
5. Fluid Rate charts (based on Parkland formula) and TBSA diagrams courtesy of the University of Utah Burn Center; 2014. As presented in [Appendix III. Burn and Burn Fluid Charts](#)
6. Hettiaratchy S, Papini R. Initial management of a major burn: II—assessment and resuscitation. *BMJ*. 2004;329(7457):101–103. doi:10.1136/bmj.329.7457.101
7. McIntire AM, Harris SA, Whitten JA, et al. Outcomes Following the Use of Nebulized Heparin for Inhalation Injury (HIHI Study). *J Burn Care Res* 2017; 38:45-52
8. Miller AC. Influence of nebulized unfractionated heparin and N-acetylcysteine in acute lung injury after smoke inhalation injury. *J Burn Care Res*. 2009; 30:249–256

Crush Injury/Crush Syndrome

Patient Care Goals

1. Recognizing traumatic crush injury mechanism
2. Minimize systemic effects such as rhabdomyolysis, hyperkalemia, acute kidney injury

Patient Presentation

Inclusion Criteria

Traumatic crush mechanism of injury

Nontraumatic injuries that may cause compartment syndrome include prolonged immobilization, prolonged compression of the torso/limbs, electrical injury, or burns

Exclusion Criteria

None noted

Patient Management

Assessment

1. Identify any severe hemorrhage
2. Assess airway, breathing, and circulation
3. Evaluate for possible concomitant injury (e.g., fractures, solid organ damage, or spinal injury)
4. Monitor for development of compartment syndrome (pain out of proportion to clinical exam, tense swelling, pain with passive stretch, muscle weakness, absent pulses, and paresthesias)

Treatment and Interventions

1. The treatment of crushed casualties should begin as soon as they are discovered
2. If severe hemorrhage is present, see [Extremity Trauma/External Hemorrhage Management Guideline](#)
3. Establish IV access. IV fluids should be administered prior to releasing the crushed body part. Administer 1000 mL normal saline (NS) bolus. Avoid lactated Ringer's solution as it contains potassium. Crush injury without adequate fluid resuscitation develops into crush syndrome
4. For significant crush injuries or prolonged entrapment of an extremity, consider sodium bicarbonate 1 mEq/kg (maximum dose of 50 mEq) IV bolus over 5 minutes
5. Attach cardiac monitor. Obtain/interpret 12-lead EKG, if available. Carefully monitor for dysrhythmias or signs of hyperkalemia before and immediately after release of pressure and during transport (e.g., peaked T waves, wide QRS, lengthening QT interval, loss of P wave)
6. For pain control, consider analgesics [See [Pain Management including Procedural Sedation Guideline](#)]
7. Consider the following post extrication:
 - a. Continued resuscitation with normal saline (500–1000 mL/hr for adults, 10 mL/kg/hr for children)

- b. If EKG suggestive of hyperkalemia or if findings of hyperkalemia, administer IV fluids and consider administration of
 - i. Calcium chloride—1 g IV/IO over 5 minutes, ensure IV patency and do not exceed 1 mL per minute (Pediatric: 10% 20 mg/kg, max 1 g, IV/IO over 5 minutes)
- c. If not already administered, for significant crush injuries with EKG suggestive of hyperkalemia, administer sodium bicarbonate 1 mEq/kg (max dose of 50 mEq) IV bolus over 5 minutes
- d. If EKG suggestive of hyperkalemia, consider albuterol 5 mg via small volume nebulizer (can be repeated if no response is seen)

Patient Safety Considerations

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

Notes/Educational Pearls

1. Causes of mortality in untreated crush syndrome:
 - a. Immediate
 - i. Severe head injury
 - ii. Traumatic asphyxia
 - iii. Torso injury with damage to intrathoracic or intra-abdominal organs
 - b. Early
 - i. Sudden release of a crushed extremity may result in reperfusion syndrome (acute hypovolemia, electrolyte abnormalities, and subsequent lethal arrhythmia)
 - ii. Hyperkalemia (potassium is released from injured muscle cells)
 - iii. Hypovolemia/shock
 - c. Late
 - i. Acute kidney injury (from release of toxins from injured muscle cells)
 - ii. Coagulopathy and hemorrhage
 - iii. Sepsis

Key Considerations

1. Rapid extrication and evacuation to a definitive care facility (trauma center preferred)
2. A patient with a crush injury may initially present with very few signs and symptoms. Maintain a high index of suspicion for any patient with a compressive mechanism of injury
3. A fatal medical complication of crush syndrome is hyperkalemia. Suspect hyperkalemia if T-waves become peaked, QRS becomes prolonged (greater than 0.12 seconds), absent P wave, prolonged QTc, or sine wave. Continue fluid resuscitation through extrication and transfer to hospital

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914089—Injury—Crush Syndrome

Key Documentation Elements

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

Performance Measures

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

References

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

Extremity Trauma/External Hemorrhage Management

Patient Care Goals

1. Minimize blood loss from extremity hemorrhage
2. Avoid hemorrhagic shock due to extremity hemorrhage
3. Minimize pain and further injury due to fractures, dislocations, or soft-tissue injuries

Patient Presentation

Inclusion Criteria [Refer to [Crush Injury and Crush Syndrome Guideline](#)]

1. Traumatic extremity hemorrhage (external hemorrhage) due to blunt or penetrating injury
2. Known or suspected extremity fractures or dislocations

Exclusion Criteria

None noted

Patient Management

Assessment

1. Assess degree of extremity/external bleeding/blood loss
2. Vascular status of extremity
 - a. Pallor
 - b. Pulse
 - c. Capillary refill and skin temperature
3. Evaluate for obvious deformity, shortening, rotation, or instability
4. Neurologic status of extremity
 - a. Sensation to light touch
 - b. Distal movement of extremity

Treatments and Interventions

1. Manage bleeding:
 - a. Expose the wound and apply direct pressure to bleeding site, followed by a pressure dressing
 - b. If direct pressure/pressure dressing is ineffective or impractical:
 - i. If the bleeding site is amenable to tourniquet placement, apply a commercial tourniquet to extremity
 1. Tourniquet should be placed 2–3 inches proximal to wound, not over a joint, and tightened until bleeding stops and distal pulse is eliminated
 2. If bleeding continues, place a second tourniquet proximal to the first
 3. For thigh wounds, consider placement of two tourniquets, side-by-side, and tighten sequentially
 4. If tourniquet has been placed prior to patient contact, do not remove, unless it was applied improperly.

- c. **Wound packing**
 - i. **Indications:** Groin/axillary (“junctional”) injury or any limb wound with persistent bleeding despite direct pressure and/or application of commercial tourniquet(s)
 - ii. **Materials:** Hemostatic gauze, regular gauze, or any available material
 - iii. **Procedure:** Pack tightly and fully to the depth of the wound until bleeding stops (may require significant packing for deep, large wounds), then apply direct pressure and/or pressure dressing; do not remove packing to assess bleeding
 - 1. Pack around (do not remove) bone fragments or foreign objects.
- d. Junctional tourniquets may be considered for groin or axillary wounds, if available
- e. Consider tranexamic acid (TXA) at 2 grams over 10 minutes for injury associated with hemorrhagic shock if within three hours of injury
- 2. Manage pain [See [Pain Management including Procedural Sedation Guideline](#)]:
 - a. Pain management should be strongly considered for patients with tourniquets and suspected fractures
 - b. Do not loosen tourniquet to relieve pain
- 3. Stabilize suspected fractures/dislocations:
 - a. Strongly consider pain management before attempting to move a suspected fracture
 - b. If distal vascular function is compromised, gently attempt to restore normal anatomic position, and reassess perfusion status
 - c. Use splints as appropriate to limit movement of suspected fracture
 - d. Elevate extremity fractures above heart level whenever possible to limit swelling
 - e. Apply ice/cool packs to limit swelling in suspected fractures or soft tissue injury, but do not apply ice directly to bare skin
 - f. Reassess distal neurovascular status after any manipulation or splinting of fractures/dislocations
 - g. Dress open wounds associated with fractures with saline-moistened gauze
- 4. Remove wet or blood-soaked clothing and use measures to prevent heat loss.
- 5. Remove jewelry and potentially constricting clothing from the injured limb.
- 6. Do not remove impaled foreign bodies.

Patient Safety Considerations

- 1. If improvised tourniquet has been placed by bystander, reassess, and consider placing commercial tourniquet proximal to it.
- 2. If tourniquet is placed:
 - a. Ensure that the tourniquet is sufficiently tight to occlude the distal pulse
 - b. Ensure that the tourniquet is well marked and visible, and that all subsequent clinicians are aware of the presence of the tourniquet
 - c. Do not cover the tourniquet with clothing or dressings
- 3. Mark the time of tourniquet placement prominently on the patient and in patient care report.

4. Without removing the tourniquet or dressing, reassess frequently for signs of ongoing or renewed bleeding, such as:
 - a. Blood soaking through dressing
 - b. Bleeding distal to tourniquet

Notes/Educational Pearls

Key Considerations

1. Tourniquets should be applied to bare skin, 2–3 inches proximal to the wound
2. Tourniquet should be reassessed at every stage of patient movement to ensure ongoing hemorrhage control
3. Survival is markedly improved when a tourniquet is placed **before** shock develops
4. Properly-applied tourniquets in conscious patients are painful—treat pain with analgesics, but do not loosen a tourniquet to relieve discomfort
5. Arterial pressure points may not be effective in controlling hemorrhage; however, may help slow bleeding while tourniquet is applied
6. Amputated body parts should be transported with patient for possible reimplantation:
 - a. It should remain cool but dry
 - b. Place the amputated part in a plastic bag
 - c. Place the bag with the amputated part on ice in a second bag
 - d. Do not let the amputated part come into direct contact with the ice
7. Pediatric considerations:
 - a. External hemorrhage control to prevent shock is critical in infants and young children, due to their relatively small blood volume
 - b. Most commercial tourniquets can be used effectively on children over 2 years of age
 - c. Stretch-wrap-tuck elastic-type tourniquets can be used on any age patient
 - d. Direct pressure and wound packing may be more suitable for infants and young children
 - e. Consult with local online medical direction regarding use of traction splints for femur fractures in young children, to avoid risk of possible nerve damage

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

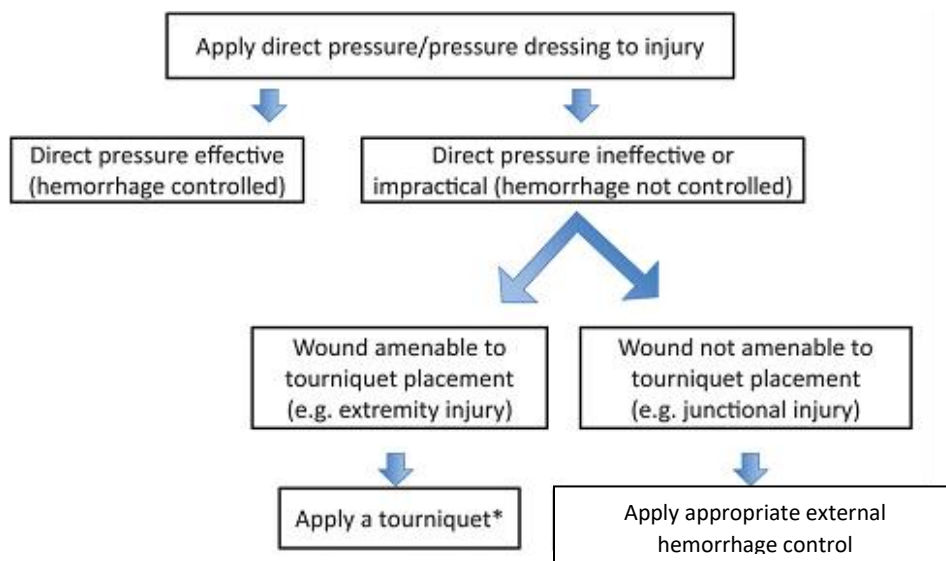
Key Documentation Elements

- Vital signs and vascular status of extremity after placement of tourniquet, pressure dressing, packing, and/or splint
- Time of tourniquet placement
- Documentation of signs/symptoms of possible compartment syndrome

Performance Measures

- Proper placement of tourniquet (location, cessation of bleeding)
- Proper marking and timing of tourniquet placement and notification of tourniquet placement to subsequent EMS clinicians and ED personnel
- Appropriate splinting and padding of fractures
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

Graphic 1. Prehospital External Hemorrhage Control Protocol



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

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

Source: *Bulger et al. 2014.*

References

1. Bedri H, Ayoub H, Engelbart J, Lilienthal M, Galet C, Skeete D. Tourniquet application for bleeding control in a rural trauma system: outcomes and implications for prehospital providers. *Prehosp Emerg Care*. 2021; DOI: 10.1080/10903127.2020.1868635
2. Bulger E et al. An evidence-based prehospital guideline for external hemorrhage control: American College of Surgeons Committee on Trauma. *Prehosp Emerg Care*. 2014;18(2):163–73
3. Charlton NP, et al. Pediatric Tourniquet Types: First Aid New TF SR. CoSTR.ILCOR.org [Internet]. Available from: <https://costr.ilcor.org/document/pediatric-tourniquet-types-first-aid-new-tf-sr>. Accessed
4. Cornelissen M, Brandwijk A, Schoonmade L, Giannakopoulos G, van Oostendorp S, Geeraedts L. The safety and efficacy of improvised tourniquet in life-threatening hemorrhage: A systematic review. *European Journal of Trauma and Emergency Surgery*. 2020; 46:531–538
5. Cunningham A, Auerbach M, Cicero M, Jafri M. Tourniquet usage in prehospital care and resuscitation of pediatric trauma patients – Pediatric Trauma Society position statement. *J Trauma Acute Care Surg*. 2018;85(4):665–667
6. Doyle G, Taillac P. Tourniquets: a review of current use with proposals for expanded prehospital use. *Prehosp Emerg Care*. 2008;12(2):241–56
7. Kelly JR, Levy MJ, Reyes J, Anders J. Effectiveness of the combat application tourniquet for arterial occlusion in young children. *JTACS*. 2020;88(5):644–647
8. Kragh J, Littrel ML, Jones JA, et al. Battle casualty survival with emergency tourniquet use to stop limb bleeding. *J Emerg Med*. 2011;41(6):590–7
9. Leonard J, Aietlow J, Morris D, et al. A multi-institutional study of hemostatic gauze and tourniquets in rural civilian trauma. *J Trauma Acute Care Surg*. 2016;81(3):441–4
10. Mawhinney A and Kirk S. A systematic review of the use of tourniquets and topical haemostatic agents in conflicts in Afghanistan and Iraq. *J R Nav Med Serv*. 2015;101(2):147–54
11. Meusnier J, Dewar C, Mavrovi E, et al. Evaluation of two junctional tourniquets used on the battlefield: Combat Ready Clamp® versus SAM® Junctional Tourniquet. *J Spec Oper Med*. 2016; 16:41–6
12. Peng H. Hemostatic agents for prehospital hemorrhage control: a narrative review. *Military Med Res*. 2020; 7:13. DOI: 10.1186/x40779-020-00241
13. *Prehospital Trauma Life Support, 9th Edition*. Burlington, MA: Jones & Bartlett; 2021
14. Snyder CL. Bleeding Children. *Pediatrics*. May 2019;143(5):1–2
15. Van Oostendorp S, Tan E, Geeraedts L. Prehospital control of life-threatening truncal and junctional haemorrhage is the ultimate challenge in optimizing trauma care: a review of treatment options and their applicability in the civilian trauma setting. *Scand J Trauma Resusc Emerg Med*. 2016;24(1):110
16. Watters J, Van P, Hamilton G, et al. Advanced hemostatic dressings are not superior to gauze for care under fire scenarios. *J Trauma*. 2011;70(6):1413–9

Facial/Dental Trauma

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

1. General Trauma [See [General Trauma Management Guideline](#)]
2. Burn trauma [See [Burns Guideline](#)]

Patient Management

Assessment

1. Overall trauma assessment
2. **ABCs** (**A**irway, **B**reathing, **C**irculation) with particular focus on ability to keep airway patent
 - a. Stable midface
 - b. Stable mandible
 - c. Stable dentition (poorly anchored teeth require vigilance for possible aspiration)
3. Bleeding (which may be severe—epistaxis, oral trauma, facial lacerations)
4. Patient medications with focus on blood thinners/antiplatelet agents
5. Cervical spine pain or tenderness [See [Spinal Care Guideline](#)]
6. Mental status assessment for possible traumatic brain injury [See [Head Injury Guideline](#)]
7. Gross vision assessment
8. Dental avulsions
9. Any tissue or teeth avulsed should be collected, if possible
10. Specific reexamination geared toward airway and ability to ventilate adequately

Treatment and Interventions

1. Administer oxygen as appropriate with a target of achieving 94–98% saturation. Use EtCO₂ to help monitor for hypoventilation and apnea
2. IV access, as needed, for fluid or medication administration
3. Pain medication per the [Pain Management Including Procedural Sedation 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 saline as the storage medium. Alternatively, an alert and cooperative patient can hold tooth in mouth using own saliva as storage medium

5. Eye trauma:
 - a. Place eye shield for any significant eye trauma
 - b. If globe is avulsed or enucleated, do not put back into socket. Cover eye socket with moist saline dressings and then place eye shield over it
6. Mandible unstable:
 - a. Expect patient cannot spit/swallow effectively and have suction readily available
 - b. Preferentially transport sitting up with emesis basin/suction available (in the absence of a suspected spinal injury.) [See [Spinal Care Guideline](#)]
7. Epistaxis: Squeeze nose (or have patient do so) for 10–15 minutes continuously.
8. Nose/ear avulsion:
 - a. Recover tissue, if possible
 - b. Transport with tissue wrapped in dry sterile gauze in a plastic bag placed on ice
 - c. Severe ear and nose lacerations can be addressed with a protective moist sterile dressing

Patient Safety Considerations

1. Frequent reassessment of airway
2. Maintenance of a patent airway is the highest priority; therefore, conduct cervical spine assessment for field clearance (per [Spinal Care Guideline](#)) to enable transport sitting up for difficulty with bleeding, swallowing, or handling secretions

Notes/Educational Pearls

Key Considerations

1. Airway may be compromised because of fractures or bleeding
2. Lost teeth not recovered on scene may be in the airway
3. After nasal fractures, epistaxis may be posterior and may not respond to direct pressure over the nares with bleeding running down posterior pharynx, potentially compromising airway
4. Protect avulsed tissue and teeth:
 - a. Avulsed teeth may be successfully reimplanted if done so in a very short period after injury
 - b. Use moist sterile dressing for ear and nose cartilage
5. For penetrating eye injuries, do not remove foreign bodies. Splint in place. Cover uninjured eye or ask patient to close eye to prevent conjugate movement of injured eye
6. Consider administration of antiemetics to prevent increases in intraocular pressure due to nausea and vomiting in penetrating and blunt trauma to the eye
[See [Nausea/Vomiting Guideline](#)]

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- Airway patency and reassessment
- Degree and location of hemorrhage
- Mental status (GCS or AVPU)
- Technique used to transport tissue or teeth
- Eye exam documented, when applicable
- Assessment and management of cervical spine
- Patient use of anticoagulant medications

Performance Measures

- Appropriate airway management and satisfactory oxygenation
- Eye shield applied to eye trauma
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

References

1. Bord S, Linden J. Trauma to the globe and orbit. *Emerg Med Clin N Am.* 2008;26(1):97–123
2. Mordini L, Lee P, Lazaro R, Biagi R, Gianetti L. Sport and dental traumatology: Surgical solutions and prevention. *Dent J (Basel)* 2021;9(3):33
3. Patel P, Stanton D, Granquist E. Common dental and orofacial trauma: evaluation and management. *Med Clin N Am.* 2014;98(6):1261–79

Head Injury

Patient Care Goals

1. Limit disability and mortality from head injury by limiting secondary brain injury through
 - a. Promoting adequate oxygenation and preoxygenating to protect against unanticipated deterioration
 - b. Promoting good cerebral perfusion and avoid hypotension
 - c. Preventing hypocapnia (by avoiding hyperventilation and overventilation)

Patient Presentation

Inclusion Criteria

Adult or pediatric patient with blunt or penetrating head injury—loss of consciousness or amnesia not required

Exclusion Criteria

None noted

Patient Management

Assessment

1. Maintain cervical stabilization [See [Spinal Care Guideline](#)]
2. Primary survey per the [General Trauma Management Guideline](#)
3. Monitoring
 - a. Continuous pulse oximetry
 - b. Frequent systolic and diastolic blood pressure measurement
 - c. Initial neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)] and reassessment with any change in mentation
 - d. Moderate/severe head injury: apply continuous waveform EtCO₂, if available
4. Secondary survey pertinent to isolated head injury
 - a. Head: Gently palpate skull to evaluate for depressed or open skull fracture
 - b. Eyes
 - i. Evaluate pupil size and reaction to light to establish baseline
 - ii. Reassess pupils if decrease in mentation
 - c. Nose/mouth/ears: Evaluate for blood/fluid drainage
 - d. Face: Evaluate for bony stability
 - e. Neck: Palpate for cervical spine tenderness or deformity
 - f. Neurologic
 - i. Perform neurologic status assessment (GCS or AVPU)
 - ii. Evaluate for focal neurologic deficit: motor and sensory

Treatment and Interventions

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

1. Airway

- a. Administer high-flow oxygen via NRB (nonrebreather) as a precaution against unanticipated deterioration
- b. If patient unable to maintain airway, consider oral airway (nasal airway should not be used with significant facial injury or possible basilar skull fracture)
- c. BVM (bag-valve-mask) ventilation if high flow oxygen (HFO)/nonrebreather (NRB) inadequate to maintain good airway and/or oxygenation
- d. Place supraglottic airway or perform endotracheal intubation or if BVM ventilation ineffective in maintaining oxygenation or if airway is continually compromised. Endotracheal intubation (ETI)/supraglottic airway (SGA) should only be used in systems that have continuous EtCO₂ monitoring

2. Breathing

- a. For patients who cannot maintain adequate oxygenation with HFO/NRB, BVM ventilation (15 years old or older: 10 breaths per minute; 2–14 years old: 20 breaths per minute; less than 2 years old: 25 breaths per minute) with gentle manual bagging. Consider flow- controlled bags and ventilation rate timers to help prevent hyper-/overventilation
- b. SGA placement or ETI should only be performed if BVM ventilation fails to maintain adequate oxygenation. With advanced airways, manage with a target EtCO₂ of 40 (normal range 35–45 mmHg)
- c. Do not induce hypocapnia through hyper-/overventilation

3. Circulation

- a. Wound care
 - i. Control bleeding with direct pressure if no suspected open skull injury
 - ii. Moist sterile dressing to any potential open skull wound
 - iii. Cover an injured eye with moist saline dressing and place cup over it
- b. Moderate/severe closed head injury
 - i. Blood pressure: avoid hypotension
 1. **Adult** (age greater than 10 years): Maintain SBP greater than or equal to 110 mmHg
 2. **Pediatric**: Maintain SBP
 - a. Age less than 1 month: Greater than 60 mmHg
 - b. Age 1–12 months: Greater than 70 mmHg
 - c. Age 1–10 years: Greater than 70 + 2x age in years
- c. Closed head injury
 - i. Administer normal saline (NS)/lactated Ringer's (LR) fluid boluses to maintain SBP above threshold. Do not wait until after the patient is already hypotensive—*prevent* hypotension.
- d. Do not delay transport to initiate IV access

4. Disability
 - a. Evaluate for other causes of altered mental status—check blood glucose during transport.
 - b. Spinal assessment and management, per [Spinal Care Guideline](#).
 - c. Perform and trend neurologic status assessment (GCS or AVPU scale).
 - i. Early signs of deterioration
 1. Confusion
 2. Agitation
 3. Drowsiness
 4. Vomiting
 5. Severe headache
 - d. Severe head injury—elevate head of bed 30 degrees.
5. Transport destination specific to head trauma
 - a. Preferential transport to highest level of care within trauma system:
 - i. GCS 3–13, P (pain) or U (unresponsive) on AVPU scale
 - ii. Penetrating head trauma
 - iii. Open or depressed skull fracture

Patient Safety Considerations

1. Do not hyperventilate patients: Maintain all patients in EtCO₂ range of 35–45 mmHg
2. Assume concomitant cervical spine injury in patients with moderate/severe head injury
3. **Geriatric Consideration:** Elderly patients with ankylosing spondylitis or severe kyphosis should be padded and immobilized in a position of comfort and may not tolerate a cervical collar
4. **Pediatric Consideration:** 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. Head injury severity guideline:
 - a. **Mild:** GCS 14–15/AVPU = (A)
 - b. **Moderate:** GCS 9–13/AVPU = (V)
 - c. **Severe:** GCS 3–8/AVPU = (P) or (U)
2. Important that clinicians be specifically trained in accurate neurologic status assessment [See [Appendix IV. Neurologic Status Assessment](#)]
3. If endotracheal intubation or invasive airways are used, continuous waveform capnography is required to document proper tube placement and assure proper ventilation rate and minute volume (preventing both hyperventilation [too fast] and overventilation [too much])

4. Herniation is difficult to diagnose in the prehospital setting. Hyperventilation results in vasoconstriction which further decreases blood flow to the brain and worsens the secondary brain injury

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914101—Injury—Head

Key Documentation Elements

- High-flow oxygen with non-rebreather (NRB) mask
- Airway status and management
- EtCO₂ monitored and documented for all traumatic brain injury (TBI) patients with advanced airway and strict avoidance of hyperventilation, overventilation, and hypocapnia)
- Neurological status with vitals: AVPU, GCS
- Exams: Neurological and Mental Status Assessment pre- and post-treatment

Performance Measures

- No oxygen desaturation *less than* 90%
- No hypotension:
 - **Adults:** *less than* 110 mmHg
 - **Pediatrics:**
 - Age *less than* 1 month: *less than* 60 mmHg
 - Age 1–12 months: *less than* 70 mmHg
 - Age 1–10 years: *less than* 70 + 2x age in years
- Assess the patient's blood pressure prior to the administration of any medication that may cause hypotension
- EtCO₂ target 40 mmHg (range 35–45 mmHg). Meticulous prevention of hypocapnia in all patients
- Triage to the appropriate level hospital within the local trauma system
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsga.org)
 - **Pediatrics—03: Documentation of Estimated Weight in Kilograms**
 - **Trauma—01: Pain Assessment of Injured Patients**

References

1. Ambrosi PB, Valenca MM, Azevedo-Filho H. Prognostic factors in civilian gunshot wounds to the head: a series of 110 surgical patients and brief literature review. *Neurosurg Rev.* 2012;35(3):429-35; discussion 435-6
2. Badjatia N, Carney N, Crocco TJ, et al: Brain Trauma Foundation; BTF Center for Guidelines Management. Guidelines for prehospital management of traumatic brain injury 2nd edition. *Prehosp Emerg Care.* 2008;12 Suppl 1:S1-52
3. Berlot G, La Fata C, Bacer B, et al. Influence of prehospital treatment on the outcome of patients with severe blunt traumatic brain injury: a single-centre study. *Eur J Emerg Med.* 2009;16(6):312-17
4. Davis DP, Koprowicz KM, Newgard CD, et al. The relationship between out-of-hospital airway management and outcome among trauma patients with Glasgow Coma Scale scores of 8 or less. *Prehosp Emerg Care.* 2011;15(2):184-92
5. Dumont TM, Visioni AJ, Reghani AI, Tranmer BI, Crookes B. Inappropriate prehospital ventilation in severe traumatic brain injury increases in-hospital mortality. *J Neurotrauma.* 2010 Jul;27(7):233-41
6. Franschman G, Peerdeman SM, Andriessen TM, et al; Amsterdam 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;71(4):826-32
7. Gaither JB, Spaite DW, Bobrow BJ, et al: Impact of Implementing the Prehospital Traumatic Brain Injury Treatment Guidelines: The Excellence In Prehospital Injury Care for Children (EPIC4Kinds) Study. *Ann Emerg Med.* 2021;77(2):139-153. DOI: 10.1016/j.annemergmed.2020.09.435. NIH Manuscript System ID: NIHMSID:1654418; PubMed PMID:33187749
8. Haut ER, Kalish BT, Cotton BA, et al. Prehospital intravenous fluid administration is associated with higher mortality in trauma patients: a National Trauma Data Bank analysis. *Ann Surg.* 2011;253(2):371–7
9. Jagoda AS, Bazarian JJ, Bruns JJ Jr, et al; American College of Emergency Physicians; Centers for Disease Control and Prevention. Clinical policy: neuroimaging and decision making in adult mild traumatic brain injury in the acute setting. *Ann Emerg Med.* 2008;52(6):714–48
10. Kleinman ME, Chameides L, Schexnayder SM, et al. Part 14: pediatric advanced life support: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation.* 2010;122: S876-908
11. Reed D. *Adult Trauma Clinical Practice Guidelines: Initial Management of Closed Head Injury in Adults: 2nd Edition.* New South Wales Institute of Trauma and Injury Management; 2011
12. Roberts I, Schierhout G. Hyperventilation therapy for acute traumatic brain injury. *Cochrane Database Syst Rev.* 1997;(4):CD000566
13. Spaite DW, Bobrow BJ, Keim SM, et al: Association of Statewide Implementation of the Prehospital Traumatic Brain Injury Treatment Guidelines With Patient Survival Following Traumatic Brain Injury: The Excellence In Prehospital Injury Care (EPIC) Study. *JAMA Surg.* 2019;154(7): e191152. doi:10.1001/jamasurg.2019.1152. NIH Manuscript System ID: NIHMSID: 1663161; PubMed PMID: 31066879; PMCID: PMC6506902
14. Stocchetti N, Maas AIR, Chieragato A, van der Plas AA. Hyperventilation in head injury a review. *Chest.* 2005;127(5):1812–27
15. Zebrack M, Dandoy C, Hansen K, Scaife E, Mann NC, Bratton SL. Early resuscitation of children with moderate-to-severe traumatic brain injury. *Pediatrics.* 2009;124(1):56–64

Spinal Care

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

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Traumatic mechanism of injury

Exclusion Criteria

None noted

Patient Management

Assessment

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

Treatment and Interventions

1. Place patient in cervical collar and initiate spinal motion restriction in adults if there are any of the following:
 - a. Patient complains of midline neck or spine pain
 - b. Any midline neck or spinal tenderness with palpation
 - c. Any abnormal mental status (including extreme agitation)
 - d. Focal or neurologic deficit
 - e. Any evidence of alcohol or drug intoxication
 - f. Another severe or painful distracting injury
 - g. Torticollis in children
 - h. A communication barrier that prevents accurate assessment
 - i. *If none of the above apply, patient may be managed without a cervical collar*

2. Patients with penetrating injury to the neck should not be placed in a cervical collar or other spinal precautions regardless of whether they are exhibiting neurologic symptoms or not. Doing so can lead to delayed identification of injury or airway compromise and has been associated with increased mortality
3. If extrication is required:
 - a. **From a vehicle:** After placing a cervical collar, if indicated, children in a booster seat and adults should be allowed to self-extricate. For infants and toddlers already strapped in a car seat with a built-in harness, extricate the child while strapped in his/her car seat
 - b. **Other situations requiring extrication:** A, preferably padded, long board may be used for extrication, using the lift and slide (rather than a logroll) technique
4. Helmet removal
 - a. If a football helmet needs to be removed, it is recommended to remove the face mask followed by manual removal (rather than the use of automated devices) of the helmet while keeping the neck manually immobilized—occipital and shoulder padding should be applied, as needed, with the patient in a supine position to maintain neutral cervical spine positioning
 - b. Evidence is lacking to provide guidance about other types of helmet removal
5. Do not transport patients on rigid long boards unless the clinical situation warrants long board use. An example of this may be facilitation of immobilization of multiple extremity injuries or an unstable patient where removal of a board will delay transport and/or other treatment priorities. In these situations, long boards should ideally be padded or have a vacuum mattress applied to minimize secondary injury to the patient.
6. Patients should be transported to the nearest appropriate facility, in accordance with the [American College of Surgeons Committee on Trauma \(ACS COT\) 2022 National Guideline for the Field Triage of Injured Patients](#).
7. Patients with severe kyphosis or ankylosing spondylitis may not tolerate a cervical collar. These patients should be immobilized in a position of comfort using towel rolls or sandbags.

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 therefore immobilization straps should go across chest and pelvis and not across the abdomen
6. Children have disproportionately larger heads. When securing pediatric patients to a spine board, the board should have a recess for the head or the body should be elevated approximately 1–2 cm to accommodate the larger head size and avoid neck flexion when immobilized
7. In an uncooperative patient, avoid interventions that may promote increased spinal movement

8. The preferred position for all patients with spine management is flat and supine. There are three circumstances under which raising the head of the bed to 30 degrees may be considered:
 - a. Respiratory distress
 - b. Suspected severe head trauma
 - c. Promotion of patient compliance

Notes/Educational Pearls

Key Considerations

1. Evidence is lacking to support or to 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. Clinicians should not manually stabilize these alerts and spontaneously moving patients since patients with pain will self-limit movement and forcing immobilization in this scenario may unnecessarily increase discomfort and anxiety
2. Certain populations with musculoskeletal instability may be predisposed to cervical spine injury. However, evidence does not support or refute that these patients should be treated differently than those who do not have these conditions. These patients should be treated according to the [Spinal Care Guideline](#) like other patients without these conditions
3. Pediatric considerations:
 - a. 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 clinician from accurately assessing the patient
 - b. There is no evidence that children experience noncontiguous multilevel injuries. The existing evidence suggests that the rate of contiguous multilevel injuries is exceedingly low at 1%
 - c. Because of variation in head size to body ratio, consider additional padding under the shoulders to avoid excessive cervical spine flexion
4. Spinal precautions should be considered a treatment or preventive therapy
5. Patients who are likely to benefit from immobilization should undergo this treatment
6. Patients who are not likely to benefit from immobilization, who have a low likelihood of spinal injury, should not be immobilized
7. Ambulatory patients may be safely immobilized on gurney with cervical collar and straps and will not generally require a spine board. The role for standing take downs is extremely limited, e.g., extrication of a patient with a high likelihood of a spinal cord injury from a large body of water. Ambulatory patients may have a collar applied and walked to the EMS gurney
8. Reserve long spine board use for the movement of patients whose injuries limit ambulation and who meet criteria for the use of spinal precautions. Remove from the long board as soon as is practical

Pertinent Assessment Findings

1. Mental status
2. Normal neurologic examination
3. Evidence of intoxication
4. Evidence of multiple traumas with other severe injuries

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- Patient complaint of neck or spine pain
- Spinal tenderness
- Mental status/GCS
- Neurologic examination
- Evidence of intoxication
- Documentation of multiple trauma
- Documentation of mechanism of injury
- Document patient capacity with:
 - All barriers to patient care in the NEMSIS element “Barriers to Patient Care” (eHistory.01—required of all software systems)
 - Exam fields for Mental Status and Neurological Assessment
 - Vitals for Level of Responsiveness and [Glasgow Coma Scale](#)
 - Alcohol and drug use indicators
- Patient age
- Patient who is underage and not emancipated: legal guardian name, contact, and relationship

Performance Measures

- Percentage of patients with high-risk mechanisms of injury and/or signs or symptoms of cervical spine injury who are placed in a cervical collar
- Percentage of patients without known trauma who have a cervical immobilization device placed (higher percentage creates a negative aspect of care)
- Percentage of trauma patients who are transported on a long backboard (target is a low percentage)
- Percentage of patients with a cervical spinal cord injury or unstable cervical fracture who did not receive cervical collar
- ***National EMS Quality Alliance (NEMSQA) Performance Measures***
(for additional information, see www.nemsqa.org)
 - *Pediatrics—03: Documentation of Estimated Weight in Kilograms*
 - *Trauma—01: Pain Assessment of Injured Patients*

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):501–3
3. Barkana Y, Stein M, Scope A, Maor R, Abramovich Y, Friedman Z, Knoller N. Prehospital stabilization of the cervical spine for penetrating injuries of the neck—is it necessary? *Injury*. 2007;31(5):305–9
4. Ben-Galim P, Dreiangel N, Mattox KL, Reitman CA, Kalantar SB, Hipp JA. Extrication collars can result in abnormal separation between vertebrae in the presence of a dissociative injury. *J Trauma*. 2010;69(2):447–50
5. Benner JP, Brauning G, Green M, Caldwell W, Borloz MP, Brady WJ. Disagreement between transport team and ED staff regarding the prehospital assessment of air medically evacuated scene patients. *Air Med J*. 2006;25(4):165–9
6. Brown JB, Bankey PE, Sangosanya AT, Cheng JD, Stassen NA, Gestring ML. Prehospital spinal immobilization does not appear to be beneficial and may complicate care following gunshot injury to the torso. *J Trauma*. 2009;67(4):774–8
7. Bureau of Emergency Medical Services. *State of New Hampshire Patient Care Protocols*. Concord, NH: New Hampshire Department of Safety; 2013
8. Burton JH, Dunn MG, Harmon NR, Hermanson TA, Bradshaw JR. A statewide, prehospital emergency medical service selective patient spine immobilization protocol. *J Trauma*. 2006;61(1):161–7
9. Burton JH, Harmon NR, Dunn MG, Bradshaw JR. EMS provider findings and interventions with a statewide EMS spine-assessment protocol. *Prehosp Emerg Care*. 2005;9(3):303–9
10. Chan D, Goldberg R, Tascone A, Harmon S, Chan L. The effect of spinal immobilization on healthy volunteers. *Ann Emerg Med*. 1994;23(1):48–51
11. Chong CL, Ware DN, Harris JH Jr. Is cervical spine imaging indicated in gunshot wounds to the cranium? *J Trauma*. 1998;44(3):501–2
12. Cirak B, Ziegfeld S, Knight VM, Chang D, Avellino AM, Paidas, CN. Spinal injuries in children. *J Pediatr Surg*. 2004;39(4):607–12
13. Cordell WH, Hollingsworth JC, Olinger ML, Stroman SJ, Nelson DR. Pain and tissue-interface pressures during spine-board immobilization. *Ann Emerg Med*. 1995;26(1):31–6
14. Davies G, Deakin C, Wilson A. The effect of a rigid collar on intracranial pressure. *Injury*. 1996;27(9):647–9
15. Decoster LC, Burns MF, Swartz EE, et al. Maintaining neutral sagittal cervical alignment after football helmet removal during emergency spine injury management. *Spine (Phila Pa 1976)*. 2012;37(8):654–9
16. Del Rossi G, Heffernan TP, Horodyski M, Rehtine GR. The effectiveness of extrication collars tested during the execution of spine-board transfer techniques. *Spine J*. 2004;4(6):619–23
17. Del Rossi G, Horodyski MH, Conrad BP, Di Paola CP, Di Paola MJ, Rehtine GR. The 6-plus-person lift transfer technique compared with other methods of spine boarding. *J Athl Train*. 2008;43(1):6–13
18. Del Rossi G, Horodyski M, Conrad BP, Dipaola CP, Dipaola MJ, Rehtine GR. Transferring patients with thoracolumbar spinal instability: Are there alternatives to the log roll maneuver? *Spine (Phila Pa 1976)*. 2008;33(14):1611–5

19. Del Rossi G, Rechline GR, Conrad BP, Horodyski M. Are scoop stretchers suitable for use on spine-injured patients? *Am J Emerg Med*. 2010;28(7):751–756
20. Dixon, M, O'Halloran J, Cummins NM. Biomechanical analysis of spinal immobilisation during prehospital extrication: a proof of concept study. *Emerg Med J*. 2014;31(9):745–9
21. Domeier RM, Frederiksen SM, Welch K. Prospective performance assessment of an out-of-hospital protocol for selective spine immobilization using clinical spine clearance criteria. *Ann Emerg Med*. 2005;46(2):123–31
22. Domeier RM, Swor RA, Evans RW, et al. Multicenter prospective validation of prehospital clinical spinal clearance criteria. *J Trauma*. 2002;53(4):744–50
23. Edlich RF, Mason SS, Vissers RJ, et al. Revolutionary advances in enhancing patient comfort on patients transported on a backboard. *Am J Emerg Med*. 2011;29(2):181–6
24. Engsberg JR, Standeven JW, Shurtleff TL, Eggars JL, Shafer JS, Naunheim RS. Cervical spine motion during extrication. *J Emerg Med*. 2013;44(1):122–7
25. Hale DF, Fitzpatrick CM, Doski JJ, et al. Absence of clinical findings reliably excludes unstable cervical spine injuries in children 5 years or younger. *J Trauma Acute Care Surg*. 2015; 78:943–948
26. Hasler RM, Kehl C, Exadaktylos AK, et al. Accuracy of prehospital diagnosis and triage of a Swiss helicopter emergency medical service. *J Trauma Acute Care Surg*. 2012;73(3):709–15
27. Hauswald M, Hsu M, Stockoff C. Maximizing comfort and minimizing ischemia: a comparison of four methods of spinal immobilization. *Prehosp Emerg Care*. 2000;4(3):250–2
28. Hauswald M, Ong G, Tandberg D, Omar Z. Out-of-hospital spinal immobilization: its effect on neurologic injury. *Acad Emerg Med*. 1998;5(3):214–9
29. Haut ER, Kalish BT, Efron DT, et al. Spine immobilization in penetrating trauma: More harm than good? *J Trauma*. 2010;68(1):115–20; discussion 120–1
30. Hemmes B, Poeze M, Brink PR. Reduced tissue-interface pressure and increased comfort on a newly developed soft-layered long spineboard. *J Trauma*. 2010;68(3):593–8
31. Hoffman JR, Mower WR, Wolfson AB, Todd KH, Zucker MI. Validity of a set of clinical criteria to rule out injury to the cervical spine in patients with blunt trauma. National Emergency X-Radiography Utilization Study Group. *N Engl J Med*. 2000;343(2):94–9
32. Hostler D, Colburn D, Seitz SR. A comparison of three cervical immobilization devices. *Prehosp Emerg Care*. 2009;13(2):256–60
33. Huerta C, Griffith R, Joyce SM. Cervical spine stabilization in pediatric patients: evaluation of current techniques. *Ann Emerg Med*. 1987;16(10):1121–6
34. Kim EG, Brown KM, Leonard JC, Jaffe DM, Olsen CS, Kuppermann N. Variability of prehospital spinal immobilization in children at risk for cervical spine injury. *Pediatr Emerg Care*. 2013;29(4):413–8

35. Kolb JC, Summers RL, Galli RL. Cervical collar-induced changes in intracranial pressure. *Am J Emerg Med*. 1999;17(2):135–7
36. 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
37. Leonard JC, Mao J, Jaffe DM. Potential adverse effects of spinal immobilization in children. *Prehosp Emerg Care*. 2012;16(4):513–8
38. Leonard JC, Kuppermann N, Olsen C, et al. Factors associated with cervical spine injury in children after blunt trauma. *Ann Emerg Med*. 2011;58(2):145–55
39. Leonard JC, Kuppermann N, Olsen C, Babcock-Cimpello L, Brown K, Mahajan P, et al. Factors associated with cervical spine in children after blunt trauma. *Ann Emerg Med*. 2011;58(2):145–155
40. Leonard JC, Jaffe DM, Olsen CS, Kuppermann N. Age- related differences in factors associated with cervical spine injuries in children. *Acad Emerg Med*. 2015; 22:1–6
41. Leonard JR, Jaffe DM, Kuppermann N, Olsen C, Leonard JC. Cervical spine injury patterns in children. *Pediatrics*. 2014;133(5): e1179–e1188
42. Lin HL, Lee WC, Chen CW, et al. Neck collar used in treatment of victims of urban motorcycle accidents: Over- or underprotection? *Am J Emerg Med*. 2011;29(9):1028-33
43. Lovell ME, Evans JH. A comparison of the spinal board and the vacuum stretcher, spinal stability and interface pressure. *Injury*. 1994;25(3):179–80
44. Luscombe MD, Williams, JL. Comparison of a long spinal board and vacuum mattress for spinal immobilisation. *Emerg Med J*. 2003;20(5):476–8
45. March JA, Ausband SC, Brown, LH. Changes in physical examination caused by use of spinal immobilization. *Prehosp Emerg Care*. 2002;6(4):421–4
46. McGuire RA, Degnan G, Amundson GM. Evaluation of current extrication orthoses in immobilization of the unstable cervical spine. *Spine (Phila Pa 1976)*. 1990;15(10):1064–7
47. Mohseni S, Talving P, Branco BC, et al. Effect of age on cervical spine injury in pediatric population: a National Trauma Data Bank review. *J Pediatr Surg*. 2011;46(9):1771–6
48. National Association of EMS Physicians/American College of Surgeons Committee on Trauma. Position statement: EMS spinal precautions and the use of the long backboard. *Prehosp Emerg Care*. 2013; 17:392–3
49. Nypaver M, Treloar D. Neutral cervical spine positioning in children. *Ann Emerg Med*. 1994;23(2):208–11
50. Office of Emergency Medical Services. *Spinal Motion Restriction Guideline*. Hartford, Connecticut. Department of Public Health; 2013
51. Parent S, Mac-Thiong JM, Roy-Beaudry M, Sosa JF, Labelle H. Spinal cord injury in the pediatric population: a systematic review of the literature. *J Neurotrauma*. 2011;28(8):1515–24
52. Peery CA, Brice J, White WD. Prehospital spinal immobilization and the backboard quality assessment study. *Prehosp Emerg Care*. 2007;11(3):293–7
53. Pieretti-Vanmarcke R, Velmahos GC, Nance ML, et al. Clinical clearance of the cervical spine in blunt trauma patients younger than 3 years: a multi-center study of the American Association for the Surgery of Trauma. *J Trauma*. 2009;67(3):543–49; discussion 549-50
54. Podolsky S, Baraff LJ, Simon RR, Hoffman JR, Larmon B, Ablon W. Efficacy of cervical spine immobilization methods. *J Trauma*. 1983;23(6):461–5

55. Prasarn ML, Zhou H, Dubose D, et al. Total motion generated in the unstable thoracolumbar spine during management of the typical trauma patient: A comparison of methods in a cadaver model. *J Neurosurg Spine*. 2012;16(5):504–8
56. Ramasamy A, Midwinter M, Mahoney P, Clasper J. Learning the lessons from conflict: Prehospital cervical spine stabilization following ballistic neck trauma. *Injury*. 2009;40(12):1342–5
57. Rhee P, Kuncir EJ, Johnson L, et al. Cervical spine injury is highly dependent on the mechanism of injury following blunt and penetrating assault. *J Trauma*. 2006;61(5):1166–70
58. Schafermeyer RW, Ribbeck BM, Gaskins J, Thomason S, Harlan M, Attkisson A. Respiratory effects of spinal immobilization in children. *Ann Emerg Med*. 1991;20(9):1017–9
59. Shafer JS, Naunheim RS. Cervical spine motion during extrication: A pilot study. *West J Emerg Med*. 2009;10(2):74–8
60. Shah MI, Kamin R, Freire J, Jaeger E, Lobo C, Sholl JM. An evidence-based guideline for pediatric prehospital spinal care using GRADE methodology. Manuscript in preparation
61. Sochor M, Althoff S, Bose D, Maio R, Deflorio P. Glass intact assures safe cervical spine protocol. *J Emerg Med*. 2013;44(3):631–6. e1
62. Spinal motion restriction in penetrating trauma: A Practice Management Guideline from the Eastern Association for the Surgery of Trauma (EAST). *J Trauma Acute Care Surg*. 2018;84(5):736–744
63. Stroh G, Braude D. Can an out-of-hospital cervical spine clearance protocol identify all patients with injuries? An argument for selective immobilization. *Ann Emerg Med*. 2001;37(6):609–15
64. Swartz EE, Hernandez AE, Decoster LC, Mihalik JP, Burns MF, Reynolds C. Prehospital emergency removal of football helmets using two techniques. *Prehosp Emerg Care*. 2011;15(2):166–74
65. Theodore N, Hadley MN, Aarabi B, et al. Prehospital cervical spinal immobilization after trauma. *Neurosurgery*. 2013;72 Suppl 2:22–34
66. Vaillancourt C, Stiell IG, Beaudoin T, et al. The out-of-hospital validation of the Canadian C-Spine Rule by paramedics. *Ann Emerg Med*. 2009;54(5):663–71. e1
67. Vanderlan WB, Tew BE, McSwain NE Jr. Increased risk of death with cervical spine immobilisation in penetrating cervical trauma. *Injury*. 2009;40(8):880–3
68. Vanderlan WB, Tew BE, Seguin CY, et al. Neurologic sequelae of penetrating cervical trauma. *Spine (Phila Pa 1976)*. 2009;34(24):2646–53
69. Velopulos, C. G., Shihab, H. M., Lottenberg, L., Feinman, M., Raja, A., Salomone, J., & Haut, E. R. Prehospital spine immobilization/spinal motion restriction in penetrating trauma: A practice management guideline from the Eastern Association for the Surgery of Trauma (EAST). *Journal of Trauma and Acute Care Surgery*, 2018, 84(5), 736–744.
70. 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
71. Werman HA, White LJ, Herron H, et al. Clinical clearance of spinal immobilization in the air medical environment: a feasibility study. *J Trauma*. 2008;64(6):1539–42
72. White CC IV, Domeier RM, Millin MG. EMS spinal precautions and the use of the long backboard – resource document to the position statement of the National Association of EMS Physicians and the American College of Surgeons Committee on Trauma. *Prehosp Emerg Care*. 2013; 17:392–3
73. White CC, 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;18(2):306–314

Trauma Mass Casualty Incident

Patient Care Goals

1. Save life and limb for greatest number given resources available
2. Triage and transport most critical requiring immediate in-hospital care first

Patient Presentation

Inclusion Criteria

Trauma MCI overwhelming immediately available resources

Exclusion Criteria

Routine EMS response for non-MCI for trauma

Patient Management

Special circumstances may occur in any incident in which the resources of the emergency medical services are overwhelmed by the number and severity of casualties.

Triage and Treat

1. Ensure scene safety for EMS clinicians
2. Senior EMS clinician rapidly assesses scene and assigns roles and responsibilities to EMS personnel
3. Refer to Hostile Environment—[Appendix IX - Active Violence Incident Response Guideline](#)
4. Sort patients using a locally agreed upon MCI triage process such as SALT (Sort, Assess, Lifesaving Interventions, Treatment/Transport), START/JUMP-START (Simple Triage and Rapid Transport), MUCC (Model Uniform Core Criteria), etc.
5. Identify those in need of immediate life-saving intervention
6. Triage categories are recommended and should be guided by local protocols: immediate, delayed, minimal, expectant, and dead
7. Triage new patients as identified
8. Retriage frequently for duration of MCI
9. **Immediate life-saving interventions for immediate patients**
 - a. Treat hemorrhage with tourniquets, direct pressure with assistance from other patients or other devices
 - b. Ensure patent airway by opening airway and using rapid adjuncts
 - c. Decompress tension pneumothorax
 - d. Use autoinjector antidotes if needed

Transport

1. First transport immediate patients
 - a. Those requiring immediate in-hospital care for life and limb, particularly surgical care (suspected torso hemorrhage, uncontrollable junctional or extremity hemorrhage)

- b. Those with injuries temporized that required immediate transport (received airway intervention, decompressed tension pneumothorax, effective tourniquets for extremity hemorrhage or amputations)
- 2. Second, transport delayed patients
 - a. Continue to retriage patients
 - b. Continue life-saving interventions
 - c. Initiate urgent required therapy
- 3. Assess minimal patients for appropriate transport decision

Patient Safety Considerations

- 1. Ensure patients remain in safe area
- 2. Reassess scene safety as incident progresses as needed

Notes/Educational Pearls

Key Considerations

- 1. The most experienced EMS clinician should perform triage
- 2. Another experienced EMS clinician should be assigned to immediate patient area and perform life-saving interventions as well as continuous triage
- 3. Prioritize patients within immediate group for transport
- 4. If available, another EMS clinician should be assigned to delayed area and perform urgent interventions if patient condition changes. Continuously triage and prioritize within the delayed patient group for transport
- 5. Patient triage category may change with subsequent triage. If need for up-triage occurs, perform life-saving interventions, and move patient to appropriate triage area (delayed or immediate)
- 6. EMS system leaders within a defined area should work collaboratively to agree upon a common triage tool
- 7. Evidence is limited on the highest performing triage tool. Available evidence suggests that the SALT triage tool was most likely to correctly triage adult emergency department patients, but all tested triage tools demonstrated relatively high rates of under triage

Pertinent Assessment Findings

None noted

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

None noted

Key Documentation Elements

- Document pertinent patient information per local EMS protocol when able and before transport

Performance Measures

- Rapidly triage, treat and transport immediate life-threatening injuries
- Maintain scene safety for EMS clinicians and patients
- Continue triage and treat for all patients until relieved, until all patients transported or dispositioned, and until incident completion

References

1. Courtney H. McKee, Robert W. Heffernan, Brian D. Willenbring, Richard B. Schwartz, J. Marc Liu, M. Riccardo Colella & E. Brooke Lerner (2020) Comparing the Accuracy of Mass Casualty Triage Systems When Used in an Adult Population, *Prehospital Emergency Care* 2019, 24:4, 515–524, DOI: [10.1080/10903127.2019.1641579](https://doi.org/10.1080/10903127.2019.1641579)
2. Model Uniform Core Criteria for Mass Casualty Triage, *Disaster Med Public Health Prep.* 2011 Jun;5(2):125–8
3. SALT Mass Casualty Triage Concept Endorsed by the American College of Emergency Physicians, American College of Surgeons Committee on Trauma, American Trauma Society, National Association of EMS Physicians, National Disaster Life Support Education Consortium, and State and Territorial Injury Prevention Directors Association. *Disaster Medicine and Public Health Preparedness*. 2008; Vol2(4): 245–6

TOXINS AND ENVIRONMENTAL



Poisoning/Overdose Universal Care

Patient Care Goals

1. Remove patient from hazardous 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

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

- viii. Seizures
- ix. Arrhythmias
- x. Respiratory depression
- xi. Chemical burns around or inside the mouth
- xii. Abnormal breath odors
- c. Inhalation
 - i. Nausea
 - ii. Vomiting
 - iii. Diarrhea
 - iv. Altered mental status
 - v. Abnormal skin color
 - vi. Dyspnea
 - vii. Seizures
 - viii. Burns to the respiratory tract
 - ix. Stridor
 - x. Sooty sputum
 - xi. Known exposure to toxic or irritating gas
 - xii. Respiratory depression
 - xiii. Sweating
 - xiv. Tearing
 - xv. Constricted/dilated pupils
 - xvi. Dizziness
- d. Injection
 - i. Local pain
 - ii. Puncture wounds
 - iii. Reddening skin
 - iv. Local edema
 - v. Numbness
 - vi. Tingling
 - vii. Nausea
 - viii. Vomiting
 - ix. Diarrhea
 - x. Altered mental status
 - xi. Abdominal pain
 - xii. Seizures
 - xiii. Muscle twitching
 - xiv. Hypoperfusion
 - xv. Respiratory depression
 - xvi. Metallic or rubbery taste

2. Toxidromes (constellations of signs and symptoms that add in the identification of certain classes of medications and their toxic manifestations). These toxidrome constellations may be masked or obscured in poly pharmacy events due to counteracting effects of the toxins
- a. Anticholinergic
 - i. *Red as a beet* (flushed skin)
 - ii. *Dry as a bone* (dry skin)
 - iii. *Mad as a hatter* (altered mental status)
 - iv. *Blind as a bat* (mydriasis)
 - v. *Hot as a pistol* (hyperthermia)
 - vi. *Full as a flask* (urinary retention)
 - vii. *“Tacky” like a pink flamingo* (tachycardia and hypertension)
 - b. Cholinergic (**DUMBELS**)

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

 - i. **D**iarrrhea
 - ii. **U**rination
 - iii. **M**iosis/**M**uscle weakness
 - iv. **B**ronchospasm/**B**ronchorrhea/**B**radycardia (*the killer Bs*)
 - v. **E**mesis
 - vi. **L**acrimation
 - vii. **S**alivation/**S**weating
 - c. Opioids
 - i. Respiratory depression
 - ii. Miosis (pinpoint pupils)
 - iii. Altered mental status
 - iv. Decreased bowel sounds
 - d. Sedative Hypnotic
 - i. Central nervous system depression
 - ii. Ataxia (unstable gait or balance)
 - iii. Slurred speech
 - iv. Normal or depressed vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment)
 - e. Stimulants (Sympathomimetic)
 - i. Tachycardia, tachydysrhythmias
 - ii. Hypertension
 - iii. Diaphoresis
 - iv. Delusions/paranoia
 - v. Seizures

- vi. Hyperthermia
- vii. Mydriasis (dilated pupils)
- f. Serotonin Syndrome (presentation with at least three of the following)
 - i. Agitation
 - ii. Ataxia
 - iii. Diaphoresis
 - iv. Diarrhea
 - v. Hyperreflexia
 - vi. Mental status changes
 - vii. Myoclonus
 - viii. Shivering
 - ix. Tremor
 - x. Hyperthermia
 - xi. Tachycardia

Exclusion Criteria

None noted

Patient Management

Assessment

1. Make sure the scene is safe. Use environmental Carbon Monoxide (CO) detector on “first in” bag if possible
2. Consider body substance isolation (BSI) or appropriate PPE
3. Assess ABCD and, if indicated, expose patient for assessment and then recover to assure retention of body heat
4. Vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) temperature, and O₂ saturation including temperature
5. Attach cardiac monitor and examine rhythm strip for arrhythmias (consider 12-lead EKG)
6. Check blood glucose level
7. Monitor pulse oximetry and end-tidal capnography (EtCO₂) for respiratory decompensation
8. Perform carboxyhemoglobin device assessment, if available
9. When indicated, identify specific medication taken (including immediate release vs sustained release), time of ingestion, dose, and quantity. When appropriate, bring all medications (prescribed and not prescribed) found in the environment
10. Obtain an accurate ingestion history (as patient may become unconscious before arrival at the emergency department (ED))
 - a. Time of ingestion or exposure
 - b. Route of exposure
 - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
 - d. Alcohol or other intoxicant taken
11. If bringing in exposure agent, consider the threat to yourself and the destination facility

12. Obtain pertinent cardiovascular history and other prescribed medications
13. Check for needle marks, paraphernalia, bites, bottles, or evidence of agent involved in exposure, self-inflicted injury, or trauma
14. Law enforcement should have checked for weapons and drugs, but you may need to recheck
15. Obtain any other pertinent patient history
16. Perform remainder of physical examination

Treatment and Interventions

1. Assure a patent airway
2. Administer oxygen as appropriate with a target of achieving 94–98% saturation, and if there is hypoventilation noted, support breathing
3. Initiate IV access for infusion of treatment medication and/or normal saline if indicated, and obtain blood samples if EMS management might change based upon the value (e.g., glucose, lactate, cyanide)
4. Consider 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. If risk of rapidly decreasing mental status, do not administer oral agents
 - b. Aspirin overdose
 - i. If altered mental status or risk of rapid decreasing mental status from polypharmacy, do not administer oral agents
 - ii. In salicylate poisonings, let the patient breathe on their own, even if tachypneic, until there is evidence of decompensation or dropping oxygen saturation. Acid/base disturbances and outcomes worsen when the patient is manually ventilated
 - c. Benzodiazepine overdose
 - i. Respiratory support
 - ii. Consider fluid challenge (20 mL/kg) for hypotension
 - iii. Consider vasopressors after adequate fluid resuscitation (1–2 liters of crystalloid in adult) for the hypotensive patient
 - d. Caustic substances ingestion (i.e., acids and alkali)
 - i. Evaluate for airway compromise secondary to spasm or direct injury associated with oropharyngeal burns
 - e. Dystonia (symptomatic), extrapyramidal signs or symptoms, or mild allergic reactions
 - i. Consider administration of diphenhydramine
 1. **Adult:** diphenhydramine 25–50 mg IV or IM
 2. **Pediatric:** diphenhydramine 1–1.25 mg/kg IVP/IO or IM (maximum single dose of 25 mg)

- f. Monoamine oxidase inhibitor overdose (symptomatic, e.g., MAOI; isocarboxazid, phenelzine, selegiline, tranylcypromine)
 - i. Consider administration of midazolam for temperature control
 - ii. **Adult and Pediatric:** Midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg—reduce by 50% for patients 69 years old or older
- g. Opiate overdose, treat per the Opioid Poisoning/Overdose Guideline
- h. Oral ingestion unknown poisoning:
 - i. If there is a risk of rapidly decreasing mental status or for petroleum- based ingestions, do not administer oral agents
 - ii. Consider early airway management
 - iii. Treat arrhythmias following Advanced Cardiac Life Support (ACLS) guidelines
 - iv. Aggressively control hyperthermia with cooling measures
 - v. Consider fluid challenge (20 mL/kg) for hypotension
 - vi. Consider vasopressors after adequate fluid resuscitation (1–2 liters of crystalloid in adult) for the hypotensive patient [See [Shock Guideline](#)]
 - vii. For agitation, consider midazolam
 1. **Adult:** midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg
 - a. Reduce by 50% for patients 69 years or older
 2. **Pediatric:** midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 4 mg or midazolam 0.2 mg/kg IN to maximum single dose of 10 mg
 - viii. For seizures, treat per [Seizures Guideline](#)
- i. Tricyclic Antidepressant (TCA)/Sodium Channel Blocker Overdose
 - i. Consider early airway management
 - ii. If widened QRS (100 msec or greater), consider sodium bicarbonate 1–2 mEq/kg IV, this can be repeated as needed to narrow QRS and improve blood pressure
 - iii. Consider fluid challenge (20 mL/kg) for hypotension
 - iv. Consider vasopressors after adequate fluid resuscitation (1–2 liters of crystalloid) for the hypotensive patient [See [Shock Guideline](#)]
 - v. For agitation, consider midazolam
 1. **Adult:** midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 5 mg
 - a. Reduce by 50% for patients 69 years or older
 2. **Pediatric:** midazolam 0.1 mg/kg in 2 mg increments slow IV push over one to two minutes per increment with maximum single dose 4 mg or midazolam 0.2 mg/kg IN to maximum single dose of 10 mg
 - vi. For seizure, treat per [Seizures Guideline](#)

Patient Safety Considerations

1. Scene/environmental safety for patient and clinician
 - a. Consider environmental carbon monoxide monitor use
2. Monitor patient airway, breathing, pulse oximetry, EtCO₂ for adequate ventilation as they may change over time
3. Repeat vital signs often
4. Monitor level of consciousness
5. Monitor EKG with special attention to rate, rhythm, QRS and QT duration
6. Maintain or normalize patient temperature
7. The regional poison center should be engaged as early as reasonably possible to aid in appropriate therapy and to track patient outcomes to improve knowledge of toxic effects. The **national 24-hour toll-free telephone number to poison control centers is (800) 222-1222**, and it is a resource for free, confidential expert advice from anywhere in the United States

Notes/Educational Pearls

Key Considerations

1. Each toxin or overdose has unique characteristics that must be considered in individual protocols
2. Activated charcoal (that does not bind to all medications or agents) is still a useful adjunct in the serious-agent, enterohepatic, or extended-release agent poisoning if the patient does not have the potential for rapid alteration of mental status or airway/aspiration risk. Precautions should be taken to avoid or reduce the risk of aspiration
3. Ipecac is not recommended for any poisoning or toxic ingestion—the manufacturer has stopped production of this medication
4. Flumazenil is not indicated in a suspected benzodiazepine overdose as it can precipitate refractory/intractable seizures if the patient is a benzodiazepine dependent patient

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914135—General—Overdose/Poisoning/Toxic Ingestion

Key Documentation Elements

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

Performance Measures

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

References

1. Boyer EW, Shannon MS. The serotonin syndrome. *N Engl J Med*. 2005; 352:1112–20
2. Brucoleri RE, Burns MM. A Literature Review of the Use of Sodium Bicarbonate for the Treatment of QRS Widening. *J Med Toxicol*. 2016 Mar;12(1):121-9. doi: 10.1007/s13181-015-0483-y. PMID: 26159649; PMCID: PMC4781799
3. Cushing TA. Selective Serotonin Reuptake Inhibitor Toxicity
<https://emedicine.medscape.com/article/821737-overview>. Updated April 24, 2018. Accessed
4. Gresham C. Benzodiazepine toxicity treatment and management.
<http://emedicine.medscape.com/article/813255-treatment#d10>. Updated January 23, 2020. Accessed
5. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw -Hill Education;2015.
<http://accessemergencymedicine.mhmedical.com/book.aspx?bookID=1163> Accessed
6. Lemyze M, Masse J, Queva C, Huchette D. Cardiac effect of sodium bicarbonate in sodium-channel blocker poisoning. *Intensive Care Med*. 2016 Apr;42(4):588-590. doi: 10.1007/s00134-015-4122-5
7. Spiller H. A prospective evaluation of the effect of activated charcoal before N-Acetyl cysteine in acetaminophen overdose. *Ann of Emerg Med*. 1994;23(3):519 -23
8. Tsai V. Tricyclic Antidepressant Toxicity.
<http://emedicine.medscape.com/article/819204-overview>. Updated May 19, 2020. Accessed
9. Wolf S. Clinical policy: critical issues in the management of patients presenting to the emergency department with acetaminophen overdose. *Ann of Emerg Med*. 2007;50(3):292–313

Acetylcholinesterase Inhibitors Exposure (Carbamates, Nerve Agents, Organophosphates)

Patient Care Goals

1. Rapid recognition of the signs and symptoms of confirmed or suspected acetylcholinesterase inhibitor (AChEI) agents such as carbamates, nerve agents, or organophosphates exposure followed by expeditious and repeated administration of atropine, the primary antidote
2. Carbamates and organophosphates are commonly active agents in commercial insecticides
3. Accidental carbamate exposure rarely requires treatment

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

1. Don the appropriate PPE
2. Remove the patient's clothing and wash the skin with soap and warm water
 - a. Acetylcholinesterase inhibitor agents can be absorbed through the skin
 - b. Contaminated clothing can provide a source of continued exposure to the toxin
3. Rapidly assess the patient's respiratory status, mental status, and pupillary status
4. Administer the antidote atropine immediately for confirmed or suspected acetylcholinesterase inhibitor agent exposure
5. Administer oxygen as appropriate with a target of achieving 94–98% saturation and provide airway management
6. Establish intravenous access (if possible)
7. Apply a cardiac monitor (if available)
8. The heart rate may be normal, bradycardic, or tachycardic
9. Clinical improvement should be based upon the drying of secretions and easing of respiratory effort rather than heart rate or pupillary response
10. Continuous and ongoing patient reassessment is critical

Assessment

1. Acetylcholinesterase inhibitor agents are highly toxic chemical agents and can rapidly be fatal
2. Patients with low-dose chronic exposures may have a more delayed presentation of symptoms
3. Antidotes (atropine and pralidoxime) are effective if administered before circulation fails
4. The patient may develop:
 - a. Miosis (pinpoint pupils)
 - b. Bronchospasm
 - c. Bradycardia
 - d. Vomiting
 - e. Excessive secretions in the form of:
 - i. Tearing
 - ii. Salivation
 - iii. Rhinorrhea
 - iv. Diarrhea
 - v. Urination
 - vi. Bronchorrhea
5. Penetration of an acetylcholinesterase inhibitor agent into the central nervous system (CNS) will cause
 - a. Headache
 - b. Confusion
 - c. Generalized muscle weakness
 - d. Seizures
 - e. Lethargy or unresponsiveness
6. Estimated level of exposure based upon signs and symptoms
 - a. Mild
 - i. Miosis alone (while this is a primary sign in vapor exposure, it may not be present in all exposures)
 - ii. Miosis and severe rhinorrhea
 - b. Mild to moderate (in addition to symptoms of mild exposure)
 - i. Localized swelling
 - ii. Muscle fasciculations
 - iii. Nausea and vomiting
 - iv. Weakness
 - v. Shortness of breath

- c. Severe (in addition to symptoms of mild to moderate exposure)
 - i. Unconsciousness
 - ii. Convulsions
 - iii. Apnea or severe respiratory distress requiring assisted ventilation
 - iv. Flaccid paralysis
- 7. Onset of symptoms can be immediate with an exposure to a large amount of the acetylcholinesterase inhibitor
 - a. There is usually an asymptomatic interval of minutes after liquid exposure before these symptoms occur
 - b. Effects from vapor exposure occur almost immediately
- 8. Signs and symptoms with large acetylcholinesterase inhibitor agent exposures (regardless of route)
 - a. Sudden loss of consciousness
 - b. Seizures
 - c. Copious secretions
 - d. Apnea
 - e. Death
- 9. Obtain an accurate exposure history (as patient may become unconscious before arrival at the ED)
 - a. Time of ingestion or exposure
 - b. Route of exposure
 - c. Quantity of medication or toxin taken (safely collect all possible medications or agents)
 - d. Alcohol or other intoxicant taken
 - e. Pertinent cardiovascular history or other prescribed medications for underlying disease
- 10. The patient can manifest any of the signs and symptoms of the toxidrome based on the route of exposure, agent involved, and concentration of the agent
 - a. Vapor exposures will have a direct effect on the eyes and pupils causing miosis
 - b. Patients with isolated skin exposures will have normally reactive pupils
 - c. Certain acetylcholinesterase inhibitor agents can place the patient at risk for both a vapor and skin exposure

Treatment and Interventions (See [dosing tables](#))

1. Medications:

- a. Atropine
 - i. Atropine is the primary antidote for organophosphate, carbamate, or nerve agent exposures, and repeated doses should be administered liberally to patients who exhibit signs and symptoms of exposure or toxicity
 - ii. Atropine may be provided in multidose vials, prefilled syringes, or auto-injectors

b. Benzodiazepines

- i. Benzodiazepines are administered as an anticonvulsant for those patients who exhibit seizure activity [See [Seizures Guideline](#) for doses and routes of administration]
- ii. Lorazepam, diazepam, and midazolam are the most frequently used benzodiazepines in the prehospital setting; midazolam may have the fastest onset of action
- iii. Benzodiazepines may be provided in multidose or single-dose vials, prefilled syringes, or auto-injectors
- iv. CANA® (Convulsive Antidote Nerve Agent) is a commercially available auto-injector that contains 10 mg of diazepam

c. Duodote®

- i. A commercially available auto-injector of nerve agent/organophosphate antidote
 - ii. Duodote® is one auto-injector that contains 2.1 mg of atropine and 600 mg of pralidoxime chloride
- d. Atropine, in large and potentially multiple doses, is the antidote for an acetylcholinesterase inhibitor agent poisoning
- e. Atropine should be administered immediately followed by repeated doses until the patient's secretions resolve
- f. Pralidoxime chloride (2-PAM) is a secondary treatment and, when possible, should be administered concurrently with atropine
- g. The stock of atropine and pralidoxime chloride available to EMS clinicians is usually not sufficient to fully treat the victim of an acetylcholinesterase inhibitor agent exposure; however, EMS clinicians should initiate the administration of atropine and, if available, pralidoxime chloride
- h. Seizures should be treated with benzodiazepines. There is some emerging evidence that, for midazolam, the intranasal route of administration may be preferable to the intramuscular route. However, intramuscular absorption may be more clinically efficacious than the intranasal route in the presence of significant rhinorrhea
- i. The patient should be emergently transported to the closest appropriate medical facility as directed by medical direction

2. **Recommended Doses** (See [dosing tables](#))

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

- a. For organophosphate or severe acetylcholinesterase inhibitor agent exposure, the required dose of atropine necessary to dry secretions and improve the respiratory status may exceed 20 mg. Atropine should be administered rapidly and repeatedly until the patient's clinical symptoms diminish. Atropine must be given until the acetylcholinesterase inhibitor agent has been metabolized.
- b. Because Duodote® auto-injectors contain pralidoxime chloride, they should not be used for additional dosing of atropine beyond the recommended administered dose of pralidoxime chloride.

- c. All the medications below can be administered intravenously in the same doses cited for the intramuscular route. However, due to the rapidity of onset of signs, symptoms, and potential death from acetylcholinesterase inhibitor agents, intramuscular administration is highly recommended to eliminate the inherent delay associated with establishing intravenous access.
- d. The antidotes can be administered via the intraosseous route. However, due to the rapidity of onset of signs, symptoms, and potential death from acetylcholinesterase inhibitor agents, intramuscular administration remains the preferable due to the inherent delay associated with establishing intraosseous access and the limited use of this route of administration for other medications.

Table 1. Mild Acetylcholinesterase Inhibitor Agent Exposure

Patient	Atropine Dose (Weight) IM or via Auto-injector
Infant: 0–2 years of age	0.05 mg/kg IM or via auto-injector (i.e., 0.25 and/or 0.5 mg auto-injector(s))
Child: 3–7 years of age (13–25 kg)	1 mg IM or via auto-injector (i.e., one 1 mg or two 0.5 mg auto-injectors)
Child: 8–14 years of age (26–50 kg)	2 mg IM or via auto-injector (i.e., 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/Frail	1 mg IM or via auto-injector
<i>Adapted from:</i> U.S. Department of Health and Human Services, ASPR, National Library of Medicine, Chemical Hazards Emergency Medical Management: Nerve Agents—Prehospital Management, https://wwwn.cdc.gov/TSP/MMG/MMGDetails.aspx?mmgid=523&toxid=93	

Table 2. Mild to Moderate Acetylcholinesterase Inhibitor Agent Exposure

Patient (Weight)	Atropine Dose IM or via Auto-injector	Pralidoxime Chloride Dose IM or via 600 mg Auto-injector
Infant: 0–2 years of age	0.05 mg/kg IM or via auto-injector (i.e., <i>0.25 mg and/or 0.5 mg auto-injector</i>)	15 mg/kg IM
Child: 3–7 years of age (13–25 kg)	1 mg IM or via auto-injector (i.e., <i>one 1 mg auto-injector or two 0.5 mg auto-injectors</i>)	15 mg/kg IM OR One auto-injector (600 mg)
Child: 8–14 years of age (26–50 kg)	2 mg IM or via auto-injector (i.e., <i>one 2 mg auto-injector or two 1 mg auto-injectors</i>)	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/Frail	2 mg IM or via auto-injector	10 mg/kg IM OR One auto-injector (600 mg)
Adapted from: U.S. Department of Health and Human Services, ASPR, National Library of Medicine, Chemical Hazards Emergency Medical Management: Nerve Agents—Prehospital Management,		

Table 3. Severe Acetylcholinesterase Inhibitor Agent Exposure

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

Table 4. Guidance for the Treatment of Seizures Secondary to Acetylcholinesterase Inhibitor Agent Exposure

Patient	Diazepam	Midazolam
Infant (0–2 y/o)	0.2–0.5 mg/kg IM Repeat q 2–5 minutes	0.2 mg/kg IM Repeat prn in 10 minutes
	0.2–0.5 mg/kg IV q 15–30 minutes May repeat twice as needed	May repeat dose once
	Total maximum dose: 5 mg	Total maximum dose: 0.4 mg/kg
Child (3–13 y/o)	0.2–0.5 mg/kg IM Repeat q 2–5 minutes	0.2 mg/kg IM Not to exceed 10 mg Repeat prn in 10 minutes
	0.2–0.5 mg/kg IV q 15–30 minutes May repeat dose twice if needed	May repeat dose once
	Total maximum dose: 5 mg if less than 5 years	Total maximum dose: 0.4 mg/kg Not to exceed 20 mg
	Total maximum dose: 10 mg if age 5 years or older 1 CANA® auto-injector	
Adolescent: 14 y/o or older	2–3 CANA® auto-injectors	0.2 mg/kg IM Total maximum dose of 10 mg Repeat prn in 10 minutes
	5–10 mg IV q 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 q 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 q 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 q 15 minutes	May repeat dose once
	Total maximum dose: 30 mg	Total maximum dose: 20 mg

Patient Safety Considerations

1. Continuous and ongoing patient reassessment is critical
2. Clinical response to treatment is demonstrated by the drying of secretion and the easing of respiratory effort
3. Initiation of and ongoing treatment should **not** be based upon heart rate or pupillary response
4. Precautions for pralidoxime chloride administration:
 - a. Although Duodote® and ATNAA® contains atropine, the primary antidote for an acetylcholinesterase inhibitor agent poisoning, the inclusion of pralidoxime chloride in the auto-injector can present challenges if additional doses of atropine are warranted by the patient condition and other formulations of atropine are unavailable:
 - i. **Pediatrics:** an overdose of pralidoxime chloride may cause profound neuromuscular weakness and subsequent respiratory depression
 - ii. **Adults:** Especially for the geriatric victim, excessive doses of pralidoxime chloride may cause severe systolic and diastolic hypertension, neuromuscular weakness, headache, tachycardia, and visual impairment
 - iii. **Geriatrics:** victim who may have underlying medical conditions, particularly impaired kidney function or hypertension, the EMS clinician 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 1 kits, Duodote® and ATNAA® have not been approved for pediatric use by the Food and Drug Administration (FDA), but they can be considered for the initial treatment for children of any age with severe symptoms of an acetylcholinesterase inhibitor agent poisoning especially if other formulations of atropine are unavailable
 - d. Pediatric Atro-Pen® auto-injectors are commercially available in a 0.25 mg auto-injector (**yellow**) and a 0.5 mg auto-injector (**red**). Atro-Pen® auto-injectors are commercially available in a 1 mg auto-injector (**blue**) and a 2 mg auto-injector (**green**)
 - e. A pralidoxime chloride 600 mg auto-injector may be administered to an infant that weighs greater than 12 kg

Notes/Educational Pearls

Key Considerations

1. Clinical effects of acetylcholinesterase inhibitor agents
 - a. The clinical effects are caused by the inhibition of the enzyme acetylcholinesterase which allows excess acetylcholine to accumulate in the nervous system
 - b. The excess accumulated acetylcholine causes hyperactivity in muscles, glands, and nerves
2. Organophosphates Insecticides

- a. Can be legally purchased by the general public
 - b. Organophosphate pesticides penetrate tissues and bind to the patient's body fat producing a prolonged period of illness and ongoing toxicity even during aggressive treatment
3. Nerve agents
- a. Traditionally classified as weapons of mass destruction (WMD)
 - b. Not readily accessible to the general public
 - c. Extremely toxic and rapidly fatal with any route of exposure
 - d. GA (tabun), GB (sarin), GD (soman), GF, and VX are types of nerve agents and are WMDs
 - e. Nerve agents can persist in the environment and remain chemically toxic for a prolonged period of time

Pertinent Assessment Findings

The signs and symptoms exhibited with the toxidrome of **DUMBELS** [See [Patient Presentation—Inclusion Criteria](#)]

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914047—Exposure—Nerve Agents

Key Documentation Elements

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

Performance Measures

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

References

1. Barkin RM, Rosen P, Seidel JS, Caputo GL, Jaffe DM. *Pediatric Emergency Medicine: Concepts and Clinical Practice*. St Louis, MO: Mosby; 1992:490–1
2. Burillo-Putze G, Nogue Xarau SN. In Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 8th Edition*. McGraw-Hill Education; 2016:1318–21
3. Eddelston M, Buckley NA, Eyer P, Dawson AH. Management of acute organophosphorus poisoning. *Lancet*. 2008;371(9612):597–607
4. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw -Hill Education; 2015
5. Horowitz BZ, Hendrickson RG. Chemical disasters. In Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 8th Edition*. McGraw-Hill Education; 2016:44–5
6. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*. 2014:825-6,2057-60,2476-7
7. Nelson LS. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw -Hill Education; 2015:1450–76
8. Nerve Agents—Prehospital Management. Chemm.nlm.nih.gov.<https://wwwn.cdc.gov/TSP/MMG/MMGDetails.aspx?mmgid=523&toxid=93> Updated April 28, 2017. Accessed August 27, 2017
9. Silbergleit R, Lowenstein D, Durkalski V, Conwit R; Neurological Emergency Treatment Trials (NETT) Investigators. **RAMPART** (Rapid Anticonvulsant Medication Prior to Arrival Trial): a double-blind randomized clinical trial of the efficacy of intramuscular **midazolam** versus intravenous lorazepam in the prehospital treatment of status epilepticus by paramedics. *Epilepsia*. 2011 Oct;52(8):45–7. doi: 10.1111/j.1528-1167.2011.03235.x. PMID: 21967361

Radiation Exposure

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. Irradiated patients pose no threat to medical clinicians
2. Contaminated patients pose very little threat to medical clinicians who use appropriate PPE including N95 masks or respirators, gloves, gowns, and face and eye protection
3. Sources of radiation
 - a. Legal
 - i. Industrial plants
 - ii. Healthcare facilities that provide radiologic services
 - iii. Nuclear power plants
 - iv. Mobile engineering sources (i.e., construction sites that are installing cement)
 - b. Illegal
 - i. Weapons of mass destruction
 - ii. "Dirty bomb" design to contaminate widespread areas
4. Physiology of radiation poisoning
 - a. Contamination: Poisoning from direct exposure to a radioactive source, contaminated debris, liquids, or clothing where radiation continues to be emitted from particles on surface
 - b. Exposure: Poisoning from radioactivity, in the form of ionizing rays, penetrating through the bodily tissues of the patient
5. Common types of radioactivity that cause poisoning
 - a. Gamma rays
 - i. Highest frequency of ionizing rays
 - ii. Penetrates the skin deeply
 - iii. Causes the most severe radiation toxicity
 - b. Beta rays: can penetrate up to 1 cm of the skin's thickness
 - c. Alpha rays
 - iv. Lowest frequency of ionizing rays
 - v. Short range of absorption
 - vi. Dangerous only if ingested or inhaled
 - d. Radioactive daughters
 - e. Products of decay of the original radioactive substance
 - ii. Can produce gamma and beta rays (i.e., uranium decays into a series of radon daughters)

6. In general, trauma patients who have been exposed to or contaminated by radiation should be triaged and treated based on the severity of their conventional injuries
7. A patient who is contaminated with radioactive material (i.e., flecks of radioactive material embedded in their clothing and skin) generally poses a minimal exposure risk to medical personnel, although should not be placed in a contained space before decontamination
8. EMS clinicians may be asked to assist public health agencies in the distribution and administration of potassium iodide in a mass casualty incident involving radiation release or exposure
9. Stages of Radiation Sickness
 - a. Prodromal: nausea, vomiting, diarrhea, fatigue, fever, agitation, starting hours up to 4 days after initial exposure
 - b. Latent: May last up to four weeks (this is the maximum period for immunocompromise due to radiation exposure); however, time span may be less as dose of radiation exposure increases. Symptoms include anorexia, fever, weakness, bleeding, diarrhea, potentially altered mental status after two to three weeks
 - c. Recovery: may take weeks to months

Pertinent Assessment Findings

1. Treatment of life-threatening injuries or medical conditions takes priority over assessment for contamination or initiation of decontamination
2. Time to nausea and vomiting is a reliable indicator of the received dose of ionizing radiation. The more rapid the onset of vomiting, the higher the whole-body dose of radiation
3. Tissue burns are a late finding (weeks following exposure) of ionizing radiation injury. If burns are present acutely, they are from a thermal or chemical mechanism
4. Seizures may suggest acute radiation syndrome if accompanied by early vomiting. If other clinical indicators do not suggest a whole-body dose of greater than 20 Gy, consider other causes of seizure
5. Delayed symptoms (days to weeks after exposure or contamination)
 - a. Skin burns with direct contact with radioactive source
 - b. Skin burns or erythema from ionizing rays
 - c. Fever
 - d. Bone marrow suppression presenting as:
 - i. immunosuppression
 - ii. Petechiae
 - e. Spontaneous internal and external bleeding

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914049—Exposure—Radiologic Agents

Key Documentation Elements

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

Performance Measures

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

References

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

Topical Chemical Burn

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion criteria

None noted

Patient Management

1. Don the appropriate PPE
2. Remove the patient's clothing, if necessary. Consider Hazardous Material Response with decontamination.
3. Contaminated clothing should preferably be placed in double bags
4. If deemed necessary and manpower resources permit, the patient should be transported by EMS clinicians who did not participate in the decontamination process, and in an emergency response vehicle that has not been exposed to the chemical
5. Information regarding the chemical should be gathered while on scene including materials safety data sheet if available
6. Communicate all data regarding the chemical to the receiving facility

Assessment

1. Clinical effects and severity of a topical chemical burn is dependent upon:
 - a. Class of agent (alkali injury or acid injury)
 - b. Concentration of the chemical the (higher the concentration, the greater the risk of injury)
 - c. pH of the chemical
 - i. Alkali-increased risk with pH greater than or equal to 11
 - ii. Acid-increased risk with pH less than or equal to 3
 - d. Onset of burn
 - i. Immediate
 - ii. Delayed (e.g., hydrofluoric acid)
2. Calculate the estimated total body surface area that is involved
3. Prevent further contamination

4. Special attention to assessment of ocular or oropharyngeal exposure—evaluate for airway compromise secondary to spasm or direct injury associated with oropharyngeal burns
5. Some acid and alkali agents may manifest systemic effects

Treatment and Interventions

1. If dry chemical contamination, carefully brush off solid chemical prior to flushing the site as the irrigating solution may activate a chemical reaction
2. If wet chemical contamination, flush the patient's skin (and eyes, if involved) with copious amounts of water or normal saline
3. Provide adequate analgesia per the [Pain Management Including Procedural Sedation Guideline](#)
4. Consider the use of topical anesthetic eye drops (e.g., tetracaine) for chemical burns of the eye
5. For eye exposure, administer continuous flushing of irrigation fluid to eye—Morgan lens may facilitate administration
6. Early airway intervention for airway compromise or bronchospasm associated with oropharyngeal burns
7. Take measures to minimize hypothermia
8. Initiate intravenous fluid resuscitation if necessary to obtain hemodynamic stability

Hydrofluoric Acid

Hydrofluoric acid (HF) is a highly corrosive substance that is primarily used for automotive cleaning products, rust removal, porcelain cleaners, etching glass, cleaning cement or brick, or as a pickling agent to remove impurities from various forms of steel. Hydrofluoric acid readily penetrates intact skin and there may be underlying tissue injury. It is unlikely that low concentration HF will cause an immediate acid-like burn however there may be delayed onset of pain to the exposed area. Higher concentration HF may cause immediate pain as well as more of a burn appearance that can range from mild erythema to an obvious burn. An oral or large dermal exposure can result in significant systemic hypocalcemia with possible QT prolongation and cardiovascular collapse.

1. For all patients in whom a hydrofluoric acid exposure is confirmed or suspected:
 - a. Vigorously irrigate all affected areas with water or normal saline for a minimum of 15 minutes
 - b. Apply a cardiac monitor for oral or large dermal exposures significant HF exposures

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 clinician and others from contamination
4. Do not attempt to neutralize an acid with an alkali or an alkali with an acid as an exothermic reaction will occur and cause serious thermal injury to the patient
5. Expeditious transport or transfer to a designated burn center should be considered for burns that involve a significant percentage of total body surface area or burns that involve the eyes, face, hands, feet, or genitals

Notes/Educational Pearls

Key Considerations

1. IV fluid resuscitation should be guided by patient age, percentage of body surface area involved in burn, body habitus and calculated by the Parkland Formula [See [Appendix III. Burn and Burn Fluid Charts](#)]
2. Since the severity of topical chemical burns is largely dependent upon the type, concentration, and pH of the chemical involved as well as the body site and surface area involved, it is imperative to obtain as much information as possible while on scene about the chemical substance by which the patient was exposed. The information gathering process will often include:
 - a. Transport of the **sealed** container of the chemical to the receiving facility
 - b. Transport of the original or a copy of the Material Safety Data Sheet (MSDS) of the substance to the receiving facility
 - c. Contacting the reference agency to identify the chemical agent and assist in management (e.g., CHEMTREC®)
3. Inhalation of HF should be considered in any dermal exposure involving the face and neck or if clothing is soaked in the product
4. Decontamination is critical for both acid and alkali agents to reduce injury—removal of chemicals with a low pH (acids) is more easily accomplished than chemicals with a high pH (alkalis) because alkalis tend to penetrate and bind to deeper tissues
5. Some chemicals will also manifest local and systemic signs, symptoms, and bodily damage

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914213—Injury—Topical Chemical Burn

Key Documentation Elements

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

Performance Measures

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

References

1. American Heart Association. *Advanced Pediatric Life Support*. Jones & Bartlett Learning LLC; 2013
2. Ferng M, Gupta R, Bryant SM. Hazardous Brick Cleaning. *J Emergency Medicine*. 2009;37(3):305–7
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw-Hill Education; 2015
4. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2010 769–770
5. O'Sullivan SB, Schmitz TJ. *Physical Rehabilitation*, 5th Edition. F.A. Davis; 2007: 1098
6. *Recommended Medical Treatment for hydrofluoric Acid Exposure*. Morristown, NJ: Honeywell Performance Materials and Technologies; October 2012
7. Tintinalli JE, ed. *Tintinalli's Emergency Medicine, 9th Edition*. McGraw-Hill Education; 2021:35–40, 1391–96

Stimulant Poisoning/Overdose

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

Assessment

1. Begin with the **ABCDs**:
 - a. **A**irway is patent
 - b. **B**reathing is oxygenating
 - c. **C**irculation is perfusing
 - d. **D**isability/neuro/mental status
 - e. Treat any compromise of these parameters
 - f. Ask about chest pain and difficulty breathing
2. Vital signs including temperature for hyperthermia
3. Apply a cardiac monitor and examine rhythm strip for arrhythmias
4. Check blood glucose level
5. Monitor EtCO₂ for respiratory decompensation

6. Check a 12-lead EKG when possible
7. Check for trauma, self-inflicted injury
8. Law enforcement should have checked for weapons and drugs, but you may need to repeat the inspection

Treatment and Interventions

1. IV access for any fluids and meds
2. Give fluids for poor perfusion; cool fluids for hyperthermia [See [Shock Guideline](#) and [Hyperthermia/Heat Exposure Guideline](#)]
3. Treat chest pain as acute coronary syndrome (ACS) and follow [ST-Elevation Myocardial Infarction \(STEMI\) Guideline](#) if there is EKG is consistent with STEMI
4. Consider treating shortness of breath as atypical ACS
 - a. Administer oxygen as appropriate with a target of achieving 94–98% saturation
5. Consider soft physical management devices especially if law enforcement has been involved in getting patient to cooperate [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]
6. Consider medications to reduce agitation and other significant sympathomimetic findings, preferably benzodiazepines, for the safety of the patients and clinicians. The administration of ketamine should be considered for delirium with agitated behavior. This may improve behavior and compliance [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]
 - a. If haloperidol is used, maintain cardiac monitoring (or obtain 12-lead EKGs) for QT-interval prolongation if feasible
7. Consider prophylactic use of antiemetic:
 - a. **Adult:** administer ondansetron 4–8 mg SLOW IV over 2–5 minutes or 4–8 mg IM or 8 mg orally disintegrating tablet
 - b. **Pediatric:** Administer ondansetron 0.15 mg/kg SLOW IV over 2–5 minutes
8. If hyperthermia suspected, begin external cooling (e.g., cold or ice packs to axilla/groin)

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

3. If patient has signs and symptoms of ACS, consider giving nitroglycerin sublingual (SL) q (quaque, every) 3–5 minutes if SBP greater than 100 mmHg and until pain resolves (if range not desired, use q 3 minutes)
 - a. Vasospasm is often the problem in this case as opposed to a fixed coronary artery lesion
 - b. Consider administration of benzodiazepines as if to treat anxiety
4. Maintaining IV access, cardiac monitor, and SPO₂/EtCO₂ monitors are key to being able to catch and intervene decompensations in a timely manner
 - a. If agitated, consider restraining the patient to facilitate patient assessment and lessen likelihood of vascular access or monitor displacements
5. Cocaine has sodium channel blocking effects and can cause significant cardiac conduction abnormalities with a widened QRS. Treatment is with sodium bicarbonate similar to a tricyclic antidepressant. Check a 12-lead EKG to assess for these complications

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914225—Medical—Stimulant Poisoning/Overdose

Key Documentation Elements

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

Performance Measures

- Recognition and treatment of hyperthermia
- Recognition of need for monitoring cardiovascular and respiratory status of patient with stimulant toxicity
- ACS evaluation and treatment considered for chest pain and shortness of breath

- Respiratory compromise quickly recognized and treated
- Cardiovascular compromise quickly recognized and treated
- Patient and medics did not suffer any harm
- Access and monitoring were not lost during transport

References

1. Kupas, D, Wydro, G, Tan, D, Kamin, R, Harrell, A, Wang, A, NASEMSO Position Paper 2020 Clinical Care and Restraint of Agitated or Combative Patients by Emergency Medical Services Practitioners <https://nasemsso.org/wp-content/uploads/Clinical-Care-and-Restraint-of-Agitated-or-Combative-Patients-by-Emergency-Medical-Services-Practitioners.pdf>. Accessed
2. Warrcik BJ, Hill M, Hekman K, et al. A 9-state analysis of designer stimulant, "bath salt, " hospital visits reported to poison control centers. *Ann Emerg Med*. 2013;62(3):244–51
3. *White Paper Report on Excited Delirium Syndrome*. ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009

Cyanide Exposure

Patient Care Goals

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

Patient Presentation

Cyanide is a colorless gas or white crystal that binds to the ferric ion in cells, blocking the enzyme cytochrome oxidase, thus preventing the use of oxygen by the cell's mitochondria, leading to cellular hypoxia. While it has a characteristic "bitter almond smell," genetically only 40% of the population can smell it

Inclusion Criteria

1. Depending on its form, cyanide can enter the body through inhalation, ingestion, or absorption through the skin. Cyanide should be suspected in occupational or other smoke exposures (e.g., firefighting), industrial accidents, natural catastrophes, suicide and murder attempts, chemical warfare, and terrorism (whenever there are multiple casualties of an unclear etiology). Nonspecific and early signs of cyanide exposure (inhalation, ingestion, or absorption) include the following signs and symptoms: anxiety, vertigo, weakness, headache, tachypnea, nausea, dyspnea, vomiting, and tachycardia
2. High concentrations of cyanide will produce:
 - a. Markedly altered level of consciousness, including rapid collapse
 - b. Seizures
 - c. Respiratory depression or respiratory arrest
 - d. Cardiac dysrhythmias (other than sinus tachycardia)
3. The rapidity of onset is related to the severity of exposure (inhalation or ingestion) and may be dramatic with immediate effects that include early hypertension with subsequent hypotension, sudden cardiovascular collapse or seizure/coma, and rapid death

Exclusion Criteria

None noted

Patient Management

Assessment

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose the patient, and then re-cover the patient to assure retention of body heat
3. Assess vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) including temperature and pulse oximetry (which may not correlate with tissue oxygenation in cyanide/smoke exposure)
4. Attach a cardiac monitor and examine rhythm strip for arrhythmias
 - a. Perform a 12-lead EKG
5. Check blood glucose level
6. Monitor pulse oximetry and EtCO₂
7. Monitor patient for signs of hypoxia (pulse oximetry *less than 94%*) and respiratory decompensation regardless of pulse oximetry reading
8. Identify the specific agent of exposure, time of ingestion/inhalation, and quantity/timing of exposure
9. Obtain patient history including cardiovascular history and prescribed medication
10. Obtain other pertinent patient history
11. Perform physical exam

Treatment and Interventions

There is **no** widely available, rapid, confirmatory cyanide blood test. Many hospitals will not be able to rapidly assess cyanide levels. Therefore, treatment decisions must be made on the basis of clinical history and signs and symptoms of cyanide intoxication. For the patient with an appropriate history and manifesting one or more significant cyanide exposure signs or symptoms, treat with:

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

Patient Safety Considerations

1. In the event of multiple casualties, be sure to wear appropriate PPE during rescue evacuation from the toxic environment
2. If the patient ingests cyanide, it will react with the acids in the stomach generating hydrogen cyanide gas. Be sure to maximize air circulation in closed spaces (ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching
3. Do not use nitrites in conjunction with suspected carbon monoxide poisoning as it worsens the hemoglobin oxygen carrying capacity even more than carbon monoxide (CO)
4. Hydroxocobalamin is only agent safe for treatment of cyanide poisoning in pregnant patients

Notes/Educational Pearls

Key Considerations

1. Pulse oximetry accurately reflects serum levels of oxygen but does not accurately reflect tissue oxygen levels therefore should not be relied upon in possible cyanide and/or carbon monoxide toxicity
2. After hydroxocobalamin has been administered, pulse oximetry levels are no longer accurate and skin, tears, and urine will all turn red. This flushing should not be interpreted as an allergic reaction
3. If the patient ingests cyanide, it will react with the acids in the stomach generating hydrogen cyanide gas. Be sure to maximize air circulation in closed spaces (ambulance) as the patient's gastric contents may contain hydrogen cyanide gases when released with vomiting or belching
4. Amyl nitrite and sodium nitrite are no longer being used and no longer available in commercial kits

Pertinent Assessment Findings

Early and repeated assessment is essential

Quality Improvement

Associated NEMESIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemesis.org)

- 9914043—Exposure—Cyanide

Key Documentation Elements

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

Performance Measure

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

References

1. Amyl Nitrite—Medical Countermeasures Database. Chemm.nlm.nih.gov. <https://wwwn.cdc.gov/TSP/MMG/MMGDetails.aspx?mmgid=523&toxid=93>. Accessed
2. Bebartá VS, Tanen DA, Lairet J, Dixon PS, Valtier S, Bush A. Hydroxocobalamin and sodium thiosulfate versus sodium nitrite and sodium thiosulfate in the treatment of acute cyanide toxicity in a swine (*Sus scrota*) model. *Ann Emerg Med*. 2010; 55(4):345– 51

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

Beta Blocker Poisoning/Overdose

Patient Care Goals

1. Early airway protection is required as patients may have rapid mental status deterioration
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

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

Exclusion Criteria

None noted

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 EtCO₂ 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. If risk of rapid decreasing mental status, do not administer oral agent without adequately protecting the airway
2. Check blood glucose level on all patients but especially on pediatric patients as beta-blockers can cause hypoglycemia in pediatric population
3. Consider atropine sulfate for symptomatic bradycardia
 - a. **Adult:** Atropine 1 mg IV q 5 minutes to maximum of 3 mg
 - b. **Pediatric:** Atropine 0.02 mg/kg (0.5 mg maximum) q 5 minutes, maximum total dose 1 mg
4. Consider fluid challenge (20 mL/kg) for hypotension with associated bradycardia
5. Consider vasopressors after adequate fluid resuscitation (1–2 liters of crystalloid) for the hypotensive patient [See [Shock Guideline](#) for pediatric vs. adult dosing]
6. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
7. If seizure, treat per [Seizures Guideline](#)
8. If widened QRS (100 msec or greater), consider sodium bicarbonate 1–2 mEq/kg IV. This can be repeated as needed to narrow QRS

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

4. Propranolol crosses the blood brain barrier and can cause altered mental status, seizure, and widened QRS similar to TCA toxicity

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914215—Medical—Beta Blocker Poisoning/Overdose

Key Documentation Elements

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

Performance Measures

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

References

1. Boyd R, Ghosh A. Towards evidence-based emergency medicine: best BETs from the Manchester Royal Infirmary. Glucagon for the treatment of symptomatic beta blocker overdose. *Emerg Med J*. 2003;20 (3): 266–7
2. Hepherd G. Treatment of poisoning caused by beta-adrenergic and calcium- channel blockers. *Am J Health Syst Pharm*. 2006;63(19):1828–35
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw -Hill Education; 2015
4. Kerns W 2nd Management of beta-adrenergic blocker and calcium channel antagonist toxicity. *Emerg Med Clin N Am*. 2007 ;25(2):309–31
5. Marraffa JM, Cohen V, Howland MA. Antidotes for Toxicological Emergencies. *Am J Health Syst Pharm*. 2012 ;69(3):19 9–212
6. Review. Erratum in. *Am J Health Syst Pharm*. 2008;65(17):1592
7. Wax PM. b-Blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. *Clinical Toxicology*. 2005; 43:131–46

Bites and Envenomation

Patient Care Goals

Bites, stings, and envenomation can come from a variety of insects, marine, and terrestrial animals. Assure adequate ventilation, oxygenation, and correction of hypoperfusion. Provide pain control which also may include external interventions to reduce pain

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

Assessment

1. Assess ABCDs and if indicated expose and then cover to assure retention of body heat
2. Vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) 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 EtCO₂ for respiratory decompensation
6. Patient pertinent history
7. Patient physical with special consideration to area of envenomation especially crotalid bite

Treatment and Interventions

1. Consider an IV fluid bolus (normal saline or lactated Ringer's) 20 mL/kg up to 2 liters
2. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient [for adult vs. pediatric dosing, see [Shock Guideline](#)]
3. If seizure, treat per [Seizures Guideline](#)
4. Specific therapy for select bites, stings, or envenomation
 - a. Envenomations that are known to have antivenom readily available in the USA include black widow spider, bark scorpions, crotalid snakes (rattlesnake, copperhead) and coral snakes
 - i. For these envenomation, consider transport to a hospital that has access to antivenom, if feasible
5. Provide adequate analgesia per the [Pain Management including Procedural Sedation Guideline](#)

Patient Safety Considerations

1. Do **NOT**:
 - a. Apply tourniquets, tight Ace®/crepe bandage, or constricting bands above or below the site of the envenomation
 - b. Incise and/or suction wound to remove toxin
 - c. Apply cold packs or immerse the affected extremity in ice water (cryotherapy)
2. EMS clinicians should not try to capture the marine or terrestrial animal or insect
3. If the 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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

1. Aacharya RP, Gastmans C, Denier Y. Emergency department triage: an ethical analysis. *BMC Emerg Med.* 2011 ;11 :16
2. American College of Medical Toxicology, American Academy of Clinical Toxicology, American Association of Poison Control Centers, European Association of Poison Control Centres, International Society on Toxinology, Asia Pacific Association of Medical Toxicology. Pressure immobilization after North American crotalinae snake envenomation. *J Med Toxicol.* 2011;7 (4): 3 22–3
3. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition.* China: McGraw -Hill Education; 2015
4. Lavonas EJ, Ruha AM, Banner W, et al. Unified treatment algorithm for the management of crotaline snakebite in the United States: results of evidence-informed consensus workshop. *BMC Emerg Med.* 2011; 11:2
5. Prestwich H, Jenner R. Best evidence topic report. Treatment of jellyfish stings in UK coastal waters: vinegar or sodium bicarbonate? *Emerg Med J.* 2007;24 (9):6 64
6. Ward N. Evidence-based treatment of jellyfish stings in North America and Hawaii. *Ann Emerg Med.* 2012; 60(4):399–414.
7. Weinstein SA, Dart RC, Stables A. Envenomations: an overview of clinical toxinology for the primary care physician. *Am Fam Physician.* 2009;80(8):793–802

Calcium Channel Blocker Poisoning/Overdose

Patient Care Goals

1. Early airway protection is required as patients may have rapid mental status deterioration
2. Assure adequate ventilation, oxygenation, and correction of hypoperfusion

Patient Presentation

Calcium channel blockers interrupt the movement of calcium across cell membranes. Calcium channel blockers are used to manage hypertension, certain rate-related arrhythmias, prevent cerebral vasospasm, and angina pectoris. Patients may present with:

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

Inclusion Criteria

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

Exclusion Criteria

None noted

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 EtCO₂ for respiratory decompensation
6. Identify specific medication taken (noting immediate release vs. sustained release formulations), time of ingestion, and quantity
7. Pertinent cardiovascular history or other prescribed medications for underlying disease
8. Patient pertinent history
9. Physical exam

Treatment and Interventions

1. Consider atropine sulfate for symptomatic bradycardia
 - a. **Adult:** atropine 1 mg IV q 5 minutes to maximum of 3 mg
 - b. **Pediatric:** atropine 0.02 mg/kg (0.5 mg maximum) q 5 minutes, maximum total dose 1 mg
2. Consider calcium chloride
 - a. **Calcium** chloride
 - i. **Adult:** Calcium chloride 0.5–1 g slow IVP (50 mg/minute)
 - ii. **Pediatric:** Calcium chloride 20 mg/kg (0.2 mL/kg) slow IVP over 10 minutes (50 mg/mL) Maximum dose 1 g or 10 mL
3. Consider IV fluid bolus (normal saline or lactated Ringer's) 20 mL/kg up to 2 liters
4. Consider vasopressors after adequate fluid resuscitation for the hypotensive patient [See [Shock Guideline](#) for adult vs. pediatric dosing]
5. Consider transcutaneous pacing if refractory to initial pharmacologic interventions
6. If seizure, consider midazolam. [See [Seizures Guideline](#) for adult vs. pediatric dosing]

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914217—Medical—Calcium Channel Blocker Poisoning/Overdose

Key Documentation Elements

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

Performance Measures

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

References

1. Ashraf M, Chaudhary K, Nelson J, Thompson W. Massive overdose of sustained-release verapamil: a case report and review of literature. *Am J Med Sci.* 1995;310(6):258–63
2. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition.* China: McGraw-Hill Education; 2015
3. Levine M. Critical care management of verapamil and diltiazem overdose with a focus on vasopressors: a 25-year experience at a single center. *Ann Emerg Med.* 2013;62(3):252–8
4. Levine M, Boyer EW, Pozner CN, et al. Assessment of hyperglycemia after calcium channel blocker overdoses involving diltiazem or verapamil. *Crit Care Med.* 2007;35(9):2071–5
5. Levine M, Nikkanen H, Pallin DJ. The effects of intravenous calcium in patient are with digoxin toxicity. *J Emerg Med.* 2011;40(1):41–6
6. Marraffa JM, Cohen J, Howland MA. Antidotes for toxicological emergencies. *Am J Health Syst Pharm.* 2012;69(3):199–212

7. Olsen KR, Erdman AR, Woolf AD, et al. Calcium channel blocker ingestion: an evidence-based consensus guideline for out-of-hospital management. *Clin Toxicol (Phila)*. 2005;(7):797–822
8. Olsen K. What is the best treatment for acute calcium channel blocker overdose? *Ann Emerg Med*. 2013;62(3):259–61
9. Shepherd G. Treatment of poisoning caused by beta-adrenergic and calcium-channel blockers. *Am J Health Syst Pharm*. 2006;63(19):1828–35. Review. Erratum in: *Am J Health Syst Pharm*. 2008;65(17):1592
10. St-Onge M, Anseeuw K, Cantrell FL, et al. Experts consensus recommendations for the management of calcium channel blocker poisoning in adults. *Crit Care Med*. 2017;45(3):e306–15
11. St-Onge M, Dubé PA, Gosselin S, et al. Treatment for calcium channel blocker poisoning: a systematic review. *Clin Toxicol (Phila)*. 2014;52(9):926–44

Carbon Monoxide/Smoke Inhalation

Patient Care Goals

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

Patient Presentation

Carbon monoxide is a colorless, odorless gas that has a high affinity for binding to red cell hemoglobin, thus preventing the binding of oxygen to the hemoglobin, leading to tissue hypoxia (although pulse oximetry may appear to be normal). A significant reduction in oxygen delivery to tissues and organs occurs with carbon monoxide poisoning. Carbon monoxide is also a cellular toxin which can result in delayed or persistent neurologic sequelae in significant exposures. With any form of combustion (fire/smoke [e.g., propane, kerosene, or charcoal stoves or heaters], combustion engines [e.g., generators, lawn mowers, motor vehicles, home heating systems]), carbon monoxide will be generated. People in a fire may also be exposed to cyanide from the combustion of some synthetic materials. Cyanide toxicity may need to be considered in the hemodynamically unstable patient removed from a fire.

Inclusion Criteria

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

Exclusion Criteria

None noted

Patient Management

Assessment

1. Remove patient from toxic environment
2. Assess ABCDs and, if indicated, expose patient and recover to assure retention of body heat
3. Vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) temperature, and O₂ saturation, and EtCO₂ if available
4. Apply a cardiac monitor, examine rhythm strip for arrhythmias, and obtain a 12-lead EKG if available

5. Check blood glucose level
6. Monitor pulse oximetry and EtCO₂ for respiratory decompensation
7. Patient pertinent history
8. Patient physical examination

Treatment and Interventions

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

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. Pulse oximetry is inaccurate due to the carbon monoxide binding with hemoglobin
2. As maternal carboxyhemoglobin levels do not accurately reflect fetal carboxyhemoglobin levels, pregnant patients are more likely to be treated with hyperbaric oxygen
3. Consider [cyanide toxicity](#) if carbon monoxide poisoning is from a fire

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

- If using an environmental carbon monoxide detector, record the level detected
- Evidence of soot or burns around the face, nares, or pharynx
- Early and repeat assessment of patient's mental status and motor function are extremely useful in determining response to therapy and the need for hyperbaric therapy
- Accurate exposure history
 - Time of ingestion/exposure
 - Route of exposure
 - Quantity of medication or toxin taken (safely collect all possible mediations or agents)
 - Alcohol or other intoxicant taken
- Signs and symptoms of other patients encountered at same location if present

Performance Measures

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

References

1. Buckley NA, Juurlink DN, Isbister G, Bennett MH, Lavonas EJ. Hyperbaric oxygen for carbon monoxide poisoning. *Cochrane Database Syst Rev*. 2011 Apr 13;(4): CD002041
2. *Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department with Acute Carbon Monoxide Poisoning*. ACEP Clinical Policies Subcommittee (Writing Committees) on Carbon Monoxide Poisoning, American College of Emergency Physicians; *Ann Emerg Med*. 2017;69:98–107
3. Hampson N. Practice Recommendations: the diagnosis, management, and prevention of carbon monoxide poisoning. *Am J Respir Crit Care Med*. 2012;186(11):1095–101
4. High Flow Nasal Cannula is superior than CPAP in carbon monoxide poisoning
5. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw-Hill Education; 2015
6. Hampson NB. Pulse oximetry in severe carbon monoxide poisoning. *Chest*. 1998;114(4):1036–41
7. Jones A. Recent advances in the management of poisoning. *Ther Drug Monit*. 2002;24(1):150–5
8. Karaman K, Golcuk Y, Yildirim B, Acar E. Am J Emerg Med. 2020 Oct 2: S0735-6757(20)30879-2. doi: 10.1016/j.ajem.2020.09.084. Bahadır Caglar¹, Suha Serin², Gokhan Yilmaz³, Alper Torun⁴, Ismet Parlak The Impact of Treatment with Continuous Positive Airway Pressure on Acute Carbon Monoxide Poisoning *Prehosp Disaster Med*. 2019 Dec;34(6):588–591. doi: 10.1017/S1049023X19005028. Epub 2019 Oct 22. PMID: 31637993
9. Touger M, Birnbaum A, Wang J, Chou K, Pearson D, Bijur P. Performance of the RAD-57 pulse co-oximeter compared with standard laboratory carboxyhemoglobin measurement. *Ann Emerg Med*. 2010;56(4):382–8

Opioid Poisoning/Overdose

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

Patients exhibiting decreased mental status, and respiratory depression of all age groups with known or suspected opioid use or abuse. Lack of miosis (pinpoint pupils) is not a reliable sign for ruling out opioid exposure, although its presence is consistent with such exposure

Exclusion Criteria

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

Patient Management

1. Don the appropriate PPE. Note that opioids have minimal vapor pressure and do not pose an exposure risk to rescuers unless aerosolized or ingested
2. Therapeutic interventions to support the patient's airway, breathing, and circulation should be initiated prior to the administration of naloxone
3. If possible, identify specific medication taken (including immediate release versus sustained release) time of ingestion, and quantity
4. Obtain and document pertinent cardiovascular history or other prescribed medications for underlying disease
5. Be aware that unsecured hypodermic needles may be on scene if the intravenous route may have been used by the patient, and that there is a higher risk of needle sticks during the management of this patient population which may also have an increased incidence of blood-borne pathogens
6. Naloxone, an opioid antagonist, should be considered for administration to patients with respiratory depression in a confirmed or suspected opioid overdose
7. Naloxone administration via the intravenous route provides more predictable bioavailability and flexibility in dosing and titration
8. Naloxone administration via the intranasal or intramuscular routes or as a nebulized solution provide additional options of medication delivery
9. If naloxone was administered to the patient prior to the arrival of EMS, obtain the dose and route through which it was administered and, if possible, bring the devices containing the dispensed naloxone with the patient along with all other medications on scene

Assessment

1. Assess the patient's airway, breathing, circulation, and mental status
2. Support the patient's airway by positioning, oxygen administration, and ventilator assistance with a bag valve mask if necessary
3. Assess the patient for other etiologies of altered mental status including hypoxia (pulse oximetry less than 94%), hypoglycemia, hypotension, and traumatic head injury

4. Legally prescribed opioids are also manufactured as an adhesive patch for transdermal absorption, and if found, should be removed from the skin

Treatments and Interventions

1. Critical resuscitation (opening and/or maintaining the airway, provision of oxygen, ensuring adequate circulation) should be performed prior to naloxone administration
2. If the patient has respiratory depression from a confirmed or suspected opioid overdose, consider naloxone administration
 - a. The administration of the initial dose or subsequent doses can be incrementally titrated until respiratory depression is reversed
3. Naloxone can be administered via the IV, IM, IN, or ETT routes. As the ETT route is not very effective, its use should be reserved for dire circumstances with a patient in extremis with no other choice
 - a. **Adults:** The typical initial adult dose ranges between 0.4–2 mg IV, IM, up to a dose of 4 mg IN or 5 mg ETT
 - b. **Pediatrics:** The pediatric dose of naloxone is 0.1 mg/kg IV, IM, IN, or ETT
 - i. Maximum dose of 2 mg IV, IM, or ETT
 - ii. Maximum dose of 4 mg IN
4. Naloxone can be administered via the IV, IM, IN, or ETT routes. As the ETT route is not very effective, its use should be reserved for dire circumstances with a patient in extremis with no other choice
 - a. **Adults:** The typical initial adult dose ranges between 0.4–2 mg IV, IM, up to a dose of 4 mg IN or 5 mg ETT
 - b. **Pediatrics:** The pediatric dose of naloxone is 0.1 mg/kg IV, IM, IN, or ETT
 - i. Maximum dose of 2 mg IV, IM, or ETT
 - ii. Maximum dose of 4 mg IN
 - c. **Naloxone** provided to laypersons and non-medical first responders via public access programs or prescriptions may be provided as a pre-measured dose in an auto-injector or nasal spray or as a premeasured, but variable, dose and/or concentration in a needleless syringe with a mucosal atomization device (MAD) on the hub
 - d. Naloxone auto-injectors contain 0.4 mg/0.4 mL or 2 mg/0.4 mL
 - i. The cartons of naloxone auto-injectors prescribed to laypersons contain two naloxone auto-injectors and one trainer
 - e. Naloxone nasal spray is manufactured in a single-use bottle that contains 4 mg/0.1 mL
 - f. For the intranasal route when naloxone is administered via a needleless syringe (preferably with MAD on the hub), divide administration of the dose equally between the nostrils to a maximum of 1 mL per nostril
 - g. The administration of naloxone can be titrated until adequate respiratory effort is achieved if administered with a syringe IV, IM, IN, or ETT
 - h. Naloxone has no benefit in the treatment of cardiac arrest. Do not delay other interventions such as chest compressions and ventilations

5. High-potency opioids [See [Key Considerations](#)] may require higher and/or more frequently administered doses of naloxone to reverse respiratory depression and/or to maintain adequate respirations
6. Regardless of the doses of naloxone administered, airway management with provision of adequate oxygenation and ventilation is the primary goal in patients with confirmed or suspected opioid overdose

Patient Safety Considerations

1. Clinical duration of naloxone
 - a. The clinical opioid reversal effect of naloxone is limited and may end within an hour whereas opioids often have a duration of 4 hours or longer
 - b. Monitor the patient for recurrent respiratory depression and decreased mental status
2. Opioid withdrawal
 - a. Patients with altered mental status secondary to an opioid overdose may become agitated or violent following naloxone administration due to opioid withdrawal therefore the goal is to use the lowest dose as possible to avoid precipitating withdrawal
 - b. Be prepared for this potential scenario and take the appropriate measures in advance to ensure and maintain scene safety
3. EMS clinicians 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, managed by ventilation followed by naloxone
2. Some opioids have additional toxic effects (i.e., methadone can produce QT prolongation and tramadol can produce seizures)
3. Overuse and abuse of prescribed and illegal opioids has led to an increase in accidental and intentional opioid overdoses
4. 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. High-potency opioids:
 - a. Fentanyl is 50–100 times more potent than morphine. It is legally manufactured in an injectable and oral liquid, tablet, and transdermal (worn as a patch) forms however

much of the fentanyl adulterating the heroin supply are illegal fentanyl analogs such as acetyl fentanyl

- b. Carfentanil is 10,000 times more potent than morphine
 - i. It is legally manufactured in a liquid form; however, a powder or tablet is the most common form of this drug that is illegally produced
 - ii. In the concentration in which it is legally manufactured (3 mg/mL), an intramuscular dose of 2 mL of carfentanil will sedate an elephant
 - c. Synthetic opioids (i.e., W-18 are 10,000 times more potent than morphine) many synthetic opioids are not detectable by routine toxicology screening assays
6. The IN route has the benefit of no risk of needle stick to the clinician
7. Patients with opioid overdose from fentanyl or fentanyl analogs may rapidly exhibit chest wall rigidity and require positive end expiratory pressure (PEEP), in addition to multiple and/or larger doses of naloxone, to achieve adequate ventilation

Pertinent Assessment Findings

1. The primary clinical indication for the use of opioid medications is analgesia
2. In the opioid overdose scenario, signs and symptoms include:
 - a. Miosis (pinpoint pupils)
 - b. Respiratory depression
 - c. Decreased mental status
3. Additional assessment precautions:
 - a. The risk of respiratory arrest with subsequent cardiac arrest from an opioid overdose as well as hypoxia (pulse oximetry less than 94%), hypercarbia, and aspiration may be increased when other substances such as alcohol, benzodiazepines, or other medications have also been taken by the patient
 - b. **Pediatric Considerations:** The signs and symptoms of an opioid overdose may also be seen in newborns who have been delivered from a mother with recent or chronic opioid use. Neonates who have been administered naloxone for respiratory depression due to presumed intrauterine opioid exposure may be narcotic dependent and should be monitored closely for seizures

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914219—Medical—Opioid Poisoning/Overdose

Key Documentation Elements

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

Performance Measures

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

References

1. American College of Medical Toxicology and the American Academy of Clinical Toxicology, *Preventing Occupational Fentanyl and Fentanyl Analog Exposure to Emergency Responders*, https://www.acmt.net/_Library/Positions/Fentanyl_PPE_Emergency_Responders_.pdf. Accessed
2. Burns G, DeRienz RT, Baker DD, Casavant M, Spiller HA. Could chest wall rigidity be a factor in rapid death from illicit fentanyl abuse? *Clin Toxicol*. 2016;54(5):420–3
3. Drugs@FDA: FDA Approved Drug Products. FDA.gov. <https://www.accessdata.fda.gov/scripts/cder/daf/>. New Drug Application (NDA) #208411. Accessed
4. Drugs@FDA: FDA Approved Drug Products. FDA.gov. <https://www.accessdata.fda.gov/scripts/cder/daf/>. New Drug Application (NDA) #209862. Accessed
5. *Fentanyl: Preventing Occupational Exposure to Emergency Responders*. Atlanta, GA: Centers for Disease Control and Prevention, the National Institute for Occupational Safety and Health; Updated November 28, 2016
6. Hoffman RS, Howland MA, Lewin NA, Nelson LS, Goldfrank LR. *Goldfrank's Toxicologic Emergencies, 10th Edition*. China: McGraw-Hill Education; 2015
7. Marx JA et al. *Rosen's Emergency Medicine: Concepts and Clinical Practice*, 2014 2052–2056
8. Nelson, LS et al. *Goldfrank's Toxicologic Emergencies*, 2014, 559–578
9. Title 21 United States Code (USC) Controlled Substance Act, Section 812. Springfield, VA: US Department of Justice, Drug Enforcement Administration

Airway Respiratory Irritants

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Signs and Symptoms

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

- g. Methyl bromide
 - h. Sodium azide
 - i. Sulfur dioxide
5. Intermediate water solubility (bronchus and bronchiole, particle size 5–10 micrometers)
- a. Chlorine
6. Low water solubility/less irritating (alveolar, particle size less than 5 micrometers)
- a. Cadmium fume
 - b. Fluorine
 - c. Hydrogen sulfide (rotten egg odor; olfactory fatigue)
 - d. Mercury fume
 - e. Mustard gas (also delayed blistering skin manifestations)
 - f. Nickel carbonyl
 - g. Ozone
 - h. Phosgene
7. Asphyxia agents (two categories)
- a. Oxygen deprivation below 19.5% oxygen atmosphere (“simple asphyxiants”) *Any gas that reduces oxygen fraction or displaces oxygen from the inspired air*
 - i. Argon
 - ii. Carbon dioxide
 - iii. Ethane
 - iv. Helium
 - v. Methane
 - vi. Natural gas (e.g., heptane, propane)
 - vii. Nitrogen
 - viii. Nitrogen dioxide (delayed symptom onset)
 - b. Chemical interfering with oxygen delivery of utilization (“chemical asphyxiants”)
 - i. Carbon monoxide [See [Carbon Monoxide/Smoke Inhalation Guideline](#)]
 - ii. Cyanide [See [Cyanide Exposure Guideline](#)]
 - iii. Hydrogen sulfide
8. Inhalants of abuse
- a. These agents or substances are a diverse class of substances that include volatile solvents, aerosols, and gases
 - b. These chemicals are intentionally inhaled to produce a state that resembles alcohol intoxication with initial excitation, drowsiness, lightheadedness, and agitation
 - c. Users of these inhaled agents are often called huffers, sniffers, baggers, or snorters
 - i. These individuals often present after inhaling an aerosol or gas with a loss of consciousness and the presence of the aerosol can or residue/paint around or in the mouth, nose, and oral pharynx
 - d. Common household products that are used as inhalants of abuse
 - i. Volatile solvents
 - 1. Paint remover
 - 2. Degreasers
 - 3. Dry-cleaning fluids
 - 4. Gasoline

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

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

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

Patient Management

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

Assessment

1. Make sure the scene is safe as many gases are heavier than air and will build up in low lying areas. This is especially true of hydrogen sulfide and it's "knock down" effect of the initial unprotected responder and subsequent casualties associated with unprotected rescuers attempting to save the first downed responder
2. Consider BSI or appropriate PPE
3. Remove patient from toxic environment
4. Decontaminate
5. Assess ABCD and if indicated, expose the patient, and then cover the patient to assure retention of body heat
6. Vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) that include temperature
7. Place cardiac monitor and examine rhythm strip for arrhythmia potentials (consider 12-lead EKG)
8. Check blood glucose Level

9. Monitor pulse oximetry and EtCO₂ for respiratory decompensation
10. Perform carboxyhemoglobin and cyanide device assessment, if available
11. Identify specific suspected agent if possible
12. Pertinent cardiovascular history or other prescribed medications for underlying disease
13. Patient pertinent history
14. Patient physical examination

Treatment and Interventions

1. Assure a patent airway
2. Administer (humidified if available) oxygen and if hypoventilation, toxic inhalation, or desaturation noted, support breathing
 - a. Maintain the airway and assess for airway burns, stridor, or airway edema and if indicated, perform intubation early (recommendation to avoid supraglottic airways—cricothyrotomy may be required in rare severe cases)
 - b. Noninvasive ventilation techniques
 - i. Use continuous CPAP, BiPAP, intermittent positive pressure breathing (IPPB), HFNC, and/or bilevel nasal CPAP for severe respiratory distress or impending respiratory failure
 - ii. Use bag-valve-mask (BVM) ventilation in the setting of hypoventilation, respiratory failure, or arrest
3. While albuterol 2.5 mg nebulized is usually sufficient for mild wheezing without clinical distress, albuterol 5 mg nebulized (or 6 puffs metered dose inhaler) should be administered to all patients in respiratory distress with signs of bronchospasm either by basic life support BLS or ALS clinicians. This medication should be repeated at this dose with unlimited frequency for ongoing distress
4. Duoneb 3 mL SVN
5. Initiate IV access for infusion of lactated Ringer's or normal saline and obtain blood samples in effort to record pre-treatment levels, e.g., via point-of-care testing, associated with EMS management (e.g., glucose, lactate, cyanide)
6. Fluid bolus (20 mL/kg) if evidence of hypoperfusion
7. If the patient is experiencing significant pain, see [Pain Management including Procedural Sedation](#).
8. Eye irrigation early
9. Treat topical chemical burns [See appropriate [Toxins and Environmental Section](#) guideline(s)]
10. In severe respiratory irritation, in particular hydrogen sulfide, with altered mental status and no improvement with removal from the toxic environment, administer oxygen (humidified if available) as appropriate with a target of achieving 94–98% saturation. Consider consultation for transfer to a tertiary care hospital. If carbon monoxide is a confirmed or suspected element of the inhalant, a facility with hyperbaric oxygen capabilities is preferred

Medication Administration

1. If wheezing is present, consider administering inhaled albuterol (2.5–5 mg) as nebulized, or four to eight puffs metered dose inhaler
2. Consider a Duoneb 3 mL SVN once

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

1. Ainslie G. Inhalational injuries produced by smoke and nitrogen dioxide. *Respir Med*. 1993; 87:169–74
2. Arwood R, Hammond J, Ward GG. Ammonia inhalation. *J Trauma*. 1985; 25:444–7
3. Baydala L, Canadian Paediatric Society, First Nations, Inuit and Métis Health Committee. Inhalant Abuse. *Paediatr Child Health*. 2010;15(7):443–8
4. Chenuel B, Sonobe T, Haouzi P. Effects of infusion of human methemoglobin solution following hydrogen sulfide poisoning. *Clin Toxicol (Phila)*. 2015;53(2):93–101
5. Chlorine Toxicity. Emedicine.medscape.com. <http://www.emedicine.com/emerg/topic851.htm> Updated Dec 11, 2015. Accessed
6. D'Alessandro A, Kuschner W, Wong H, et al. Exaggerated responses to chlorine inhalation among persons with nonspecific airway hyperreactivity. *Chest*. 1996; 109:331–7

7. Douglas WW, Hepper NGG, Colby TV. Silo-filler's disease. *Mayo Clin Proc.* 1989; 64:291–304
8. Fuller DC, Suruda AJ. Occupationally related hydrogen sulfide deaths in the United States from 1984 to 1994. *J Occup Environ Med.* 2000;42(9):939–42
9. Gorguner M, Akgun M. Acute Inhalation Injury. *Eurasian J Med.* 2010;42(1):28–35
10. Guloglu C, Kara IH, Erten PG. Acute accidental exposure to chlorine gas in the Southeast of Turkey: a study of 106 cases. *Environ Res.* 2002; 88:89–93
11. Haouzi P, Chenuel B, Sonobe T. High-dose hydroxocobalamin administered after H₂S exposure counteracts sulfide poisoning induced cardiac depression in sheep. *Clin Toxicol (Phila).* 2015 Jan;51(1): 28–36
12. Hydrogen Sulfide Toxicity. Emedicine.medcape.com. <http://www.emedicine.com/emerg/topic258.htm> Updated December 29, 2016. Accessed
13. Issley S, Lang E. Ammonia Toxicity. Emedicine.medscape.com. <http://www.emedicine.com/emerg/topic846.htm> Updated December 29, 2015. Accessed
14. Leduc D, Gris G, Lheureux P, et al. Acute and long-term respiratory damage following inhalation of ammonia. *Thorax.* 1992; 47:755–7
15. Lim SC, Yang JY, Jang AS, et al. Acute lung injury after phosgene inhalation. *Korean J Intern Med.* 1996; 11:87–92
16. Mowry JB, Spyker DA, Brooks DE, Zimmerman A, Schauben JL. 2015 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 33rd Annual Report. *Clin Toxicol (Phila).* 2016;(10):924–1109
17. Newman LS, Gottschall EB. Toxic Inhalational Lung Injury. In: Albert RK, Spiro SG, Jett JR, ed. *Clinical Respiratory Medicine. 2nd Edition.* Philadelphia, PA: Mosby; 2004:759–64
18. Noltkamper D, Burgher SW. Toxicity Phosgene 2006. Available at: <https://www.ncbi.nlm.nih.gov/books/NBK537213/>. Accessed
19. Phosgene Toxicity. Emedicine.medscape.com. <https://www.ncbi.nlm.nih.gov/books/NBK537213/>. Accessed
20. Reiffenstein RJ, Hulbert WC, Roth SH. Toxicology of hydrogen sulfide. *Ann Rev Pharmacol Toxicol.* 1992; 32:109–34
21. Sams RN, Carver HW 2nd, Catanese C, Gilson T. Suicide with hydrogen sulfide. *Am J Forensic Med Pathol.* 2013;34(2):81–2
22. Truscott A. Suicide fad threatens neighbors, rescuers. *CMAJ.* 2008 Aug 12;179(4):312–3
23. Weinberger B, Laskin DL, Heck DE, et al. The toxicology of inhaled nitric oxide. *Toxicol Sci.* 2001; 59:5–16

Riot Control Agents

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

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

Patient Management

Assessment

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

Treatment and Interventions

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

Patient Safety Considerations

1. Toxicity is related to duration of exposure and concentration of agent used (exposure in nonventilated space)
2. Patients with preexisting pulmonary conditions (e.g., asthma, COPD) may be prone to more severe respiratory effects
3. Traumatic injury may result when exposed individuals are in proximity to the device used to disperse the riot control agent (e.g., hose/stream under pressure, riot control agent projectile, grenade)

Notes/Educational Pearls

Key Considerations

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

Pertinent Assessment Findings

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

Quality Improvement

Key Documentation Elements

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

Performance Measures

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

References

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

Hyperthermia/Heat Exposure

Definitions

1. **Heat Cramps:** are muscle cramps usually in the legs and abdominal wall. Patient temperature is normal
2. **Heat Exhaustion:** has both salt and water depletion usually of a gradual onset. As it progresses tachycardia, hypotension, elevated temperature, and very painful cramps occur. Symptoms of headache, nausea, and vomiting occur. Heat exhaustion can progress to heat stroke
3. **Heat Stroke:** occurs when the cooling mechanism of the body ceases due to temperature overload and/or electrolyte imbalances. Patient core temperature is usually greater than 104°F. When no thermometer is available, it is distinguished from heat exhaustion by altered level of consciousness, seizures, or coma
4. **Heat Syncope:** transient loss of consciousness with spontaneous return to normal mentation, attributable to heat exposure

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

1. Heat cramps
2. Heat exhaustion
3. Heat stroke
4. Heat syncope
5. Heat edema
6. Stimulant drug abuse
7. Delirium with agitated behavior [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]

Exclusion Criteria

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

Patient Management

Assessment

1. Patient Assessment:
 - a. Age
 - b. Oral intake
 - c. Medications
 - d. Alcohol
 - e. Illicit drugs
 - f. Overdose
 - g. Withdrawal risk

2. Environmental Assessment:
 - a. Ambient temperature and humidity
 - b. Exertion level
 - c. Length of time at risk
 - d. Attire (clothing worn)
 - e. Confined space
 - i. **Pediatric Considerations:** Children left in cars who show signs of altered mental status and elevated body temperature should be presumed to have hyperthermia
3. Associated Symptoms:
 - a. Cramps
 - b. Headache
 - c. Orthostatic symptoms
 - d. Nausea
 - e. Weakness
 - f. Mental status changes, including
 - i. Confusion
 - ii. Coma
 - iii. Seizures
 - iv. Psychosis
4. Vital Signs:
 - a. Core temperature: usually 104°F or greater (if thermometer available)
 - b. Skin:
 - i. Flushed and hot
 - ii. Dry or sweaty
 - iii. Signs of first or second degree burns from sun exposure
 - c. Other signs of poor perfusion/shock

Treatment and Interventions

1. Move victim to a cool area and shield from the sun or any external heat source
2. Remove as much clothing as is practical and loosen any restrictive garments
3. If alert and oriented, give small sips of cool liquids
4. If altered mental status, check blood glucose level
5. Manage airway as indicated
6. Place on cardiac monitor and record ongoing vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment)
7. If core temperature is greater than 104°F (40°C) or if altered mental status is present, begin active cooling
8. Cooling efforts should continue until the patient's temperature is less than 102.2°F (39°C) or, if continuous temperature monitoring is not available, until the patient demonstrates improvement in mental status
9. Establish IV access for patients suffering from heat stroke—give cool fluids at 20 mL/kg boluses and reduce to 10 mL/kg/hr boluses when vitals are stable
10. Monitor for arrhythmia and cardiovascular collapse [See [Cardiovascular Section](#)]
11. Treat seizures, per the [Seizures Guideline](#)

12. All patients suffering from life threatening heat illness (including heat stroke) should be transported to the hospital

Patient Safety Considerations

Consider use of physical securing devices [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)] to protect vascular access sites.

Notes/Educational Pearls

Key Considerations

1. Patients at risk for heat emergencies include neonates, infants, geriatric patients, and patients with mental illness
2. Contributory risk factors may come from:
 - a. Prescription and over-the-counter herbal supplements
 - b. Cold medications
 - c. Heart medications
 - d. Diuretics
 - e. Psychiatric medications
 - f. Drug abuse
 - g. Accidental or intentional drug overdose
3. Heat exposure can occur either due to increased environmental temperatures or prolonged exercise or a combination of both:
 - a. Environments with temperature *greater than* 90°F and humidity *greater than* 60% present the most risk
4. Heat stroke is associated with cardiac arrhythmias independent of drug ingestion/overdose. Heat stroke has also been associated with cerebral edema
5. For patients with signs and symptoms of heat stroke, rapid cooling takes priority over other interventions (e.g., cardiac monitoring, IV access)
6. Do not forget to look for other causes of altered mental status such as low blood glucose level, or, in the proper circumstances (i.e., endurance exercise events), consider exercise associated hyponatremia (EAH), especially in the patient with altered mental status, normal blood glucose, and normal temperature
7. *Controversy*: shivering may occur while treating heat stroke:
 - a. It is uncertain how harmful shivering is to heat stroke patients
 - b. Cooling should be continued until the above temperature and mental status goals are met
8. Hyperthermia not from environmental factors has a differential that includes the following:
 - a. Fever and delirium
 - b. Hyperthyroid storm
 - c. Delirium tremens (DTs)
 - d. CNS lesion or tumor
 - e. Adverse drug event: neuroleptic malignant syndrome, malignant hyperthermia
 - f. Mental status changes without hyperthermia in the correct circumstances could be exercise associated hyponatremia

9. There is no evidence supporting EMS obtaining orthostatic vital signs as a clinical indicator

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

- Blood glucose level obtained
- Fluids given for hypotension
- Attempts to reduce core temperature
- Time from arrival at scene to when active cooling by immersion is started
- All decompensations during EMS care reviewed
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - Hypoglycemia—01: Treatment Administered for Hypoglycemia.
- Measure of patients who received treatment to correct their hypoglycemia
 - Pediatrics—03: Documentation of Estimated Weight in Kilograms

References

1. Belval, L., Casa, D., Adams, W., Chiampas, G., Holschen, J., Hosokawa, Y., Jardine, J., Kane, S., Labotz, M., Lemieux, R., McClaine, K., Nye, N., O'Connor, F., Prine, B., Raukar, N., Smith, M. and Stearns, R., 2022. *Consensus Statement—Prehospital Care of Exertional Heat Stroke*.
2. Bouchama A, Knochel JP. Heat Stroke. *NEJM*. 2002;346(25):1978–88
3. Bouchama A, Dehbi M, Chaves-Carballo E. Cooling and hemodynamic management in heatstroke: practical recommendation. *Crit Care Lond Engl*. 2007;11(3): R54
4. Brugger H, Bouzat P, Pasquier M, Mair P, Fieler J, Darocha T, Blancher M, de Riedmatten M, Falk M, Paal P, Strapazzon G, Zafren K, Brodmann Maeder M. Cut-off values of serum potassium and core temperature at hospital admission for extracorporeal rewarming of avalanche victims in cardiac arrest: A retrospective multi-centre study. *Resuscitation*. 2019;139:222–229. doi: 10.1016/j.resuscitation.2019.04.025
5. Epstein, Y., Yanovich, R. “Heatstroke” *N Engl J Med* 2019;380:2449-59. <https://www.nejm.org/doi/pdf/10.1056/NEJMra1810762?articleTools=true>. Accessed
6. Heled Y, Rav-Acha M, Shani Y et al. The “Golden Hour” for heatstroke treatment. *Mil Med*, 2004 169(3):184–186
7. Lipman G, Eifling K, Ellis MA, et. al. Wilderness Medical Society practice guidelines for the prevention and treatment of heat-related illness. *Wilderness Environ Med*. 2013;24(4):351–61
8. Luhning, K. E., Butts, C. L., Smith, C. R., Bonacci, J. A., Ylanan, R. C., Ganio, M. S., & McDermott, B. P. (2016). Cooling Effectiveness of a Modified Cold-Water Immersion Method After Exercise-Induced Hyperthermia. *Journal of athletic training*, 51(11), 946-951. <https://doi.org/10.4085/1062-6050-51.12.07>. Accessed
9. Paal P, Gordon L, Strapazzon G, Brodmann Maeder M, Putzer G, Walpoth B, Wanscher M, Brown D, Holzer M, Broessner G, Brugger H. Accidental hypothermia- an update: The content of this review is endorsed by the International Commission for Mountain Emergency Medicine (ICAR MEDCOM). *Scand J Trauma Resusc Emerg Med*. 2016;24:111. doi: 10.1186/s13049-016-0303-7
10. ROBERT GAUER, MD, BRYCE K. MEYERS, DO, MPH, Heat Related Illnesses. *Am Fam Physician*. 2019 Apr 15;99(8):482–489
11. The Futility of Orthostatic Measurements. Lifeinthefastlane.com. <https://litfl.com/the-futility-of-orthostatic-measurements/>. Published January 14, 2014. Accessed
12. Vicario SJ, Okabajue R, Haltom T. Rapid cooling in classic heatstroke treatment: effect on mortality rates. *Am J Emerg Med*. 1986;4(5):394–8

Hypothermia/Cold Exposure

Patient Care Goals

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

Patient Presentation

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

Inclusion Criteria

Patients suffering systemic or localized cold injuries.

Exclusion Criteria

1. Patients without cold exposure
- OR**
2. Patients with cold exposure but no symptoms referable to hypothermia or frostbite

Patient Management

Assessment

1. Patient assessment should begin with attention to the primary survey, looking for evidence of circulatory collapse and ensuring effective respirations:
 - a. The patient suffering from moderate or severe hypothermia may have severe alterations in vital signs including weak and extremely slow pulses, profound hypotension, and decreased respirations
 - b. The rescuer may need to evaluate the hypothermic patient for a pulse for longer than the normothermic patient (up to 60 seconds)
2. History: along with standard SAMPLE—type history, additional patient history should include:
 - a. Attention to any associated injury or illness
 - b. Duration of cold exposure
 - c. Ambient temperature
 - d. Treatments initiated before EMS arrival

3. There are several means to categorize the severity of hypothermia based on either core body temperature readings or clinical evaluation. If possible and reliable, EMS clinicians should perform core body temperature measurements and categorize patients into one of the three follow levels of hypothermia:
 - a. **Mild:** 32.1°–35°C/89.8°–95°F
 - b. **Moderate:** 28.1°–32°C/82.5°–89.7°F
 - c. **Severe:** 24°–28°C/75.2°–82.4°F
 - d. **Profound:** less than 24°C (75.2°F)
4. Equally important is the patient's clinical presentation and the signs or symptoms the patient is experiencing—the above temperature-based categorization should be balanced against these clinical findings:
 - a. **Mild:** vital signs not depressed; normal mental status; shivering is preserved; body maintains the ability to attempt 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 30°–31°C (86°–87.8°F), and general slowing of bodily functions; the body loses the ability to thermo-regulate

Treatment and Interventions

1. Maintain patient and rescuer safety
2. Manage airway per the [Airway Management Guideline](#)
3. Mild hypothermia:
 - a. Remove the patient from the environment and prevent further heat loss by removing wet clothes and drying skin, insulate from the ground, shelter the patient from wind and wet conditions, and insulate the patient with dry clothing or a hypothermia wrap/blanket. Cover the patient with a vapor barrier and, if available, move the patient to a warm environment
 - b. Hypothermic patients have decreased oxygen needs and may not require supplemental oxygen
 - i. If oxygen is deemed necessary, it should be warmed to a maximum temperature between 40°–42°C (104°–108°F) 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](#)
 - g. Consider IV access
 - i. Indications for IV access and IV fluids in the mildly hypothermic patient are similar to those of the nonhypothermic patient

- ii. IV fluids, if administered, should be warmed, ideally to 42°C (107.6°F)
 - iii. Bolus therapy is preferable to continuous drip
- h. If alterations in mental status, consider measuring blood glucose and treat as indicated (treat per [Hypoglycemia Guideline](#) or [Hyperglycemia Guideline](#)) and assess for other causes of alterations of mentation
- i. Transport to a hospital capable of rewarming the patient
- 4. Moderate or severe hypothermia:
 - a. Perform ABCs (Airway, Breathing, Circulation), pulse checks for patients suffering hypothermia should be performed for 60 seconds, and obtain core temperature, if possible, for patients exhibiting signs or symptoms of moderate/severe hypothermia
 - i. Core temperatures can be measured by esophageal probe, if one is available, the patient's airway is secured, and the clinician has been trained in its insertion and use.
 - ii. Rectal temperatures may also be used, with caution to avoid worsening the hypothermia by undressing the patient (e.g., done in a warm environment such as a heated ambulance)
 - iii. If neither esophageal nor rectal thermometers are available, an epitympanic field thermometer with an isolating ear cap may be used, but is generally less accurate
 - b. Manage airway as needed
 - i. Care must be taken not to hyperventilate the patient as hypocarbia may reduce the threshold for ventricular fibrillation in the cold patient
 - ii. Indications and contraindications for advanced airway devices are similar in the hypothermic patient as in the normothermic patient
 - c. Prevent further heat loss by removing the patient from the environment and removing wet clothes and drying skin, insulate from the ground, shelter the patient from wind and wet conditions, and insulate the patient with dry clothing or a hypothermia wrap/blanket. Cover the patient with a vapor barrier and, if available, move the patient to a warm environment
 - d. Initiate field-rewarming methods such as placement of large heat packs or heat blankets (chemical or electric if feasible) to the anterior chest or wrapped around the patient's thorax if large enough
 - i. Chemical or electrical heat sources should never be applied directly to the skin
 - ii. Use a barrier between the skin and heat source to prevent burns
 - iii. Forced air warming blankets (e.g., Bair Hugger®) can be an effective field rewarming method if available
 - e. Handle the patient gently
 - i. Attempt to keep the patient in the horizontal position, especially limiting motion of the extremities to avoid increasing return of cold blood to the heart
 - ii. Once in a warm environment, clothing should be cut off (rather than removed by manipulating the extremities)
 - iii. Move the patient only when necessary, such as to remove the patient from the elements

- f. Apply cardiac monitor or AED if available
 - g. Establish IV and provide warmed isotonic crystalloid bolus. Repeat as necessary
 - h. If alterations in mental status, consider measuring blood glucose and treat as indicated (treat per [Hypoglycemia Guideline](#) or [Hyperglycemia Guideline](#)) and assess for other causes of alterations of mentation
 - i. Transport as soon as possible to a hospital capable of resuscitation. If cardiac arrest develops, consider transport to a center capable of extracorporeal circulation (ECMO) or cardiopulmonary bypass (if feasible)
 - j. Warm the patient compartment of the ambulance to at least 24°C (75.2°F) during transport
5. Frost bite:
- a. If the patient has evidence of frostbite, and ambulation/travel is necessary for evacuation or safety, avoid rewarming of extremities until definitive treatment is possible. Additive injury occurs when the area of frostbite is rewarmed then inadvertently refrozen. Only initiate rewarming if refreezing is absolutely preventable
 - i. If rewarming is feasible and refreezing can be prevented use circulating warm water (37°–39°C/98.6°–102°F) to affected body part, thaw injury completely. If warm water is not available, rewarm frostbitten parts by contact with nonaffected body surfaces. **Do not rub** or cause physical trauma
 - ii. After rewarming, cover injured parts with loose sterile dressing. If blisters are causing significant pain, and the clinician is so trained, these may be aspirated, however, should not be deroofed. Do not allow injury to refreeze. Treat per the [Pain Management including Procedural Sedation Guideline](#)

Patient Safety Considerations

1. Given the additive effects of additional cold stress, the patient should be removed from the cold environment as soon as operationally feasible
2. In patients suffering from moderate to severe hypothermia, it is critical to not allow these patients to stand or exercise as this may cause circulatory collapse
3. Devices that self-generate heat (e.g., heat packs) that are being utilized during the rewarming process should be wrapped in a barrier to avoid direct contact with the skin and to prevent burns. Available evidence suggests that heat packs with peak temperatures above 45°C (113°F) are most likely to cause burns. In patients who are unresponsive, or unable to recognize a developing injury, please check the area in which the heating pad is placed regularly to ensure no tissue damage occurs

Notes/Educational Pearls

Key Considerations

Considerations in cardiac arrest

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

2. Fixed and dilated pupils, apparent rigor mortis, and dependent lividity may not be contraindication for resuscitation in the severely hypothermic patient
3. The mainstay of therapy in severe hypothermia and cardiac arrest should be effective chest compressions and attempts at rewarming. Chest compressions should be provided at the same rate as in normothermic patients
4. The temperature at which defibrillation should first be attempted in the severely hypothermic cardiac arrest victim and the number of defibrillation attempts is unclear. There are different approaches regarding resuscitation of the hypothermic arrest patient:
 - a. Per the American Heart Association (AHA), if the patient has a shockable rhythm (VF/VT), defibrillation should be attempted. It is reasonable to continue defibrillation attempts per AHA protocols concurrently with rewarming strategies
 - b. The state of Alaska's 2014 guidance on management of hypothermic patients in cardiac arrest advises that defibrillation should be attempted once, followed by 2 minutes of chest compressions, then rhythm and pulse checks:
 - i. If defibrillation is unsuccessful and the patient's core temperature is less than 30°C (86°F), do not make further attempts at defibrillation until the core temperature has increased to greater than 30°C (86°F)
 - ii. Continue CPR and attempt to rewarm the patient
 - c. An alternate strategy, per the Wilderness Medical Society's accidental hypothermia guideline, suggests that if the patient's core temperature is below 30°C (86°F), attempt defibrillation once, then wait until the patient has been rewarmed at least 1°–2°C or to 30°C (86°F) before attempting additional shocks. It is noted that the likelihood of successful defibrillation increases with every one-degree increase in temperature
 - d. If defibrillation is unsuccessful and the patient's core temperature is greater than 30°C (86°F), follow guidelines for normothermic patients
 - e. If available monitors reveal asystole, CPR alone is the mainstay of therapy
 - f. If monitoring reveals an organized rhythm (other than VF or VT) and no pulses are detected, do not start CPR, but continue to monitor:
 - i. While this may represent pulseless electrical activity (PEA), this may also represent situations in which the patient's pulses are not detectable but remain effective due to decreased metabolic needs
 - ii. In the case of PEA, the rhythm will deteriorate rapidly to asystole, in which case, CPR should be initiated
 - iii. Given the potential to cause VF with chest compressions, the Alaska guidance offers that it is better to maintain effective cardiac activity than to start CPR and cause VF
5. Manage the airway per standard care in cardiac arrest victims [See [Cardiac Arrest Guideline](#)]:
 - a. In the absence of advanced airways, ventilate the patient at the same rate as a normothermic patient
 - b. If the patient has an advanced airway, ventilate at half the rate recommended for a normothermic patient to prevent hyperventilation. If EtCO₂ is available, ventilate to maintain normal EtCO₂ levels

6. There is little evidence to guide use of medications in severe hypothermia with cardiac arrest, however 2010 AHA updates to advanced cardiac life support recommend use of vasopressors according to standard ACLS protocols while the 2014 Alaska guidelines and the Wilderness Medical Society's accidental hypothermia guideline for the management of hypothermic patients advises medications should be withheld until the patient's core temperature is greater than 30°C (86°F):
 - a. Above 30°C (86°F), intervals between medication provision should be doubled until the patient reaches 35°C (95°F), at which time, normal medication intervals may be adopted
7. Upon ROSC, treat per [Adult Post-ROSC Care Guideline](#)
8. Patients with severe hypothermia and arrest may benefit from resuscitation even after prolonged downtime, and survival with intact neurologic function has been observed even after prolonged resuscitation:
 - a. Patients should not be considered deceased until rewarming has been attempted
9. If a hypothermic patient clearly suffered cardiac arrest and subsequently became hypothermic afterward with prolonged down time between arrest and rescue, there is no rationale for initiating resuscitation and warming the patient

Pertinent Assessment Findings

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

- Patient core temperature and means of measurement (when available)
- Presence of cardiac dysrhythmias
- Documentation of associated trauma (when present)
- Blood glucose level obtained
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - Hypoglycemia—01: Treatment Administered for Hypoglycemia
 - Trauma—01: Pain Assessment of Injured Patients

References

1. *Alaska Emergency Medical Services. State of Alaska Cold Injury Guidelines—2014.* Anchorage, AK: Department of Health and Social Services, Division of Public Health; July 15, 2014
2. Brown DJ, Brugger H, Boyd J, Paal P. Accidental Hypothermia. *NEJM*. 2012;367(2):1930-8
3. Casa DJ, DeMartini JK, Bergeron MF, Csillan D, Eichner ER, Lopez RM, Ferrara MS, Miller KC, O'Connor F, Sawka MN, Yeargin SW. National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses. *J Athl Train*. 2015 Sep;50(9):986-1000. doi: 10.4085/1062-6050-50.9.07. Erratum in: *J Athl Train*. 2017 Apr;52(4):401. PMID: 26381473; PMCID: PMC4639891
4. Dow, Jennifer MD, MHA Giesbrecht, Gordon G. PhD Danzl, Daniel F. MD Zafren, Ken MD Bennett, Brad L. PhD Grissom, Colin K. MD <https://pubmed.ncbi.nlm.nih.gov/31326282/> December 1, 2019
5. McIntosh SE, Hamonko M, Freer L, et al. Wilderness Medical Society guidelines for the prevention and treatment of frostbite. Dec 1, 2019. [https://www.wemjournal.org/issue/S1080-6032\(19\)X0006-X](https://www.wemjournal.org/issue/S1080-6032(19)X0006-X)
6. Venden Hoek et al. Part 12: cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122;(18 Suppl 3): S829–61
7. Panchal et al. Part 3: Adult Basic and Advanced Life Support: 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2020;142:S366–S468
8. Brugger H, Bouzat P, Pasquier M, Mair P, Fieler J, Darocha T, Blancher M, de Riedmatten M, Falk M, Paal P, Strapazzon G, Zafren K, Brodmann Maeder M. Cut-off values of serum potassium and core temperature at hospital admission for extracorporeal rewarming of avalanche victims in cardiac arrest: A retrospective multi-centre study. *Resuscitation*. 2019;139:222–229. doi: 10.1016/j.resuscitation.2019.04.025
9. Paal P, Gordon L, Strapazzon G, Brodmann Maeder M, Putzer G, Walpoth B, Wanscher M, Brown D, Holzer M, Broessner G, Brugger H. Accidental hypothermia-an update: The content of this review is endorsed by the International Commission for Mountain Emergency Medicine (ICAR MEDCOM). *Scand J Trauma Resusc Emerg Med*. 2016;24:111. doi: 10.1186/s13049-016-0303-7

Drowning

Patient Care Goals

1. Rapid assessment and management of life-threatening injuries
2. Rescue from the water-based environment
3. Transport patients suffering from drowning for hospital evaluation unless field arrest resuscitation termination guidelines apply.

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

When protocol is inapplicable.

Patient Management

Assessment

1. History should include circumstances leading to the submersion, details of mechanism of injury, time under water
2. 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 ABCs (Airway, Breathing, Circulation) approach with prompt airway management and supplemental breathing
3. History, mechanism of injury and exam should include consideration of possible c-spine injury. Manage c-spine if evaluation suggests injury to the cervical spine
4. Assess for other associated injury such as injury to the head or dive-related emergency

Treatment and Interventions

1. Ensure scene safety for patient and rescuers. Remove patient from water as soon as possible:
 - a. Practice the safest water rescue technique possible, given circumstances on scene
 - b. Evacuate to land or a watercraft as soon as possible
 - c. If there is a delay to accessing shore or a rescue boat, initiate in-water basic life support consisting of ventilation only
2. Manage airway per the [Airway Management Guideline](#)
3. Follow [Cardiac Arrest Guideline](#) as indicated with consideration of **ABCs** (**A**irway, **B**reathing, **C**irculation) strategy for drowning victims in cardiac arrest:
 - a. Initiate 5 rescue breaths followed by 30 chest compressions
 - b. After the initial 5 breaths, use ratio of 30 compressions to 2 breaths
4. If mechanism or history suggest cervical spine injury, manage c-spine, per the [SpinalCare Guideline](#)

5. Monitor vital signs (pulse, blood pressure, respiratory rate, neurologic status assessment) including oxygen saturations
6. If O₂ saturations are less than 92%, administer oxygen as appropriate with a target of achieving 94–98% saturation. Consider positive pressure ventilation in patients with signs or symptoms of respiratory difficulty
7. Consider hypothermia, treat per [Hypothermia/Cold Exposure Guideline](#)
8. If the victim was involved in underwater diving and uncertainty exists regarding the most appropriate therapy, consider contacting medical direction and discussing need for hyperbaric treatment. Include discussion regarding:
 - a. Submersion time
 - b. Greatest depth achieved
 - c. Ascent rate
 - d. Gas mix
9. Establish IV access
10. Fluid bolus as indicated
11. Advanced airway management as indicated. Consider CPAP in awake patients with respiratory distress
12. Cardiac monitor

Patient Safety Considerations

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

Notes/Educational Pearls

Key Considerations

1. The World Health Organization definition of drowning is “the process of experiencing respiratory impairment from submersion/immersion in liquid”
2. Drowning is further defined in the following categories
 - a. Nonfatal drowning: patients rescued from drowning
 - b. Fatal drowning: any death, acutely or sub-acutely, resulting from drowning
3. Submersion refers to situations in which the patient’s airway is underwater. Immersion refers to situations in which the patient’s body is in water, but the patient’s airway remains out of the water
4. **Pediatric Considerations:**
 - a. Drowning is a common cause of death in children
 - b. Risk factors for drowning include male gender, age less than 14 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 five initial breaths be provided to the drowning victim:
 - a. The initial ventilations may be more difficult to achieve as water in the airways may impede alveolar expansion
 - b. If cardiac arrest after 5 rescue breaths, refer to [Cardiac Arrest Guideline](#).
8. Active efforts to expel water from the airway (by abdominal thrusts or other means) should be avoided as they delay resuscitative efforts and increase the potential for vomiting and aspiration
9. Long-standing teaching has suggested that rescuers should always assume c-spine injury in victims of drowning:
 - a. The 2010 American Heart Association update on special circumstances in cardiac arrest notes that routine c-spine precautions in all victims of drowning is likely unnecessary unless the mechanism or injury, history, or physical exam suggests a cervical spine injury
 - b. Mechanisms of injury highly suggestive of cervical spine injury include diving, water skiing, surfing, or watercraft accidents
10. Uncertainty exists regarding survival in cold water drowning; however, recent literature suggests the following:
 - a. If water temperature is less than 43°F (6°C) and the patient is submerged with evidence of cardiac arrest:
 - i. Survival is possible for submersion time less than 90 minutes and resuscitative efforts should be initiated
 - ii. Survival is not likely for submersion time greater than 90 minutes and clinicians 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 clinicians 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
12. Decompression illness may have a variety of presentations depending on system affected (e.g., skin, joint(s), pulmonary, neurologic), and can occur even when a diver does not exceed dive table limits

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

- Recognition and appropriate care of pulmonary/respiratory complaints
- Cervical spine management when appropriate
- Adherence to [Cardiac Arrest \(VF/VT/Asystole/PEA\) Guideline](#)

References

1. Harris M. ABC of resuscitation, near drowning. *BMJ*. 2003;327(7427):1336–8
2. Idris AH, Berg RA, Bierens J, et al. Recommended guidelines for uniform reporting of data from drowning: The “Utstein Style.” *Circulation*. 2003;108(20):2565–74
3. Layon J, Modell JH. Drowning, update 2009. *Anesthesiology*. 2009;110(6):1390–401
4. Olshaker J. Submersion. *Emerg Med Clin N Am*. 2004;22(2):357–67
5. Perkins, Olasveengen et al. BLS Task Force March 15, 2021, *Resuscitation* <https://costr.ilcor.org/document/drowning-tfsr-costr> Drowning BLS Systematic Review. Accessed
6. Szpilman D, Bierens JJ, Handley AJ, Orlowski JP. Drowning. *N Engl J Med*. 2012;366(22):2102–10
7. Vanden Hoek T, Morrison LJ, Shuster M, et al. Part 12: Cardiac arrest in special situations. 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation*. 2010;122(18 Suppl 3): S829–61

Dive (SCUBA) Injury/Accidents

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

24-hours of diving

Exclusion Criteria

Patients without history of recent (within 48 hours) SCUBA diving exposure

Patient Management

Assessment

1. History should include circumstances leading to the complaint, details of mechanism of injury, time under water, depth of dive, compliance with dive tables/decompression stops, gas mixture used, and water temperature (if available)
2. Be alert for signs of barotrauma (pulmonary barotrauma, arterial gas embolism, pneumothorax, pneumomediastinum, ear/sinus/dental barotrauma, dysrhythmias, skin mottling or erythema, neurologic signs and symptoms etc.) and/or decompression sickness (joint pain, mental status change, other neurologic symptoms including paralysis) or nitrogen narcosis (confusion, intoxication)
3. Assess for other associated injury such as injury to the head or spine (if mechanism and symptoms suggest), marine envenomation, hypothermia, or other injury

Treatment and Interventions

1. If a SCUBA accident includes associated drowning/near-drowning [See [Drowning Guideline](#)]
2. Manage airway as indicated and provide 100% oxygen
3. If air embolism suspected, place in left lateral recumbent position (patient lying with the left side down, knees drawn upward, and flat)
 - a. Trendelenburg position is sometimes recommended to help trap the air in the dependent right ventricle, and may be useful if a central venous catheter is being used to withdraw the air, but this position may increase cerebral edema
4. Monitor vital signs including oxygen saturations and cardiac rhythm (if possible)
5. Administer oxygen as appropriate with a target of achieving 94–98% saturation
 - a. Use positive pressure ventilation (e.g., CPAP) carefully in patients for whom pulmonary barotrauma is a consideration [See [Airway Management Guideline](#)] and if

signs or symptoms of tension pneumothorax are present perform needle decompression.
May use Capnospot with needle decompression.

6. Patients with symptoms suspicious for decompression illness, should be placed on supplemental oxygen regardless of saturations to enhance washout of inert gasses
7. Assess for hypothermia, treat per [Hypothermia/Cold Exposure Guideline](#)
8. Consider contacting medical direction and discussing need for hyperbaric treatment and primary transport to facility with hyperbaric oxygen therapy (HBOT) capability—include discussion regarding factors such as submersion time, greatest depth achieved, ascent rate, and gas mix
9. Establish IV access
10. Fluid bolus as indicated

Patient Safety Considerations

1. If the patient is still in the water, seek safest and most rapid means of removal safe (within your scope of training) while minimizing risk of further injury
2. Seek assistance early for special rescue/extrication and transportation needs
3. Check for multiple patients (e.g., group dive table calculation error(s) or contaminated dive gases)

Notes/Educational Pearls

Key Considerations

1. Rescue efforts should be coordinated between all responding agencies to ensure that the patient is rapidly accessed and safely removed from the water if diver unable to do so themselves
2. If air medical transport is necessary, the patient should be transported with the cabin pressurized to lowest possible altitude. If an unpressurized aircraft is used (i.e., most helicopter emergency medical services [HEMS]), 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
5. Decompression illness may have a variety of presentations depending on system affected (e.g., skin, joint(s), pulmonary, neurologic), and can occur even when a diver does not exceed dive table limits
6. Do not attempt to disassemble, turn off, or modify any of the dive equipment. The dive computer may provide a clue about the patient's exposure to depth

Pertinent Assessment Findings

1. Vital signs findings
2. Neurologic status assessment findings
3. Respiratory assessment findings (i.e., oxygen saturation, respiratory rate)
4. Subcutaneous emphysema

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

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

Key Documentation Elements

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

Performance Measures

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

References

1. Chandy D, Weinhouse GL. Complications of SCUBA diving. Post TW, ed. UpToDate. Waltham, MA: UpToDate. (Accessed March 15, 2021)
2. Doolette DJ, Mitchell SJ. Recreational technical diving part 2: decompression from deep technical dives. *Diving Hyperb Med*. 2013;43(2):96–104
3. FAA Aeronautical Information Manual—Decompression Sickness after Scuba Diving. https://www.faa.gov/air_traffic/publications/atpubs/aim_html/chap8_section_1.html. Accessed
4. Fock A, Harris R, Slade M. Oxygen exposure and toxicity in recreational technical divers. *Diving Hyperb Med*. 2013;43(2):67–71
5. Fock AW. Analysis of recreational closed-circuit rebreather deaths 1998–2010. *Diving Hyperb Med*. 2013;43(2):78–85
6. Gordy S, Rowell S. Vascular Air Embolism. *Int J Crit Illn Inj Sci*. 2013;3(1):73–6
7. Madden D, Lozo M, Dujic Z, Ljubkovic M. Exercise after SCUBA diving increases the incidence of arterial gas embolism. *J Appl Physiol (1985)*. 2013;115(5):716–22
8. Mitchell SJ, Doolette DJ. Recreational technical diving part 1: an introduction to technical diving methods and activities. *Diving Hyperb Med*. 2013;43(2):86–93
9. Muth C-M, Tetzlaff K. [Scuba diving and the heart. Cardiac aspects of sport scuba diving]. *Herz*. 2044;29(4):406–13
10. Sykes O, Clark JE. Patent foramen ovale and scuba diving: a practical guide for physicians on when to refer for screening. *Extrem Physiol Med*. 2013;2(1):10
11. Türkmen N, Okan A, Selçuk C, Bülent E, Murat SG, Umit NG. Scuba diver deaths due to air embolism: two case reports. *Soud Léč*. 2013;58(2):26–8
12. Vann RD, Gerth PJ, Denoble CF, Pieper CF, Thalmann ED. Experimental trials to assess the risks of decompression sickness in flying after diving. *Undersea Hyberb Med*. 2004 Winter;3(4):431–44
13. 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 studies. *Diving Hyperb Med*. 2013;43(2):72–7

Altitude Illness

Definitions

1. Acute mountain sickness: Headache plus one or more of the following: anorexia, nausea or vomiting, fatigue or weakness, dizziness or lightheadedness or difficulty sleeping. (In infants and young children, symptoms include pallor, fussiness, vomiting, decreased appetite, poor sleep, decreased playfulness.) These symptoms must occur in the setting of recent arrival to high altitude (generally considered greater than 5000-7000 feet)
2. High altitude pulmonary edema (HAPE): Progressive dyspnea, cough, hypoxia, and weakness in high altitude environments (considered greater than 8000 feet). (In infants and young children, symptoms again include pallor, fussiness, vomiting, decreased appetite, poor sleep, decreased playfulness.) Patients may or may not exhibit new symptoms if acute mountain sickness precedes symptoms of HAPE
3. High altitude cerebral edema (HACE): Heralded by mental status changes in patients with symptoms of acute mountain sickness including altered mentation, ataxia, or stupor and progressing to coma. Typically seen in high altitude environments (greater than 8000 feet)
4. Feet to meters conversion reference

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

Patient Care Goals

1. Improve oxygenation through a combination of descent and supplemental O₂
2. Safe but rapid transport from the high-altitude environment to a lower altitude environment

Patient Presentation

Inclusion Criteria

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

Exclusion Criteria

When protocol is inapplicable

Patient Management

Assessment

Assessment should target the signs and symptoms of altitude illness but should also consider alternate causes of these symptoms

Treatment and Interventions

1. Ensure scene safety for rescuers
2. Stop ascent
 - a. Patients with acute mountain sickness only may remain at their current altitude and initiate symptomatic therapy
 - b. Patients with HACE or HAPE should initiate descent
3. Perform **ABCs** (**A**irway, **B**reathing, **C**irculation) and manage airway as necessary
4. Administer supplemental oxygen, if available, with goal to keep oxygen saturations 90%

Notes/Educational Pearls

Key Considerations

1. Patients suffering from altitude illness have exposed themselves to a dangerous environment. By entering the same environment, clinicians 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 noncardiogenic 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. Children with the following are at greater risk for altitude illness:
 - a. Those with a concurrent upper or lower respiratory tract infection or otitis media
 - b. Full term infants less than 6 weeks of age, or preterm infants less than 46 weeks post conceptual age
 - c. Congenital heart disease
 - d. Down syndrome, especially those with obstructive sleep apnea
 - e. Those with bronchopulmonary dysplasia (BPD), cystic fibrosis, sickle cell anemia, severe scoliosis, and neuromuscular diseases
 - f. Premature infants beyond 46-weeks with a history of oxygen requirement, PBD or pulmonary hypertension

- g. Children who live at high altitude when they descend to lower altitude, then return home are at risk for HAPE

Pertinent Assessment Findings

1. Consider airway management needs in the patient with severe alteration in mental status
2. HAPE will present with increasing respiratory distress and rales on exam
3. HACE will present with mental status changes, ataxia, and progressing to coma

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914021—Environmental—Altitude Sickness

Key Documentation Elements

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

Performance Measures

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

References

1. Barry P, et al. Clinical review: altitude illness. *BMJ*. 2003
2. Bartsch P, Swenseon ER. Acute high-altitude illness. *N Engl J Med*. 2013; 368:2294–302
3. Gallagher SA, Hackett PH. High-altitude illness. *Emerg Med Clin N Am*. 2004;22(2):329–55
4. Gallagher SA, Hackett P. Acute Mountain sickness and high-altitude cerebral edema. Post TW, ed. UpToDate. Waltham, MA: UpToDate. (Accessed March 15, 2021)
5. Hackett P, Gallagher. High altitude disease: unique pediatric considerations. Post TW, ed. UpToDate. Waltham, MA: UpToDate. (Accessed March 15, 2021)
6. Imray C, Wright A, Subudhi A, Roach R. Acute Mountain sickness: pathophysiology, prevention and treatment. *Prog Cardiovasc Dis*. 2010;52(6):467–84
7. Jackson Hole Fire/EMS. *Operations Manual: Altitude illness*. Jackson Hole, WY: Teton County
8. Luks AM, McIntosh SE, Grissom CK, et al. Wilderness Medical Society consensus guidelines for the prevention and treatment of acute altitude illness. *Wilderness Environ Med*. 2010;25(4 Suppl): S4–14
9. Luks AM, McIntosh SE, Grissom CK, et al. Wilderness Medical Society Practice guidelines for the prevention and treatment of acute altitude illness: 2014 update. *Wilderness Environ Med*. 2014;25(4 Suppl): S4–14
10. West JB. High-altitude medicine. *Am J Respir Crit Care Med*. 2012;186(12):1229–37

Conducted Electrical Weapon Injury (i.e., TASER®)

Patient Care Goals

1. Manage the condition that triggered the application of the conducted electrical weapon with special attention to patients meeting criterion for delirium with agitated behavior [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]
2. Ensure patient is appropriately secured or restrained with assistance of law enforcement to protect the patient and clinicians [See [Agitated or Violent Patient/Behavioral Emergency Guideline](#)]
3. Perform comprehensive trauma and medical assessment for injuries (e.g., from falls or altercations or concomitant medical issues)
4. If discharged from a distance, up to two single-barbed darts (13 mm length) should be located
 - a. Do not remove barbed dart from sensitive areas (head, neck, hands, feet, or genitals)

Patient Presentation

Inclusion Criteria

1. Patient received either a weapon's direct-contact discharge or struck by the barbed dart of a 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

None noted

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 delirium with agitated behavior manifested by varied combination of agitation, reduced pain sensitivity, elevated temperature, persistent struggling, or hallucinosis

Treatment and Interventions

1. Make sure patient is appropriately secured with assistance of law enforcement to protect the patient and staff. Consider psychologic management medications if patient struggling against physical devices and may harm themselves or others
2. Some EMS agencies treat all barbed darts as a foreign body and leave them for physician removal while others allow EMS or law enforcement to remove barbed darts except for sensitive areas (head, neck, hands, feet, or genitals). Follow local protocols, including those of law enforcement for evidence collection and retention
3. Treat medical and traumatic injury

Patient Safety Considerations

1. Before removal of the barbed dart, make sure the cartridge has been removed from the conducted electrical weapon
2. Patient should not be restrained in the prone, face down, or hog-tied position as respiratory compromise is a significant risk
3. The patient may have underlying pathology before being tased (refer to appropriate guidelines for managing the underlying medical/traumatic pathology)
4. Perform a comprehensive assessment with special attention looking for signs and symptoms of active medical decompensation
5. Transport the patient to the hospital
6. EMS clinicians who respond for a conducted electrical weapon patient should not perform a “medical clearance” for law enforcement to then take the patient to a nonmedical facility

Notes/Educational Pearls

Key Considerations

1. Conducted electrical weapon can be discharged in three fashions:
 - a. Direct contact without the use of the darts
 - b. A single dart with additional contact by direct contact of weapon
 - c. From a distance up to 35 feet with two darts
2. The device delivers 19 pulses per second with an average current per pulse of 2.1 milliamps which, in combination with toxins/drugs, patient’s underlying diseases, excessive physical exertion, and trauma, may precipitate arrhythmias. Thus, consider cardiac monitoring and 12-lead EKG assessment
3. Drive Stun is a direct weapon two-point contact that is designed to generate pain and not incapacitate the subject. Only local muscle groups are stimulated with the Drive Stun technique

Pertinent Assessment Findings

1. Thoroughly assess the patient for trauma as the patient may have fallen from standing or higher
2. Ascertain if more than one TASER® cartridge was used (by one or more officers, in effort to identify total number of possible darts and contacts)

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914203—InjuryConducted Electrical Weapon (e.g., Taser)

Key Documentation Elements

- If darts removed, document the removal location in the patient care report
- Physical exam trauma findings
- Cardiac rhythm and changes
- Neurologic status assessment findings

Performance Measures

- Comprehensive patient documentation as this is a complex patient
- Abnormal findings or vital signs were addressed
- Patient received cardiac monitoring and/or 12-lead EKG evaluation
- If indicated, review for appropriate securing technique

References

1. Ho JD, Dawes DM, Buttman LL, Moscati RM, Janchar TA, Miner JR. Prolonged TASER use on exhausted humans does not worsen markers of acidosis. *Am J Emerg Med*. 2009;27(4):413–8
2. Ho JD, Dawes DM, Cole JC, et al. Corrigendum to “lactate and pH evaluation in exhausted humans with prolonged TASER X26 exposure or continued exertion.” *Forensic Sci Int*. 2009;190(1–3):80–6
3. Ho JD, Dawes DM, Cole JB, Hottinger JC, Overton KG, Miner JR. Lactate, and pH evaluation in exhausted humans with prolonged TASER X26 exposure or continued exertion. *Forensic Sci Int*. 2009;190(1–3):80–6
4. Ho JD, Dawes DM, Nelson RS, et al. Acidosis and catecholamine evaluation following simulated law enforcement “use of force” encounters. *Acad Emerg Med*. 2010;17(7): e60–8
5. Ho JD, Dawes DM, Nystrom PC, et al. Markers of acidosis and stress in a sprint versus a conducted electrical weapon. *Forensic Sci Int*. 2013;233(1–3):84–9
6. Kroll MW, Adamec J, Wetli CV, Williams HE. Fatal traumatic brain injury with electrical weapon falls. *J Forensic Legal Med*. 2016; 43:12–19
7. Kroll MW, Ritter MB, Kennedy EA, Silverman NK, et al. Eye injuries from electrical weapon probes: Incidents, prevalence and legal implications. *J Forensic Legal Med*. 2018; 55:52-57
8. Kroll MW, Ritter MB, Kennedy EA, Siegal NK, et al. Eye injury from electrical weapon probes: Mechanisms and treatment. *Am J Emerg Med*. 2018; 37:427–432
9. Kunz SN, Calkins HG, Adamec J, Kroll MW. Adrenergic and metabolic effects of electrical weapons: review and meta-analysis of human data. *Intl J Legal Med*. 2018; 132:1469–1475
10. Kunz SN, Calkins H, Adamec J, Kroll MW. Cardiac and skeletal muscle effects of electrical weapons: a review of human and animal studies. *Forens Sci Med Pathol*. 2018; 14:358-366
11. Kunz SN, Adamec J. A comparative brief on conducted electrical weapon safety. *Wien Med Wochenschr* 2019; 169:185–192
12. Pinto DS, Clardy PF. Environmental and weapon-related electrical injuries. Uptodate.com [Internet]. January 22, 2020. Accessed March 31, 2021
13. Stevenson R, Drummond-Smith I. Medical Implications of Conducted Electrical Devices in Law Enforcement. *J Forens Leg Med*. Published online June 10, 2020;73:101948
14. Vilke G, Chan T, Bozeman WP, Childers R. Emergency Department Evaluation After Conducted Energy Weapon Use: Review of the Literature for the Clinician. *J Emerg Med*. 2019;57(5):740– 746
15. *White Paper Report on Excited Delirium Syndrome*. ACEP Excited Delirium Task Force, American College of Emergency Physicians; September 10, 2009

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 noted

Patient Management

Assessment

1. Verify scene is secure. The electrical source must be disabled prior to assessment
2. Perform primary survey with specific focus on dysrhythmias or cardiac arrest—apply a continuous cardiac monitor and obtain 12-lead EKG as soon as feasible
3. Identify all sites of burn injury. If the patient became part of the circuit, there will be an additional site near the contact with ground. Electrical burns are often full thickness and involve significant deep tissue damage, and there may be multiple burn sites
4. Assess for potential associated trauma and note if the patient was thrown from contact point. If patient has altered mental status, assume trauma was involved and treat accordingly
5. Assess for potential compartment syndrome from significant extremity tissue damage
6. Determine characteristics of source if possible (AC or DC, voltage, amperage, and time of injury)

Treatment and Interventions

1. Identify dysrhythmias or cardiac arrest—even patients who appear dead (particularly dilated pupils) may have good outcomes with prompt intervention [see appropriate guideline for additional information and patient assessment/treatment]
2. Apply spinal motion restriction if associated trauma suspected [See [Trauma Section](#)]
3. Apply dry dressing to any wounds
4. Remove constricting clothing and jewelry since additional swelling is possible

5. Administer IV fluid resuscitation. Remember that external appearance will underestimate the degree of tissue injury but that electrical injuries do not generally require as much fluid as thermal burn injuries
6. Electrical injuries may be associated with significant pain, treat per [Pain including Procedural Sedation Management Guideline](#)

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
1mA	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

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914095—Injury—Electrical Injuries

Key Documentation Elements

- Characteristics of electrical current
- Downtime if found in cardiac arrest
- Positioning of the patient with respect to the electrical source
- Accurate description of external injuries
- Document presence or absence of associated trauma

Performance Measures

- Confirmation of scene safety
- Documentation of electrical source and voltage if known
- Documentation of cardiac monitoring
- Documentation of appropriate care of associated traumatic injuries
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - Trauma—01: Pain Assessment of Injured Patients

References

1. Electrical Injuries. Emedicine.medscape.com. <http://emedicine.medscape.com/article/433682-overview>. Updated February 8, 2017. Accessed
2. Pham TN, Gibran NS. Thermal and electrical injuries. *Surg Clin North Am*. 2007;87(1):185-206
3. Price TG, Cooper MA. Electrical and lightning injuries. In Hockenberger R, ed. *Rosen's Emergency Medicine*, 9th Edition. 2009

Lightning/Lightning Strike Injury

Patient Care Goals

1. Identify patient(s) as lightning strike victim(s)
2. Move to safe area
3. Initiate immediate resuscitation of cardiac arrest victim(s), within limits of mass casualty care, also known as “reverse triage”
4. Cardiac monitoring during transport
5. Treat associated traumatic injuries

Patient Presentation

1. Lightning strikes may happen in a variety of environmental conditions
 - a. Most commonly they occur in outdoor or wilderness circumstances
 - b. Golf courses, exposed mountains or ledges and farms/fields all present conditions that increase risk of lightning strike, when hazardous meteorological conditions exist
2. Lacking bystander observations or history, it is not always immediately apparent that patient has been the victim of a lightning strike Subtle findings such as injury patterns might suggest lightning injury

Inclusion Criteria

Patients of all ages who have been the victim of lightning strike injury

Exclusion Criteria

No recommendations

Patient Management

Assessment

1. Respiratory
 - a. Apnea
 - b. Agonal respirations
 - c. Respiratory paralysis
2. Cardiovascular
 - a. Dysrhythmias
 - b. Transient hypertension
3. Neurologic
 - a. Seizures
 - b. Confusion
 - c. Paralysis
 - d. Paraplegia
 - e. Vertigo/dizziness
 - f. Paresthesias
 - g. Amnesia
 - h. Memory deficits
 - i. Anxiety
 - j. Fixed/dilated pupils possible (autonomic dysfunction)

4. Skin
 - a. Ferning or fern-like superficial skin burn ("Lichtenberg figures")
 - b. Vascular instability may result in cool, mottled extremities
 - c. Frequent first and/or second-degree burns
 - d. Third degree burns less common
5. Patient may be in full cardiopulmonary arrest or have only respiratory arrest, as injury is a result of DC current
6. May have stroke-like findings as a result of neurologic insult
7. May have secondary traumatic injury as a result of over pressurization, blast or missile injury
8. Fixed/dilated pupils may be a sign of neurologic insult, rather than a sign of death/impending death. Should not be used as a solitary, independent sign of death for the purpose of discontinuing resuscitation in this patient population

Treatment and Interventions

1. Assure patent airway—if in respiratory arrest only, manage airway as appropriate
2. If in cardiopulmonary arrest, treat per [Cardiac Arrest Guideline](#)
3. Consider IV initiation—avoid initiation through burned skin
4. Monitor EKG. Be alert for potential arrhythmias. Consider 12-lead EKG, when available
5. Consider early pain management for burns or associated traumatic injury [See [Pain Management Including Procedural Sedation Guideline](#)]

Patient Safety Considerations

1. Recognize that repeat strike is a risk. Patient and rescuer safety is paramount
2. Victims do not carry or discharge a current, so the patient is safe to touch and treat

Notes/Educational Pearls

Key Considerations

1. Lightning strike cardiopulmonary arrest patients have a high rate of successful resuscitation, if initiated early, in contrast to general cardiac arrest statistics
2. There may be multiple victims
3. If multiple victims, cardiac arrest patients whose injury was witnessed or thought to be recent should be treated first and aggressively (reverse from traditional triage practices)
 - a. Patients suffering cardiac arrest from lightning strike initially suffer a combined cardiac and respiratory arrest
 - b. Return of spontaneous circulation may precede resolution of respiratory arrest
 - c. Patients may be successfully resuscitated if provided proper cardiac and respiratory support, highlighting the value of "reverse triage"
4. It may not be immediately apparent that the patient is a lightning strike victim
5. Injury pattern and secondary physical exam findings may be key in identifying patient as a victim of lightning strike
6. Lightning strike is a result of very high voltage, very short duration DC current exposure

Pertinent Assessment Findings

1. Presence of thermal or nonthermal burns
2. Evidence of trauma
3. Evidence of focal neurologic deficits

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

(for additional information, go to www.nemsis.org)

- 9914209—Injury—Lightning/Lightning Strike

Key Documentation Elements

- Initial airway status
- Initial cardiac rhythm
- Neurologic exam (initial and repeat)
- Associated/secondary injuries
- Pain scale documentation/pain management

Performance Measures

- Cardiopulmonary issues addressed early and documented appropriately
- Patient transported to closest appropriate facility
- Pain scale documented and treated per guidelines (when appropriate)
- **National EMS Quality Alliance (NEMSQA) Performance Measures**
(for additional information, see www.nemsqa.org)
 - o Trauma—01: Pain Assessment of Injured Patients

References

1. Anderson DR, Gillberg JM, Torrey JW, Koneru JN. Lightning induced inappropriate ICD shock: an unusual case of electromagnetic interference. *Pacing Clin Electrophysiol*. 2012;35(6): e159–62
2. Arnoldo BD, Purdue GF. The diagnosis and management of electrical injuries. *Hand Clin*. 2009;25(4):469–79
3. Blumenthal R. Secondary missile injury from lightning strike. *Am J Forensic Med Pathol*. 2012;33(1):83–5
4. Blumenthal R, Jandrell IR, West NJ. Does a sixth mechanism exist to explain lightning injuries? Investigating a possible new injury mechanism to determine the cause of injuries related to close lightning flashes. *Am J Forensic Med Pathol*. 2012;33(3):222–6
5. Brunner FX. [Bilateral tympanic membrane perforation caused by a lightning accident]. *HNO*. 1984;32(10):429–30
6. Centers for Disease Control and Prevention (CDC). Lightning-associated deaths—United States, 1980–1995. *MMWR Morb Mortal Wkly Rep*. 1998 May 22;47(19):391–94
7. Cherington M, Kurtzman R, Krider EP, Yarnell PR. Mountain medical mystery: unwitnessed death of a healthy young man, caused by lightning. *Am J Forensic Med Pathol*. 2001;22(3):296–8
8. Cooper MA. Emergent care of lightning and electrical injuries. *Semin Neurol*. 1995;15(3):268–78
9. Cooper MA. A fifth mechanism of lightning injury. *Acad Emerg Med*. 2002;9(2):172–4
10. Davis C, Engeln A, Johnson E, et al; Wilderness Medical Society. Wilderness Medical Society practice guidelines for the prevention and treatment of lightning injuries. *Wilderness Environ Med*. 2012;23(3):260–9
11. Davis C, Engeln A, Johnson E, et al; [Wilderness Medical Society Practice Guidelines for the Prevention and Treatment of Lightning Injuries: 2014 Update - Wilderness & Environmental Medicine \(wemjournal.org\)](https://doi.org/10.1016/j.wem.2014.08.011) <https://doi.org/10.1016/j.wem.2014.08.011>. Accessed
12. Desai BK, Fairclough R. A case of a speech impediment following a near lightning strike. *Int J Emerg Med*. 2011; 4:60
13. Dronacahrya L, Poudel R. Lightning induced atrial fibrillation. *Kathmandu Univ Med J (KUMJ)*. 2008;6(24):514–5
14. Duclos PJ, Sanderson LM, Klontz KC. Lightning-related mortality, and morbidity in Florida. *Public Health Rep*. 1990;105(3):276–82
15. Dundon BK, Puri R, Leong DP, Worthley MI. Takotsubo cardiomyopathy following lightning strike. *BMJ*. 2008; 25:460–1
16. Fontanarosa PB. Electrical shock and lightning strike. *Ann Emerg Med*. 1993;22(2 Pt 2):378–87
17. Forster SA, Silva IM, Ramos MLC, Gragnani A, Ferreira LM. Lightning burn—review and case report. *Burns*. 2013;39(2): e8–12
18. Glunčić I, Roje Z, Glunčić V, Poljak K. Ear injuries caused by lightning: report of 18 cases. *J Laryngol Otol*. 2001;115(1):4–8

19. Guardiola B, Planella M, Ferreruela M, Velasco J, Pérez-Bárcena J, Llompарт-Pou JA. [Brain injury secondary to lightning strike]. *Med Intensiva*. 2013;37(5):367–8
20. Haraldsson PO, Bergstedt M. [Unconsciousness and persistent tinnitus caused by lightning injury to the ear during telephoning]. *Läkartidningen*. 1983;80(19):2024
21. Hinkelbein J, Spelten O, Wetsch WA. [Lightning strikes and lightning injuries in prehospital emergency medicine. Relevance, results, and practical implications]. *Unfallchirurg*. 2013;116(1):74–9
22. Jefferiss WR. Three cases of lightning-stroke. *Br Med J*. 1876;1(786):102
23. Kaliszan M, Karnecki K, Jankowski Z. [A case of fatal lightning stroke at an unusual site—the city center]. *Arch Med Sądowej Kryminol*. 2012;62(3):208–12
24. Kleinschmidt-DeMasters, BK. Neuropathology of lightning-strike injuries. *Semin Neurol*. 1995;15(4):323–8
25. Ko SH, Chun W, Kim HC. Delayed spinal cord injury following electrical burns: a 7-year experience. *Burns*. 2004;30(7):691–5
26. Kubilius D, Rimdeika R. Simultaneous lightning injury in a group of people: case report. *Burns*. 2012;38(3): e9–12
27. Lane JR. Clinical lecture on injuries from lightning. *Br Med J*. 1872;2(605):114–6
28. Leiria TLL, Pires LM, Kruse ML, de Lima GG. Struck by lightning: a case of nature-induced pre- excited atrial fibrillation. *Circ Arrhythm Electrophysiol*. 2013;6(2): e20–1
29. Levy DR, Akiyama T. Lightning-induced ventricular fibrillation. *Cardiology J*. 2007;14(1):91–4
30. Lichtenberg R, Dries D, Ward K, Marshall W, Scanlon P. Cardiovascular effects of lightning strikes. *J Am Coll Cardiol*. 1993;21(2):531–6
31. *Lightning Safety Awareness*. Boston, MA: American Meteorological Society; April 29, 2002.
32. Lightning-related Medical Encounters, Active and Reserve Components, U.S. Armed Forces, January 2009-August 2012. *MSMR*. 2012;19(9):18–9
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 Electrophysiol J*. 2010;10(9):429–34
34. Modayil PC, Lloyd GW, Mallik A, Bowdler DA. Inner ear damage following electric current and lightning injury: a literature review. *Eur Arch Otorhinolaryngol*. 2014;271(5):855–61
35. Mora-Magaña I, Collado-Corona MA, Toral-Martíñon R, Cano A. Acoustic trauma caused by lightning. *Int J Pediatr Otorhinolaryngol*. 1996;35(1):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. *Am J Otolaryngol*. 2012;33(6):767–9
37. Navarrete N. Severe rhabdomyolysis without renal injury associated with lightning strike. *J Burn Care Res*. 2013;34(3): e209–12
38. O’Keefe Gatewood M, Zane RD. Lightning injuries. *Emerg Med Clin N Am*. 2004;22(2):369–403.
39. Parsaik AK, Jahlskog JE, Singer W, et al. Central hyperadrenergic state after lightning strike. *Clin Auton Res*. 2013;23(4):169–173

40. Pedersen ML, Bülent U, Morten NL, Carl P. [Survival following lightning strike and treatment of sequelae]. *Ugeskr Laeger*. 2011;173(15):1138–9
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. *Emerg Med Int*. 2012; 2012:167698
42. Russell KW, Cochran AL, Sagar TM, Morris SE, McDevitt MC. Lightning burns. *J Burn Care Res*. 2013;35(6): e436–8
43. Slesinger TL, Bank M, Drumheller BC, et al. Immediate cardiac arrest and subsequent development of cardiogenic shock caused by lightning strike. *J Trauma*. 2010;68(1): e5–7
44. Soomaroo L, Murray V. Weather and environmental hazards at mass gatherings. *PLoS Curr* 2012;4: e4fca9ee30afc4
45. Thacker MTF, Lee R, Sabogal RI, Henderson A. Overview of deaths associated with natural events, United States, 1979–2004. *Disasters*. 2008;32(2):303–15
46. Thomson EM, Thomas MH. Lightning injuries in sports and recreation. *Curr Sports Med Rep*. 2013;12(2):120–4
47. Walsh KM. Lightning and severe thunderstorms in event management. *Curr Sports Med Rep*. 2012;11(3):131–4
48. Walsh KM, Cooper MA, Holle R, Rakov VA, Roeder WP, Ryan M; National Athletic Trainers' Association. National Athletic Trainers' Association position statement: lightning safety for athletics and recreation. *J Athl Train*. 2013;48(2):258–70
49. Wankhede AG, Sariya DR. Damage due to lightning when it strikes the face. *Foren Sci Int*. 2013;224(1–3): e1–3
50. Ward NJ, Little JH, Higgins GL III. Man with confusion and resolved paralysis. Lightning strike injury. *Ann Emerg Med*. 2012;59(4):335, 340
51. Wiesenthal L, Jacoby A, Davis KP, Campagne D, Snowden B, Hughes S. Lightning safety awareness of visitors in three California national parks. *Wilderness Environ Med*. 2011;22(3):257–61
52. Zimmermann C, Cooper MA, Holle RL. Lightning safety guidelines. *Ann Emerg Med*. 2002;39(6):660–4

APPENDICES



I. Medications

The project team considered the use of Institute for Safe Medication Practices (ISMP) Tall Man Letters methodology to avoid the miscommunication of look-alike 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 October 23, 2021. Additional references include the 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care, position statements from the American Academy of Clinical Toxicology and the European Association of Poison Control Centers (<http://clintox.org/documents/positionpapers/Cathartics.pdf>), and the article: Rodrigo GJ, Pollack CV, Rodrigo C, Rowe BH. Heliox for non-intubated acute asthma patients. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD002884.

NOTE: Not all contraindications listed on the <http://www.medscape.com> website were included for the purposes of this document. Contraindications which were not pertinent to EMS clinicians were not included for the purposes of streamlining this document.

Medication List

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

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

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

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®, and Ecotrin®

Class—Antiplatelet agent, nonsteroidal antiinflammatory drug (NSAID)

Pharmacologic Action—Inhibits synthesis of prostaglandin by cyclooxygenase, inhibits platelet aggregation, and 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, and 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

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 less than 90 mmHg), sick sinus syndrome (if no pacemaker), second- and third-degree heart block (if no pacemaker present), and complete heart block. Contraindications for IV administration: Use in newborns (because of benzyl alcohol), concomitant beta-blocker therapy, cardiogenic shock, ventricular tachycardia (must determine whether origin is supraventricular or ventricular)

Diphenhydramine

Name—Benadryl®

Class—Antihistamine—first generation

Pharmacologic Action—Histamine H1-receptor antagonist of effector cells in respiratory tract, blood vessels, and GI smooth muscle

Indications—For urticarial and/or pruritis in the management of patients suffering from allergic reaction as well as for the management of patients suffering from dystonia/akathisia

Contraindications—Documented hypersensitivity, use controversial in lower respiratory tract disease (such as acute asthma), premature infants and neonates

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

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

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 nonpharmacologic 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

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—Nonsteroidal 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 of the patent ductus arteriosus (PDA) is necessary for pulmonary or systemic blood flow

Ipratropium

Name—Atrovent®

Class—Anticholinergics, respiratory

Pharmacologic Action—Anticholinergic (parasympatholytic) agent; inhibits vagally mediated reflexes by antagonizing acetylcholine action; prevents increase in intracellular calcium concentration that is caused by interaction of acetylcholine with muscarinic receptors on bronchial smooth muscle

Indications—For the management of asthma and chronic obstructive pulmonary disease (COPD)

Contraindications—Documented hypersensitivity to ipratropium, atropine, or derivatives

Isopropyl Alcohol

Name—No brand name available

Class—Secondary alcohol

Pharmacology—In addition to traditional role as antiseptic, may be used as antiemetic

Indications—Nausea and vomiting

Contraindications—None

Ketamine

Name—Ketalar®

Class—General anesthetics, systemic

Pharmacologic Action—Produces dissociative anesthesia. Blocks N-methyl D-aspartate (NMDA) receptor

Indications—For the management of agitated or violent behavior

Contraindications—Hypersensitivity

RELATIVE/CONTROVERSIAL CONTRAINDICATIONS: Head trauma, intracranial mass/hemorrhage, hypertension, angina, and stroke, underlying psychiatric disorder

WARNING: Overdose may lead to panic attacks and aggressive behavior; rarely seizures, increased ICP, and cardiac arrest. Very similar in chemical makeup to PCP (phencyclidine), but it is shorter acting and less toxic

Labetalol

Name—Trandate®

Class—Beta-blockers, alpha activity

Pharmacology—Nonselective beta blocker with intrinsic sympathomimetic activity; also, alpha blocker

Indications—Severe hypertension with pre-eclampsia symptoms

Contraindications—Asthma or obstructive airway disease, severe bradycardia, second-degree or third-degree heart block (without pacemaker), cardiogenic shock, bronchial asthma, uncompensated cardiac failure, hypersensitivity, sinus bradycardia, sick sinus syndrome without permanent pacemaker; conditions associated with prolonged and severe hypotension. Use with caution in patients taking calcium channel blockers. Hypotension with or without syncope may occur, monitor. Consider preexisting conditions, such as, sick sinus syndrome before initiating therapy. Use caution in patients with history of severe anaphylaxis to allergens; patients taking beta-blockers may become more sensitive to repeated challenges; treatment with epinephrine in patients taking beta-blockers may be ineffective or promote undesirable effects. Use with caution in patients with myasthenia gravis, psoriasis, or psychiatric illness (may cause or exacerbate CNS depression)

Lidocaine

Name—Lidocaine CV®, Lidopen®, Xylocaine®

Class—Class Ib antidysrhythmics

Pharmacologic Action—Class 1b antidysrhythmic; combines with fast sodium channels and thereby inhibits recovery after repolarization, resulting in decreasing myocardial excitability and conduction velocity

Indications—For the management of refractory or recurrent ventricular fibrillation or pulseless VT

Contraindications—Hypersensitivity to lidocaine or amide-type local anesthetic, Adams-Stokes syndrome, SA/AV/intraventricular heart block in the absence of artificial pacemaker. nitro (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 endplate by motor nerve impulse. Slows rate of sinoatrial (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

Contraindication—Hypersensitivity, myocardial damage, diabetic coma, heart block, hypermagnesemia, and 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)

Midazolam

Name—Versed®

Class—Anticonvulsants, other; antianxiety agent; anxiolytics; benzodiazepines

Pharmacologic Action—Binds receptors at several sites within the CNS, including the limbic system and reticular formation; effects may be mediated through gamma-aminobutyric acid (GABA) receptor system; increase in neuronal membrane permeability to chloride ions enhances the inhibitory effects of GABA; the shift in chloride ions causes hyperpolarization (less excitability) and stabilization of the neuronal membrane

Indications—For the management of seizures, uncontrolled shivering in hypothermia, and for the management of agitated or violent patients suffering behavioral emergencies

Contraindications—Documented hypersensitivity, severe respiratory depression, and sleep apnea

WARNING: May cause respiratory depression, arrest, or apnea

Naloxone

Name—Narcan®

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)

Nitrous Oxide

Name—N₂O

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, antianginal

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 O₂ demand. Also improves coronary collateral circulation. Lower BP, increases heart rate, occasional paradoxical bradycardia

Indications—As an antianginal medication for the management of chest pain as well as a reducer of preload for patients suffering from acute pulmonary edema

Contraindications—Hypersensitivity, acute myocardial infarction, severe anemia, recent use of erectile dysfunction medications (sildenafil (Viagra®—within last 24 hours), tadalafil (Cialis®—within last 48 hours), vardenafil (Levitra®—within last 48 hours), or other phosphodiesterase-5 inhibitors). There is potential for dangerous hypotension, narrow angle glaucoma (controversial: may not be clinically significant). Nitrates are contraindicated in the presence of hypotension (SBP less than 90 mmHg), extreme bradycardia (less than 50 BPM), tachycardia in the absence of heart failure (greater than 100 BPM), and right ventricular infarction

Norepinephrine

Name—Levophed®, Levarterenol®

Class—Alpha/beta adrenergic agonist

Pharmacologic Action—Strong beta-1 and alpha-adrenergic effects and moderate beta-2 effects, which increase cardiac output and heart rate, decrease renal perfusion and peripheral vascular resistance, and cause variable BP effects

Indications—As a pressor agent used in the management of shock

Contraindications—Hypersensitivity, hypotension due to blood volume deficit, peripheral vascular thrombosis (except for lifesaving procedures)

RELATIVE CONTRAINDICATIONS: concomitant use with some general anesthetics: chloroform, trichloroethylene, cyclopropane, halothane

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WARNING: Norepinephrine is a vesicant and can cause severe tissue damage if extravasation occurs. Do not use in the same IV line as alkaline solutions as these may deactivate it

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

varicella and fungal infections

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

Rocuronium

Name—Zemuron, informally known as “roc”

Class—Non-depolarizing neuromuscular blockers

Pharmacologic Action—Involves inducing muscle relaxation and paralysis through a mechanism known as competitive antagonism at the neuromuscular junction.

Indications—As an adjunct to facilitate drug-assisted mechanical airway management, and to provide skeletal muscle relaxation or mechanical ventilation.

Contraindications—Hypersensitivity, patient who is not sedated or not under the influence of anesthesia to avoid the risk of awareness.

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

Tranexamic Acid

Name—Lysteda

Class—Antifibrinolytic agent

Pharmacologic Action—An antifibrinolytic agent that works to reduce or prevent bleeding by inhibiting the breakdown of blood clots

Indications—Heavy menstrual bleeding, trauma, postpartum hemorrhage

Contraindications—A history of hypersensitivity to TXA, active thromboembolic disorders (like deep vein thrombosis, pulmonary embolism, or stroke), and conditions involving active intravascular clotting or consumptive coagulopathy

II. Approved Abbreviations

The following is the Project's list of approved medical abbreviations used in this document. The Drug.com article "Medical Abbreviations on Pharmacy Prescriptions" at <https://www.drugs.com/article/prescription-abbreviations.html> is considered the reference of authority.

Table X: List of Abbreviations

Abbreviation	Description
ACS	acute coronary syndrome
AED	automatic external defibrillator
A-FIB	atrial fibrillation
ALS	advanced life support
AMS	altered mental status
ASA	aspirin
AV	atrioventricular
AVPU	alert, verbal, pain, unresponsive (neurological status measure)
BiPAP	bi-level positive airway pressure
BLS	basic life support
BP	blood pressure
BPM	beats per minute
BSA	body surface area
BSI	body substance isolation
BVM	bag-valve-mask
CABG	coronary artery bypass graft
CAD	coronary artery disease
CARES	Cardiac Arrest Registry to Enhance Survival
CC	chief complaint
CDC	Centers for Disease Control and Prevention
CHF	congestive heart failure
CNS	central nervous system
CO	carbon monoxide
CO ₂	carbon dioxide
COPD	chronic obstructive pulmonary disease

CP	chest pain
CPAP	continuous positive airway pressure
CPI	continuous performance improvement
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
ECPR	extracorporeal cardiopulmonary resuscitation
EEG	electroencephalogram
EENT	eye, ear, nose, and throat
EGD	extraglottic device
EKG	electrocardiogram
EMS	emergency medical services
EMT	emergency medical technician
ePCR	electronic patient call/care record/report
ET	endotracheal
ETA	estimated time of arrival
EtCO ₂	end-tidal carbon dioxide; end-tidal capnography
ETOH	ethanol (alcohol)
ETT	endotracheal tube
FBAO	foreign body airway obstruction
FiO ₂	fraction of inspired oxygen
g	gram(s)

GI	gastrointestinal
gtt	drops
GU	genitourinary
GYN	gynecology (gynecological)
HFNC	high flow nasal cannula
HR	heart rate (hour)
ICU	intensive care unit
IM	intramuscular
IO	intraosseous
IPPB	intermittent positive pressure breathing
IV	intravenous
IVP	intravenous push
J	joules
JVD	jugular vein distension

kg	kilogram
KVO	keep vein open
L	liter
LMA	laryngeal mask airway
LPM	liters per minute
LR	lactated Ringer's
MAT	multifocal atrial tachycardia
mcg	microgram(s)
MED	medicine
mg	milligram(s)
mg/dL	milligrams per deciliter
MI	myocardial infarction (heart attack)
mL	milliliter
mmHg	millimeters of mercury
mmol	millimole
MOLST	medical orders for life-sustaining treatment

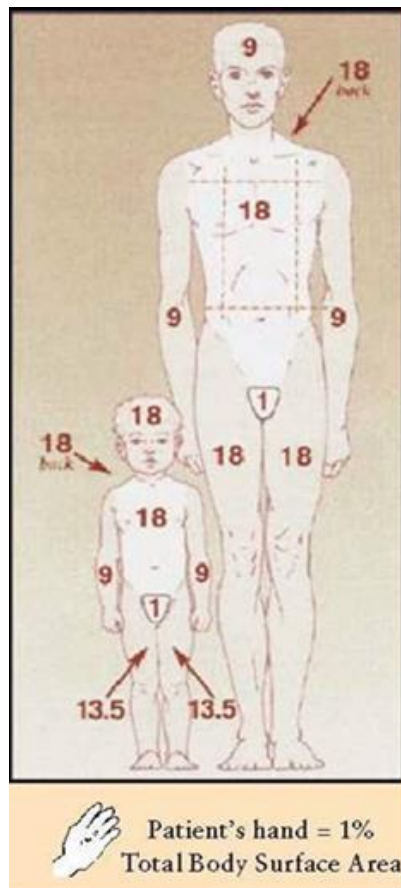
MS	mental status
msec	millisecond
MVC	motor vehicle crash
N/V	nausea/vomiting
NC	nasal cannula
NRB	non-rebreather
NS	normal saline
NSR	normal sinus rhythm
OB/GYN	obstetrics/gynecology
O ₂	oxygen
P	pulse
PAC	premature atrial contraction
PCR	Patient call/care record/report
PE	pulmonary embolus
PEA	pulseless 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

RSI	rapid sequence intubation
Rx	medicine
sat	saturation
SBP	systolic blood pressure
SC	subcutaneous
SCBA	self-contained breathing apparatus
SCUBA	self-contained underwater breathing apparatus
SGD	supraglottic device

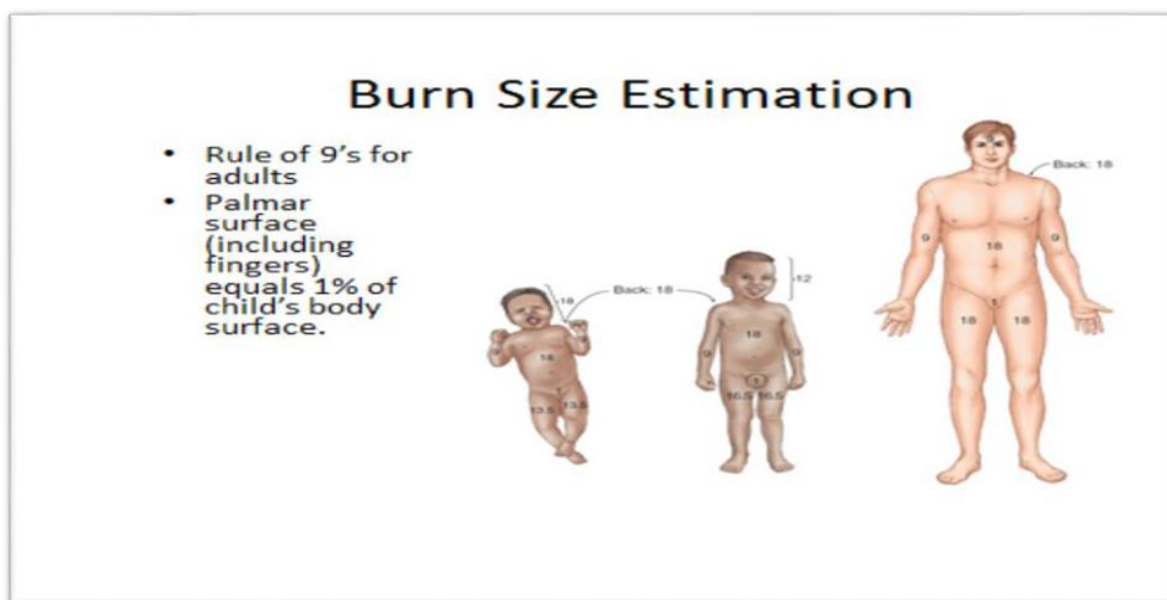
SL	sublingual
SOB	shortness of breath
ST	sinus tachycardia
SVT	supraventricular tachycardia
T	temperature
TBSA	total body surface area
TCA	tricyclic antidepressants
TIA	transient ischemic attack
TID	three times a day
TKO	to keep open
VF	ventricular fibrillation
VS	vital signs
VT	ventricular tachycardia
y/o	years old (years old)

III. Burn and Burn Fluid Charts

Burn Size Chart 1



Source: Used with permission, University of Utah Burn Center
Burn Size Chart 2



Source: American Heart Association, *Pediatric Advanced Life Support Textbook*, 2013

Percentage of Total Body Surface Area by Age, Anatomic Structure, and Body Habitus

Adult	
Anatomic Structure	Surface Area
Anterior head	4.5%
Posterior head	4.5%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	9%
Posterior leg, each	9%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia, perineum	1%
Adult—Obese 80 kg	
Anatomic Structure	Surface Area
Head and neck	2%
Anterior torso	25%
Posterior torso	25%
Leg, each	20%
Arm, each	5%
Genitalia/perineum	0%

Child	
Anatomic Structure	Surface Area
Anterior head	9%
Posterior head	9%
Anterior torso	18%
Posterior torso	18%
Anterior leg, each	6.75%
Posterior leg, each	6.75%
Anterior arm, each	4.5%
Posterior arm, each	4.5%
Genitalia/perineum	1%
Infant 10 kg	
Anatomic Structure	Surface Area
Head and neck	20%
Anterior torso	16%
Posterior torso	16%
Leg, each	16%
Arm, each	8%
Genitalia/perineum	1%

IV. 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) 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	

Table X: AVPU

- A:** The patient is alert
- V:** The patient responds to verbal stimulus
- P:** The patient responds to painful stimulus
- U:** The patient is completely unresponsive

B**BALANCE**Loss of Balance,
Dizziness**E****EYES**

Vision Changes

F**FACE**Drooping, Severe
Headache**A****ARMS**Weakness,
Numbness**S****SPEECH**Trouble Speaking,
Confusion**T****TIME**Symptom Onset,
LKW**Common Stroke Symptoms*****Sudden onset of these symptoms could be a stroke.
Consider stroke and notify the hospital.****Right-Sided (Hemisphere) Stroke**

- Slurred speech – dysarthria
- Weakness or numbness of the left side of face, arm, or leg
- Left-sided neglect
- Right gaze preference

Left-Sided (Hemisphere) Stroke

- Speech problems – what is being said or inability to get words out
- Problems with comprehension
- Weakness or numbness of the right side of face, arm, or leg
- Left gaze preference

Brainstem Stroke

- Nausea, vomiting, or vertigo
- Speech problems
- Swallowing problems
- Abnormal eye movements
- Decreased consciousness
- Crossed findings (both sides of the body)

**Hemorrhagic Stroke:
Intracerebral Hemorrhage**

- Nausea and vomiting
- Headache
- One-sided weakness
- Decreased consciousness

**Hemorrhagic Stroke:
Subarachnoid Hemorrhage**

- Worst headache of Life
- Intolerance to light
- Neck stiffness or pain

*Symptoms may occur alone or in combination with each other.

**Mission:Lifeline®
Stroke****EMS Pre-Hospital Checklist****Recommended interventions
to be performed on-scene
or during transport:**

- Perform Pre-Hospital Stroke Screen
- Identify Last Known Well
- Perform Large Vessel Screening
- Perform Blood Glucose
- Start IV
- 12-lead ECG
- Ask if on blood thinners and notify hospital

**Notify Hospital
of the following:**

- ▶ Incoming Stroke Alert
- ▶ Last Known Well
- ▶ Large Vessel Screening Score
- ▶ Blood Glucose
- ▶ Vital signs
- ▶ 12-lead ECG findings
- ▶ If known anticoagulant use

**GOAL:
ON-SCENE
TIME
< 15
MINUTES****AS SOON AS POSSIBLE
WITHIN 4.5 HOURS**
in select patients**IV thrombolytics****AS SOON AS POSSIBLE WITHIN
UP TO 24 HOURS
AFTER STROKE BEGINS²**
in select patients**mechanical
thrombectomy**

Clot busters and clot-removal procedures must be administered within a few hours of stroke symptoms to lessen the chance of being disabled after stroke.

B**BALANCE**Loss of
Balance,
Dizziness**E****EYES**Vision
Changes**F****FACE**Drooping,
Severe
Headache**A****ARMS**Weakness,
Numbness**S****SPEECH**Trouble
Speaking,
Confusion**T****TIME**Symptom
Onset,
LKW**VAN Assessment**

Extend arms with palms up for 10 seconds. Is arm weakness present?

Yes: Continue VAN

No: VAN negative. Exam Finished

VISION

- Vision loss or uneven eyes? (Tip: Gaze away from weakness) ☐
- Forced gaze/unable to track?
Ask patient to follow your finger Rt to Lt ☐
- Visual field cut or blind?
Ask pt. to look at your nose
Hold 2 fingers on Lt, 1 on Rt
Ask pt. to count total fingers ☐
- Crossed/uneven eyes?
Observe for uneven/crossed eyes
(pt. may complain of double vision) ☐

APHASIA

- Inability to talk or follow commands? (Tip: with right weakness) ☐
- Expressive?
Ask pt. to name 2 objects (pen, shirt, etc.)
Ask pt. to repeat: "The sky is blue in Miles City"
(don't count slurred words) ☐
- Receptive?
Ask pt. to follow 2 commands (close eyes and make a fist) ☐

NEGLECT

- Ignoring left body (Tip: with left weakness) ☐
- Unable to feel both sides at the same time
Ask pt. to close eyes, touch both arms ☐

Weakness plus one or all of the V, A, or N = **VAN Positive**No weakness or evidence of V, A, or N = **VAN Negative****Radio/Phone Consultation**

Identification: _____ Prenotification: YES / NO

Pt Age: _____ Sex: _____ Onset: <4 hrs. <24 hrs.

CC (OPQRST, LKW, etc): _____

LOC (AVPU/GCS): _____

S & Sx: _____

BP: _____ P: _____ R: _____ T: _____ SpO2: _____

Skin: _____ Cardio/Resp: _____ BG: _____ Pupils: _____

Neuro: _____ ECG: _____

PMHx: _____

Meds: _____

Allergies: _____

Interventions: _____

ETA: _____ Code: _____

V. Abnormal Vital Signs

Abnormal Vital Signs

Age	Heart Rate	Respiratory Rate	Systolic BP	Temp (°C)
0 d–1 mo	>205	>60	<60	<36 or >38
≥ 1 mo–3 mo	>205	>60	<70	<36 or >38
≥ 3 mo–1 yr	>190	>60	<70	<36 or >38.5
≥ 1 yr–2 yr	>190	>40	<70 + (age in yr x 2)	<36 or >38.5
≥ 2 yr–4 yr	>140	>40	<70 + (age in yr x 2)	<36 or >38.5
≥ 4 yr–6 yr	>140	>34	<70 + (age in yr x 2)	<36 or >38.5
≥ 6 yr–10 yr	>140	>30	<70 + (age in yr x 2)	<36 or >38.5
≥ 10 yr–13 yr	>100	>30	<90	<36 or >38.5
> 13 yr	>100	>16	<90	<36 or >38.5

VI. 2022 National Guideline for the Field Triage of Injured Patients

National Guideline for the Field Triage of Injured Patients

RED CRITERIA

High Risk for Serious Injury

Injury Patterns	Mental Status & Vital Signs
• Penetrating injuries to head, neck, torso, and proximal extremities • Skull deformity, suspected skull fracture • Suspected spinal injury with new motor or sensory loss • Chest wall instability, deformity, or suspected flail chest • Suspected pelvic fracture • Suspected fracture of two or more proximal long bones • Crushed, degloved, mangled, or pulseless extremity • Amputation proximal to wrist or ankle • Active bleeding requiring a tourniquet or wound packing with continuous pressure	All Patients • Unable to follow commands (motor GCS < 6) • RR < 10 or > 29 breaths/min • Respiratory distress or need for respiratory support • Room-air pulse oximetry < 90% Age 0–9 years • SBP < 70mm Hg + (2 x age years) Age 10–64 years • SBP < 90 mmHg or • HR > SBP Age ≥ 65 years • SBP < 110 mmHg or • HR > SBP

Patients meeting any one of the above RED criteria should be transported to the highest-level trauma center available within the geographic constraints of the regional trauma system

YELLOW CRITERIA

Moderate Risk for Serious Injury

Mechanism of Injury	EMS Judgement
• High-Risk Auto Crash – Partial or complete ejection – Significant intrusion (including roof) • >12 inches occupant site OR • >18 inches any site OR • Need for extrication for entrapped patient – Death in passenger compartment – Child (Age 0–9) unrestrained or in unsecured child safety seat – Vehicle telemetry data consistent with severe injury • Rider separated from transport vehicle with significant impact (eg, motorcycle, ATV, horse, etc.) • Pedestrian/bicycle rider thrown, run over, or with significant impact • Fall from height > 10 feet (all ages)	Consider risk factors, including: • Low-level falls in young children (age ≤ 5 years) or older adults (age ≥ 65 years) with significant head impact • Anticoagulant use • Suspicion of child abuse • Special, high-resource healthcare needs • Pregnancy > 20 weeks • Burns in conjunction with trauma • Children should be triaged preferentially to pediatric capable centers If concerned, take to a trauma center

Patients meeting any one of the YELLOW CRITERIA WHO DO NOT MEET RED CRITERIA should be preferentially transported to a trauma center, as available within the geographic constraints of the regional trauma system (need not be the highest-level trauma center)

Note: “Low-level” refers to less than 10 feet including ground level falls

Source: The American College of Surgeons Committee on Trauma (ACS COT), 2022

VII. EMS System Destination Policy

- I. Purpose
 - A. To provide guidelines for ambulance destination decision for calls other than interfacility transfers, within the city of Sioux Falls.
- II. Trauma Patients
 - A. Trauma meeting trauma activation criteria (see Trauma Activation Policy) and open or angulated fractures must be transported to a verified trauma center. A senior paramedic may also elect to divert to a verified trauma center based on his/her assessment of potentially serious trauma or mechanism.
 - B. Transport to the verified trauma center of the patient's choice, or if the patient has no preference, transport as follows:
 - 1. East of Minnesota Avenue—Avera McKennan Hospital and University Medical Center
 - 2. West of Minnesota Avenue—Sanford USD Medical Center
- III. Acute Stroke
 - A. Stroke Alert Criteria: Stroke (CVA)
 - B. Transport to the Primary Stroke Center or higher of the patient's choice, or if the patient has no preference, transport as follows:
 - 1. East of Minnesota Avenue—Avera McKennan Hospital and University Medical Center
 - 2. West of Minnesota Avenue—Sanford USD Medical Center
- IV. Cardiac Patients
 - A. Stable (ECG changes, signs/symptoms consistent with ACS)
 - 1. Transport to the acute care hospital of the patient's choice, or if the patient has no preference, transport as follows:
 - a. East of Minnesota Avenue and North of 41st Street—Avera McKennan Hospital and University Medical Center
 - b. West of Minnesota Avenue and North of 41st Street—Sanford USD Medical Center
 - c. South of 41st Street—Avera Heart Hospital—Avera Heart Hospital of South Dakota
 - B. Unstable (ECG changes consistent with STEMI, STEMI Alert, Post cardiac arrest resuscitation of suspected cardiac etiology), unstable/symptomatic rhythms, external pacer, intubated)
 - 1. Transport to the acute care hospital of the patient's choice, either Sanford USD Medical Center or Avera Heart Hospital of South Dakota, or if the patient has no preference, transport as follows:
 - a. South of 41st Street—Avera Heart Hospital of South Dakota
 - b. North of 41st Street—Sanford USD Medical Center
- V. Pregnancy (Pregnancy related complications > 20 weeks gestation or active labor)
 - A. Transport to the acute care hospital with OB/GYN services of the patient's choice, or if the patient has no preference, transport as follows:
 - 1. East of Minnesota Avenue—Avera McKennan Hospital and University Medical Center
 - 2. West of Minnesota Avenue—Sanford USD Medical Center

VI. Other Patients

- A. Transport the patient to the emergency department of their choice, or if the patient has no preference, transport as follows:
 - 1. Avera McKennan Hospital and University Medical Center if East of Minnesota Avenue and West of Sycamore Avenue
 - 2. Sanford USD Medical Center if West of Minnesota Avenue and East of I-29
 - 3. Avera ED West if West of I-29
 - 4. Avera ED East if East of Sycamore Avenue

VII. Other Considerations

- A. If unable to ventilate or intubate, senior paramedic can elect to divert to closest emergency department
- B. Multiple patients transported in the same ambulance must be transported to the same hospital. This takes priority over an individual patient's preferred destination. If the patients prefer differing hospital, follow the guidance above to determine the destination as appropriate. Inform the patients that they can later be transferred to their hospital of choice.
- C. Avera Behavioral Health Center (ABHC) Transports
 - 1. For transfers to ABHC, contact ABHC Security (322-5909) Use the dedicated entrance.
 - 2. Transfer care to nursing staff and document on the PCR. When transporting a patient from ABHC to another facility, go to the sending ABHC unit and receive medical information and any hard copy information from unit staff prior to transporting the patient.
- D. The senior paramedic may use discretion in destination decisions because of traffic, weather, road conditions or other unforeseen circumstances. Document on the PCR. Online Medical Control may be contacted for destination issues.
- E. For law enforcement holds and arrests, follow guidance above for Cardiac, Stroke, Pregnancy, Trauma, and Behavioral Health, with these additional considerations:
 - 1. For patients on a law enforcement emergency mental health hold, the law enforcement officers will determine the destination. They should, when able, consider the patient's preferences (preferred doctor, religious preferences, insurance network, etc.).
 - 2. For patients under arrest, transport to the medical facility of the law enforcement officer's choosing.

VIII. EMS System Certification Policy

- I. Purpose
 - A. To provide for the establishment of minimum standards to be met by those providing care in the Sioux Falls Regional EMS system, so as to promote the health and safety of the people of the region
 - B. Certification is required for all EMS providers to provide patient care within the system. Loss of certification equates with the loss of privilege to practice. See Incident Investigation and Management Policy
- II. Requirements for initial certification and biannual recertification for all providers
 - A. Successful completion of provider-specific requirements as listed in IV below
 - B. Background check completed by the hiring agency as well as the state certifying or licensing agency prior to initial certification
 - C. Once certified, the provider must notify the Medical Board of any felony charges or convictions, or charges or convictions in another jurisdiction that would constitute a felony in South Dakota. See Incident Investigation and Management Policy
 - D. Application for certification must be made in writing to the Medical Director, and must include proof that all prerequisites are met, as well as a recommendation for certification by the agency's trainer/FTO
 - E. Recommendation of the Medical Director and approval of the Medical Board
- III. Requirements for specific providers in addition to II, above:
 - A. Emergency Medical Dispatcher
 - 1. Initial certification and recertification requires current BLS for Healthcare Providers or Heartsaver certification (or equivalent) and IAEMD certification
 - 2. Recertification requires completion of continuing education as specified in the EMD policy
 - 3. Completion of requirements for provisional certification as specified in Metro Communications' Medical Priority Dispatch Certification Policy
 - B. First Responder - Police
 - 1. Initial certification requires completion of Medical Board approved first aid course including current BLS for Healthcare Providers or Heartsaver AED certification (or equivalent)
 - 2. Recertification requires current CPR and first aid training
 - C. EMT First Responder
 - 1. Initial certification and recertification requires
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Recommended: current ITLS/PHTLS certification (or equivalent)
 - D. EMS Driver
 - 1. Initial certification requires
 - a. Successful completion of a state approved course to demonstrate competencies in CPR, AED, HIPAA, infection control, patient movement, equipment, communications systems, and emergency vehicle operations
 - b. Ambulance Driver certification from the STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS
 - E. EMT Ambulance
 - 1. Initial certification and recertification requires
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure.
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Recommended: current ITLS/PHTLS certification (or equivalent)
 - F. Advanced EMT
 - 1. Initial certification
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)

- c. Current ITLS/PHTLS certification (or equivalent)
 - d. Successful completion of an oral exam administered by the Medical Director
 - e. Successful completion of an approved field training program including a written guidelines test and skills validation (submit documentation to REMSA)
 - f. Successful completion of skills validation program
- 2. Recertification
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Current ITLS/PHTLS certification (or equivalent)
 - d. ALS skills competence at level of certification as evidenced by skills validation and CQI
- G. Paramedic
 - 1. Initial certification
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Current ITLS/PHTLS certification (or equivalent)
 - d. Current ACLS certification (or equivalent)
 - e. Current PALS certification (or equivalent)
 - f. Successful completion of an oral exam administered by the Medical Director
 - g. Successful completion of an approved classroom and field training program including a written guidelines test and skills validation (submit documentation to REMSA)
 - 2. Recertification
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Current ITLS/PHTLS certification (or equivalent)
 - d. Current ACLS certification (or equivalent)
 - e. Current PALS certification (or equivalent)
 - f. ALS skills competence as evidenced by skills validation and CQI
- H. Senior Paramedic
 - 1. Initial certification
 - a. Current certification as a Paramedic within the system
 - b. Successful completion of an approved senior paramedic field training program (submit documentation to REMSA)
 - c. A written request from the employer that includes an assessment of the candidate's clinical and leadership skills
 - d. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - e. Current BLS for Healthcare Providers certification (or equivalent)
 - f. Current ITLS/PHTLS certification (or equivalent)
 - g. Current ACLS certification (or equivalent)
 - h. Current PALS certification (or equivalent)
 - i. Successful completion of an exam administered by the Medical Director
 - 2. Recertification
 - a. STATE BOARD OF MEDICAL AND OSTEOPATHIC EXAMINERS licensure
 - b. Current BLS for Healthcare Providers certification (or equivalent)
 - c. Current ITLS/PHTLS certification (or equivalent)
 - d. Current ACLS certification (or equivalent)
 - e. Current PALS certification (or equivalent)
 - f. ALS skills competence as evidenced by skills validation and CQI
- I. Critical Care Paramedic
 - 1. Initial certification
 - a. Current Senior Paramedic certification
 - b. Current FP-C or CCP-C certification
 - c. Recommendation of the REMSA Medical Director and Employer

2. Recertification
 - a. Current FP-C or CCP-C certification
 - b. Senior Paramedic requirements
- IV. Skill Validation, Training and Continuing Education for paramedics in RSI approved services
 - A. Annual skill validation to include proficiency in the following areas:
 1. Drug-Assisted Intubation
 2. Surgical Cricothyrotomy with the use of pig necks
 3. Needle Cricothyrotomy
 4. Chest Decompression
 5. Intraosseous Lines
 6. Endotracheal Intubation (Adult, Child and Infant)
 7. End-tidal CO₂ Monitor
 8. Cardiac Monitoring, 12 lead EKG's and STEMI Recognition
 9. Supraglottic Airways
 10. CPAP
- V. Certification Process
 - A. Notice of Certifications to be considered by the REMSA Medical Board will be given by posting the candidates name and certification sought on the REMSA Medical Board Meeting Agenda. Candidates may appear before the Medical Board if they wish
 - B. The Medical Director will present the candidate's credentials and test results, if applicable, to the Medical Board, along with his recommendation for certification or denial of certification
 - C. If certification is not recommended by the Medical Director, the candidate will be notified of that fact in writing at least 7 days prior to the Medical Board meeting at which their certification will be considered. The candidate may appear before the Medical Board to provide information
 - D. The Medical Board may grant or deny certification or may ask for further information before ruling. The Medical Board may request that the candidate appear before the Medical Board to provide information
 - E. Appeal Process
 1. Denial of certification by the Medical Board will be communicated to the individual in writing and will state the reason for the denial. Copies will be given to the employer and the Executive Director of REMSA
 2. An individual or agency may appeal the denial of certification to REMSA by filing a written request with the Executive Director within 7 days of receipt of notification of denial of certification
 3. REMSA will hold a hearing within 7 days of receipt of a written request to appeal a decision on certification. After a hearing, REMSA may affirm the Medical Board's decision, remand for further proceedings, or reverse and remand if the Medical Board's decision is found to be clearly erroneous in light of the entire evidence, or arbitrary, or capricious, or an abuse of discretion
 4. A REMSA decision may be appealed following the city of Sioux Falls appeal process
 5. In the event of an appeal, the decision of the Medical Board is in effect until the completion of the appeals process
- VI. Revocation of Certification—see Incident Investigation and Management Policy

IX. Active Violence Incident Response and Mass Casualty Incidents



Standard Operating Procedures

Sioux Falls Fire Rescue

Effective July 31, 2024

Saving Lives, Protecting Property SOP 801.6

Subject: Active Violence Incident Response and Mass Casualty Incidents

To propose changes to this policy contact: Division Chief of Operations

I. Purpose:

- A. To establish procedures for the safe and effective management of civilian casualties resulting from an active shooter engaged in the process of killing or attempting to kill other people. These procedures apply to active crime scenes and may take place in any geographical area or structure. The safety and effectiveness of Fire/EMS resources responding to these incidents depends on integration and coordination with law enforcement (LE).

II. General Instructions:

- B. The use of the National Incident Management System (NIMS) Incident Command System (ICS) will be used with one Incident Command Post (ICP) and common terminology. Fire and police terms, shall be determined prior warm zone deployment. (e.g., zone definitions, force protection, cover, cleared, secured, etc.)

- A. Ongoing training between SFFR and SFPD is necessary to ensure each agency and its members are prepared and equipped to work within the warm zone to further enhance patient/victim survivability.
- B. SFFR will use the THREAT principles in our integrated response with LE and in the actions set forth for warm zone care.

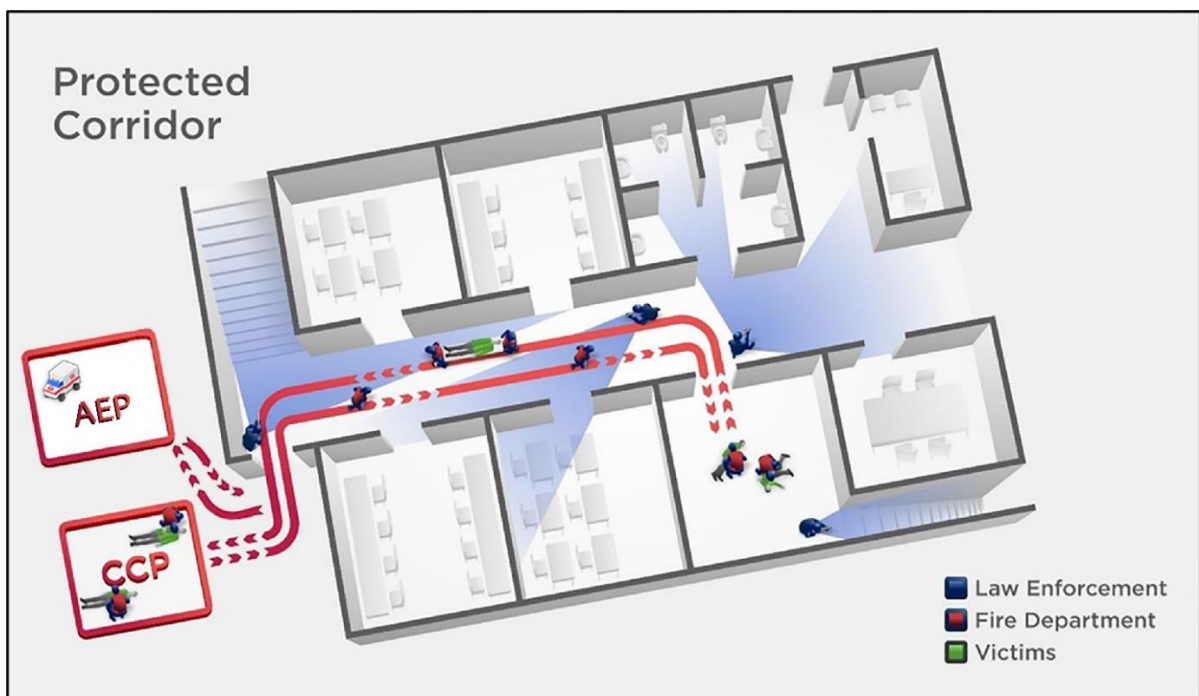
T—Threat suppression
H—Hemorrhage control
RE—Rapid Extrication to safety
A—Assessment by medical providers
T—Transport to definitive care

- C. All Fire and EMS operations in the crime scene, i.e., Hot Zone, Warm Zone and Cold Zone will be under the authority and protection of LE personnel with the following priorities:
- Establish unified command (Face to Face Communication): As soon as possible after arrival of initial unit(s) from each jurisdictional agency.
 - Initiate point of wounding care: As soon as possible
 - Initiate evacuation and transport of critical victim(s):
 - Complete of transportation of all critical victim(s). Treatment and care of non-critical patients
 - Transport of non-critical patients
- D. **Warm Zone Care:** A joint effort by on scene LE and fire personnel to provide immediate care to injured patients at the point of wounding, within a warm zone. The 4 Types of Warm Zone Care:

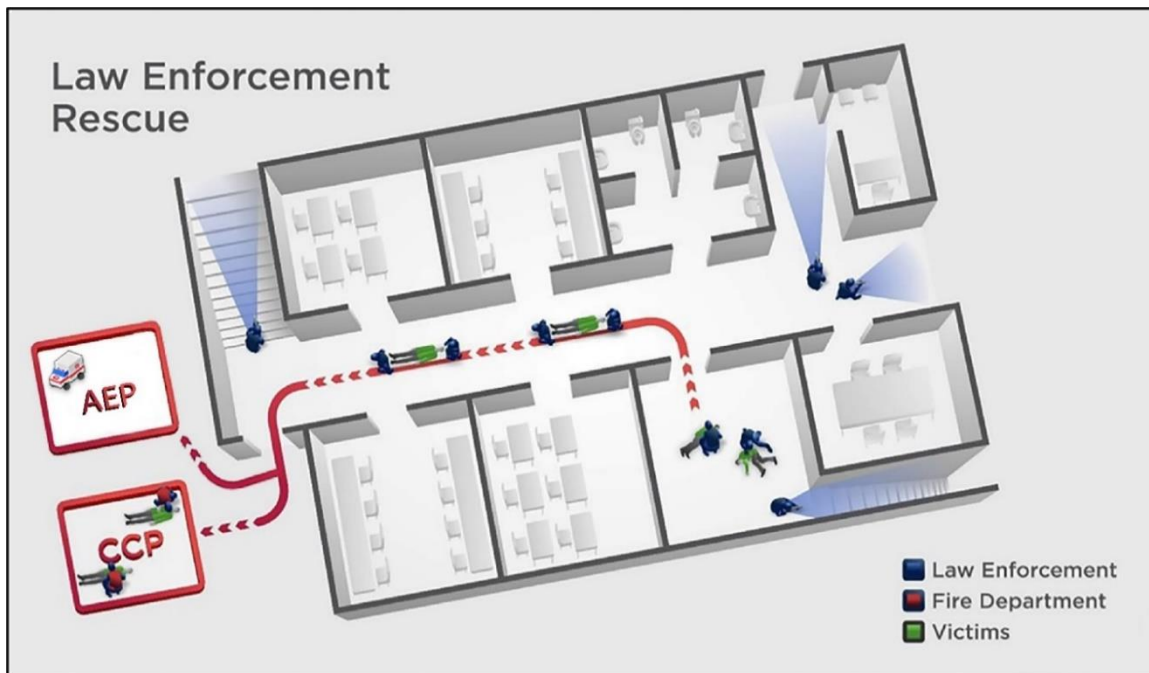
1. **Rescue Task Force:** RTF is a set of teams deployed to provide point of wound care to victims where there is an ongoing ballistic or explosive threat. These teams treat, stabilize, and remove the injured in a rapid manner under the protection and direction of LE officers.



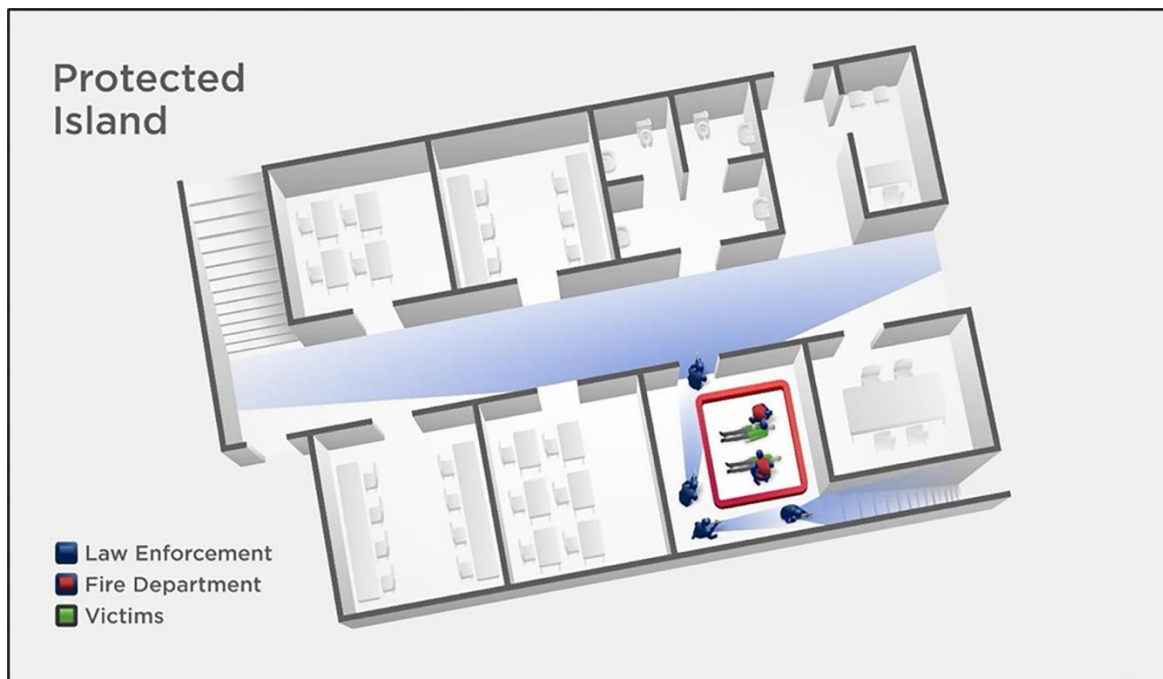
2. **Protected Corridor:** A pathway secured by LE officers for the purpose of allowing unescorted Fire/EMS entry into the warm zone.



3. **Police Rescue:** Immediate medical care provided by LE officers on scene at the point of wounding. Police Rescue should coincide with the basic tenets of TCCC.



4. **Protected Island:** An interior casualty collection point secured by LE officers within the warm zone. LE officers conduct rescue operations to move patients from unprotected areas to the Protected Island.



- E. When available, each member operating in an Active Violent Incident should be equipped with a Kevlar helmet, body armor, flash light, radio, and exam gloves.
- F. UC should consider IED or other secondary devices. Threat zones must also be identified by the UC. Threat zones include the following:
 - 1. Hot Zone- Area where there is a known hazard or direct and immediate life threat. (i.e., any uncontrolled area where an “active shooter” could directly engage). **SFFR personnel will not be deployed into Hot Zones.**
 - 2. Warm Zone- Area of indirect threat (i.e. an area where LE has either cleared or isolated the threat to a level of minimal or mitigated risk). This area can be considered not secure but clear.
 - 3. Cold Zone- Areas where there is little or no threat, due to geographic distance from the threat or the area has been secured by LE (i.e., the area where SFFR may stage to triage, treat, and transport patient/victims once removed from the warm zone).
- G. In a Warm Zone deployment, Fire personnel should secure a Casualty Collection Point when deemed necessary. The decision to form a CCP may be dependent on a high concentration of patients found at certain physical locations within an area or structure by initial contact teams..
 - 1. Considerations for CCP locations:
 - a. Any location where multiple patients are found or located in close proximity to one another.
 - b. Proximity to evacuation assets
 - c. Proximity to evacuation routes, to include non-traditional avenues such as aerial device access to an elevated location or floor within a building.
 - d. Patient and provider flow.
 - e. Ability to secure the location if possible and necessary.
 - f. Ensure proper and adequate personnel are available.
 - g. Ensure adequate medical and evacuation supplies are readily available.
- H. All injuries in an Active Violent Incident should be treated using the Tactical Emergency Casualty Care (TECC) guidelines. Any patient/victim who can ambulate without assistance should be directed by the team to self-evacuate down the cleared corridor under police direction, and any victim who is dead should be visibly marked to allow for easy identification and to avoid repeated evaluations by additional personnel.
- I. TECC provides a framework to prioritize medical care while accounting for ongoing high-risk operations and focuses primarily on the intrinsic tactical variables of ballistic and penetrating trauma compounded by the prolonged evacuation times. (Using the right interventions at the right time).
- J. TECC is applied in 3 phases as defined by the dynamic relationship between the provider and the threat.
 - 1. Direct Threat (Hot zone)
 - 2. Indirect Threat (Warm zone)
 - 3. Evacuation Care (Cold zone)
- K. RTF teams will work under the indirect threat phase, where care is rendered once the casualty is no longer under a direct and immediate threat.

X. EMS System Call Reprioritization and Cancellation Policy

I. Purpose

- A. To provide guidelines for first responder and ambulance reprioritization and cancellation decisions.

II. Procedure

- A. For moving medical calls, if the caller refuses to stop, Metro will not dispatch responders unless special circumstances exist. In life threatening situations, the call taker shall stay on the phone (if able) until the patient reaches a hospital or is willing to stop. Call takers may direct drivers to nearest fire station.
- B. If responders are not yet on scene and the caller decides to leave and transport themselves or the patient to the hospital, responders can be cancelled if it is confirmed that the patient has left the scene.
- C. If responders are not yet on scene and Metro Communications receives updated information from a 9-1-1 caller that the original report of an ill or injured person is false, responders can be canceled. Updated information can also be used to re-prioritize the call if indicated.
- D. The first responder on scene (Police, Fire Rescue or Ambulance) will notify Metro Communications if the report of an ill or injured patient proves to be false so that other responders may be canceled.
- E. If there is a patient, the first responder on scene (Police, Fire Rescue or Ambulance) will provide a SEND update (see III below). Metro Communications may use that information to re-prioritize the call if indicated.
- F. If responders find that the patient has left or is leaving the scene (including being transported by police), notify Metro Communications so that other responders can be canceled.
- G. If additional resources will be needed, request via Metro Communications.
- H. After assessment, Sioux Falls Fire Rescue may cancel ambulance response when there is no patient or if the injury or illness is very minor and an adult is refusing treatment and transport.
- I. After assessment, the ambulance senior paramedic may cancel or downgrade first responders if appropriate.

J. Obvious Death

1. On a P1 Cardiac Arrest, if the first EMS unit on scene (SFFR or PCEMS) determines it is an obvious death, they should pronounce the death and notify Metro who will then cancel whichever agency is not yet on scene. Be sure to notify PD and that someone notifies the coroner.
2. If a P3 Cardiac arrest comes in when PCEMS is at Level 0 or Level 1, Metro will send SFFR (no need to wait 10 minutes). SFFR can pronounce the death and PCEMS can be cancelled. Be sure to notify PD and that someone notifies the coroner. (If SFFR is experiencing system overload, a P3 obvious death call can hold for an available SFFR or PCEMS unit.)

III. SEND Update (Secondary Emergency Notification of Dispatch)

- A. A complete and accurate SEND update is crucial to appropriate prioritization or reprioritization of EMS calls in our system. A SEND update should be provided to dispatch each time you make patient contact on a call. The SEND update should be based on the following 7 criteria. Avoid using terms such as "use mi" or "sort of" when describing patient condition.
1. Chief complaint and incident type?
 - a. Is there more than one person injured?
 2. Approximate age?
 3. Conscious: Yes/No
 - a. Alert?
 4. Breathing: Yes/No
 - a. Any difficulty?
 5. Is there chest pain also?
 6. Is there serious bleeding? (spurting/pouring out)
 7. Do you need a lights-and-sirens response? (optional)

XI. Patients Requesting Transport to the VA

- I. In general, patients in need of advanced life support measures should be transported to an emergency department with critical care admission capability.
- II. The following categories of patients should NOT be transported to the VA Hospital:
 - A. Patients with STEMI
 - B. Patients in cardiac arrest or with unstable cardiac rhythms:
 1. Asystole
 2. Ventricular fibrillation
 3. Ventricular tachycardia
 - C. Patients in need of an urgent/emergent airway, for example a patient who has been intubated in the field or who needs a secured airway and attempts in the field have been unsuccessful.
 - D. Multiple trauma patients.
 - E. Patients with life or limb threatening injuries.
 - F. Patients with extensive burns.
 - G. Patients with acute focal neurologic deficits or serious head injury.
 - H. Pregnant women.
 - I. Patients with gynecologic emergencies.
 - J. Victims of alleged sexual assault.
- III. For patients who do not have the conditions in II above, and who request transport to the VA, call the VA at (605) 373-4005. The VA ED physician will discuss the patient with EMS and make the decision to accept.
- IV. Patients who refuse to be transported unless taken to the VA but are in need of advanced life support, and do not fall into one of the categories in II above, may be treated per the Sioux Falls REMSA protocols. If orders are needed beyond the REMSA protocols, the patient should be transported to an acute care hospital. If patient refuses, contact on-line Medical Control.

XII. Protocol for Assessment and Transportation to the Link

I. Purpose

- A. To identify individuals that meet criteria for transport to the.

II. Procedure

- A. An individual who is suspected to be intoxicated, has substance use issues and/or an acute mental illness crisis and no other emergency medical need(s) may be transported to the Link if the following criteria are met:
 - 1. Not actively suicidal (suicidal definition: individual makes suicidal statement with intent, method, and/or plan to kill self)
 - 2. Not on a Mental Health Hold
 - 3. Age 18 or older
 - 4. No acute medical conditions or wounds needing sutures
 - 5. No trauma to head/face/scalp
 - 6. Restraints or sedation are not required
 - 7. Able to ambulate with assistance of 1 or 2
 - 8. If EMS assessed, acceptable vital signs
 - a. Pulse 50-110
 - b. Systolic BP 90-190
 - c. Diastolic BP 50-100
 - d. Respiratory Rate 8-24
 - e. Blood glucose 60-250
 - f. GCS > 12
 - g. Pulse Ox >92% (90% if a smoker)
 - 9. If there is any doubt whether the individual is in need of emergency medical care, Law Enforcement or EMS should transport to an Emergency Department.
 - 10. An individual who is released from EMS to Law Enforcement for transport to the Link does not need to sign a refusal.
- B. Violent or threatening individuals may be diverted directly to the jail by Law Enforcement. Link staff may also divert to jail after initial assessment.
- C. Overflow
 - 1. When The Link is out of beds, staff will notify Metro Communications and will notify again when beds are available.
 - 2. If Law Enforcement or EMS are on scene with an individual who would normally go to the Link but they are out of beds, transport to an emergency department.
 - 3. Overflow walk-in patients will be medically assessed by Link Staff and if cleared will be transported to an Emergency Department by Avera Security. Transportation will be by Law Enforcement to the jail if the patient is violent or threatening. If a medical condition warrants EMS transportation EMS will be called to transport to an Emergency Department

Version 1.01

Approved by SFREMSA Medical Board 2021-04-08

Adopted by SFREMSA 2021-04-28

XIII. Transfer of Care Policy

This protocol defines the requirements for completing the ALS EMS Patient Care Report either by the electronic Patient Care Reporting System (PCR) or by paper forms and the transfer of patient records and belongings between EMS clinicians and hospital personnel.

- I. Transfer of Patient Care—First Responder to Ambulance
 - A. When patient care is transferred from one unit to another unit (i.e. first responder to ambulance) a verbal report shall be provided including the history of present illness/injury, past medical history/medications/allergies, and treatments or interventions performed, and the proposed plan of care shall be provided.
 - B. Any paper documentation, available at the time of the transfer of patient care, shall be provided.
 - C. Transport shall not be delayed for report completion. First responders can electronically update and complete their PCR record after patient transport is initiated.
 - D. All interventions performed prior to arrival shall be documented in the transporting service's PCR.
- II. Transfer of Patient Care—Ambulance to Hospital
 - A. See Communications Policy for online medical control and radio report.
 - B. When patient care is transferred from the ambulance to the hospital, a verbal report, including the history of present illness/injury, past medical history/medications/allergies, and treatments or interventions performed shall be provided to the RN or MD.
 - C. Patient placement assignment is the responsibility of hospital personnel.
 - D. Ambulance units shall be made available a completed PCR within 24 hours.

XIV. Refusal of Care Policy

- I. Whenever an ambulance is requested and patient contact is made, it is the purpose of the EMS system to treat and transport that patient with his/her consent. Treatment and/or transport by ambulance should always be offered to a patient.
- II. Policy
 - A. If care is refused, EMS personnel should attempt to assess the patient for severity of illness or injury.
 - B. If the senior paramedic believes that treatment and ambulance transportation are necessary, due to the severity or the illness or injury, and the patient (or responsible adult) is refusing treatment or transportation, the paramedic must assess the patient (or responsible adult) for mental competence.
 - C. Mentally competent adults (18 years of age or older) are allowed by law to refuse care or ambulance transport for themselves, regardless of the severity of their illness or injury.
 - D. A person is mentally competent if (s)he:
 1. Appears to understand the benefits of treatment and/or transportation and the risks of refusal, AND
 2. Appears to understand the potential consequences of his/her decision, AND
 3. Is able to communicate his/her decision
 - E. When a patient or responsible party refuses transport or care that the senior paramedic believes is necessary, it is the responsibility of the senior paramedic to:
 1. Assess the patient.
 2. Assess the competence of the patient (or responsible adult).
 3. Contact the appropriate supervisory, law enforcement and/or medical control personnel.
 4. Assure that the refusal is informed.
 5. Ask the patient (or responsible adult) to sign a Refusal of Care Form and obtain witnesses signatures.
 6. Carefully document patient assessment and instructions or advice regarding refusal of treatment.
 - F. If there is any doubt about the advisability of refusal of care, contact direct medical control.
 - G. QI Process
 1. Calls will be reviewed as part of the standard QI process. Forward any calls needing special review to the supervisor on duty and REMSA Medical Director.

XV. REMSA System Incident Investigation and Management Policy

I. Purpose

- A. To assure high quality prehospital care within the EMS system.
- B. To provide an opportunity for remediation and retraining of providers when necessary.
- C. To protect the public from unsafe prehospital care.
- D. To provide for due process in disciplinary decisions.

II. Definitions

- A. Emergency Medical Services: the full spectrum of health care provided to the patient, including bystander action, dispatch and pre-arrival instructions, first response service, ambulance services, transportation to and between medical facilities, on-line medical control, entry at the medical facility and quality assurance of the entire program.
- B. Probation: an individual provider's privilege to participate in patient care within the EMS system is restricted as stipulated for a specific period of time.
- C. Suspension: an individual provider's privilege to participate in patient care within the EMS system is withdrawn for a specific period of time.
- D. Revocation: an individual provider's privilege to participate in patient care within the EMS system is withdrawn permanently.

III. The Medical Director, at the direction of the Medical Board, is responsible for the quality of care given by prehospital providers, both individuals and agencies, within the EMS system. Class I incidents as specified below and variations from accepted practice will be reported to the Medical Director for possible action, which may include retraining, temporary suspension of certification, or permanent loss of certification as specified below.

- A. Incidents will be classified as Class I and Class II. See attached lists.

IV. Class I incidents

- A. When a report is made to the Medical Director which may be a Class I incident, the Medical Director will initiate an incident investigation form to establish if, in fact, there is sufficient evidence to suggest that any offense occurred and that it falls into the class I category.
- B. The Medical Director will then determine if there is sufficient cause to believe that the Emergency Medical Dispatcher, First Responder, EMT, Advanced EMT, or Paramedic involved in the incident was responsible for the offense.
- C. After his initial investigation and determination, the Medical Director will notify the head of the department employing the individual(s) involved. The Medical Director then may:
 - 1. Elect to close the case with no further action taken, with a report to the Medical Board.
 - 2. Suspend the individual's privilege to practice in the EMS system for a period of no longer than 72 hours or three shifts, AND/OR
 - 3. Place the individual on probation for a period of not more than 90 days, with notification within 7 days to the Medical Board, after which time the actions of the individual while on probation will be reviewed by the Medical Board. During the probationary period, the individual may be restricted as follows:
 - a. The individual will not be permitted to participate in direct patient care without the direct supervision or observation by senior or supervisory personnel not involved in the incident leading to the disciplinary action. Personnel supervising the individual shall complete an evaluation of the individual's performance for the Medical Board.
 - b. The individual will participate in prescribed remediation, the length and type to be determined by the Medical Board.
 - c. Both a and b above.
- D. The Medical Director will call a special meeting of the Medical Board within 10 days to review the case. The individual involved and the individual's department head will be

notified in writing of the action and given the opportunity to meet with the Medical Board and/or provide written documentation.

E. The Medical Board, after review, may

1. Close the case.
2. Continue the suspension until additional information is provided.
3. Place or continue the individual on probation for a period of not more than 90 days, after which time the actions of the individual while on probation will be reviewed by the Medical Board. During the probationary period, the individual may be restricted as follows:
 - a. The individual will not be permitted to participate in direct patient care without the direct supervision or observation by senior or supervisory personnel not involved in the incident leading to the disciplinary action. Personnel supervising the individual shall complete an evaluation of the individual's performance for the Medical Board.
 - b. The individual will participate in prescribed remedial training, the length and type of which to be determined by the Medical Board.
 - c. Both a and b above.
4. Impose a temporary suspension of the individual's privileges to practice in the EMS system, to be accompanied by prescribed remedial training, the length and type of which to be determined by the Medical Board, after which time the actions of the individual while on suspension will be reviewed by the Medical Board.
5. Impose a permanent revocation of the individual's privileges to practice in the EMS system.

V. Class II incidents

- A. When a report is made to the Medical Director which may be a Class II incident, the Medical Director will initiate an incident investigation form to establish if, in fact, there is sufficient evidence to suggest that any offense occurred and that it falls into the class II category.
- B. The Medical Director will then determine if there is sufficient cause to believe that the Emergency Medical Dispatcher, First Responder, EMT, Advanced EMT, Paramedic, or On-line Physician involved in the incident was responsible for the offense.
- C. After his initial investigation and determination, the Medical Director will notify the head of the department employing the individual(s) involved. The Medical Director then may:
 1. Elect to close the case with no further action taken, with a report to the Medical Board.
 2. Issue a warning letter to the individual with a copy to the employer.
 3. Place the individual on probation (as in IV.E.3.) until the Medical Board meets to review the case.

VI. Appeal Process

- A. All disciplinary actions will be communicated to the individual in writing and will state the reason for the action. Copies will be given to the employer and the Executive Director of REMSA.
- B. An individual or agency may request an appeal of a Medical Director decision to the Medical Board by filing a written request with the Executive Director within 7 days of receipt of the decision of the Medical Director.
- C. An individual or agency may request an appeal of the Medical Board's decision to the Commissioners of the Regional EMS Authority (REMSA), by filing a written request with the Executive Director within 7 days of receipt of the decision of the Medical Board.
- D. REMSA will hold a hearing within 7 days of the request for an appellate review. After a hearing, REMSA may affirm the Medical Board's decision, remand for further proceedings, or reverse and remand, if the Medical Board decision is found to be clearly erroneous in light of the entire evidence, or arbitrary, or capricious, or an abuse of discretion.

- E. A REMSA decision may be appealed following the City of Sioux Falls appeal process.
- F. In the event of an appeal, the decision of the Medical Board is in effect until the completion of the appeals process.

CLASS I Incidents

For all providers

- Misrepresentation of information in order to obtain certification
- Conviction of a felony, or a crime in another jurisdiction that constitutes a felony in South Dakota, or conviction of a crime which affects the provider's ability to continue to practice competently or safely
- Engaging in or permitting the performance of unacceptable patient care by himself or auxiliaries working under his supervision due to his deliberate or negligent act or acts or failure to act
- Continuing to practice although the provider has become unfit to practice his profession competently or safely. Examples could include professional incompetence, failure to keep abreast of current professional theory or practice, physical or mental disability, or addiction or severe dependency upon or use of alcohol or other drugs which endanger the public by impairing a provider's ability to practice safely
- Engaging in lewd or immoral conduct in connection with a delivery of emergency medical care to patients
- Employing, assisting or enabling in any manner an unlicensed or uncertified person to provide emergency medical services
- Failing to maintain adequate safety and sanitary conditions for the provision of emergency medical services in accordance with the standards established by the rules of the board
- Engaging in false or misleading advertising
- Willful neglect of a patient
- Abandonment of a patient, (recognizing that scene and provider safety may be a first priority)
- Being under the influence of any drug or intoxicant while on duty or while participating in patient care (each agency's policies for drug testing will be used, results to be provided to the Medical Director)
- Breach of confidentiality
- Intentional falsification of patient care records, or quality assurance or improvement records. More than 3 class II incidents, resulting from separate patient contacts, in a three month period
- Any other offense of similar severity not listed at the discretion of the Medical Director

Emergency Medical Dispatcher

- Failure to determine location
- Failure to determine consciousness
- Failure to determine breathing
- Failure to assign correct response code
- Failure to give correct instructions
- Failure to report hazards

Police First Responder

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions

First Responder EMT

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions
- Failure to follow AED SOG

Ambulance EMT

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions

Advanced EMT

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions

EMT Paramedic

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions

Paramedic

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions
- Failure to follow patient care guidelines without documented reason for deviation
- Failure to obey a legitimate on-line physician's order either by omission or commission in the presence of good communication

Senior Paramedic

- Actions that put patients, the public, or other providers at risk of illness or injury
- Failure to complete primary and secondary survey
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation

- Failure to implement spinal precautions
- Failure to follow patient care guidelines without documented reason for deviation
- Failure to obey a legitimate on-line physician's order either by omission or commission in the presence of good communication
- Failure to assume control of patient care situation, resulting in risk to patient or providers

Class II Incidents

- Failure of the individual to respond within 72 hours, without good cause, (excluding weekends and holidays) to a written request for information or documentation regarding an incident under investigation by the Medical Director or his designee
- Abuse of equipment
- Documentation errors
- Inadequate patient assessment
- Medication errors
- Failure to check equipment leading to an inability to communicate with medical control, inability to administer appropriate medications, or otherwise negatively affecting the ability of the individual to function at his/her level of certification
- Failure to appear before the Medical Director, Medical Board or REMSA when so requested
- Failure to show respect to patients or the public while on duty or while participating in prehospital care
- Improper or unprofessional radio conduct
- Improper or unprofessional conduct towards other EMS providers
- Other offenses similar in severity as determined by the Medical Director
- Incident Investigation/Management page 6
- Failure to recognize cardiac arrest or impending arrest
- Failure to administer O2 to patient with compromised respiratory status
- Failure to assure adequate airway, breathing, and/or circulation
- Failure to implement spinal precautions
- Failure to follow patient care guidelines without documented reason for deviation
- Failure to obey a legitimate on-line physician's order either by omission or commission in the presence of good communication
- Failure to assume control of patient care situation, resulting in risk to patient or providers

Class II Incidents

- Failure of the individual to respond within 72 hours, without good cause, (excluding weekends and holidays) to a written request for information or documentation regarding an incident under investigation by the Medical Director or his designee
- Abuse of equipment
- Documentation errors
- Inadequate patient assessment
- Medication errors
- Failure to check equipment leading to an inability to communicate with medical control, inability to administer appropriate medications, or otherwise negatively affecting the ability of the individual to function at his/her level of certification
- Failure to appear before the Medical Director, Medical Board or REMSA when so requested
- Failure to show respect to patients or the public while on duty or while participating in prehospital care
- Improper or unprofessional radio conduct
- Improper or unprofessional conduct towards other EMS providers
- Other offenses similar in severity as determined by the Medical Director

XVI. BLS Transfer Policy

I. Purpose

- A. To safely transport patients in an interfacility setting utilizing Basic Life Support (BLS) Ambulances. This document will serve as guidance for identifying and transporting these patients while adhering to a quality care.

II. Policy

- A. An interfacility transport may be completed by a BLS ambulance unless any of the following criteria are met:

Airway	Patient requires airway management beyond simple suctioning. Patient requires airway monitoring due to recent compromise or any potential impending compromise.
Breathing	Patient requires respiratory/ventilation assistance beyond supplemental oxygen. Patient requires respiratory monitoring beyond SPO2 (i.e., ETCO2).
Cardiac	Patient requires continuous cardiac monitoring. Patient has recently, within the last 24 hours, experienced an arrhythmia, ACS, or other significant cardiac event.
Disability and drugs	Patient may require pain medication during transport. Patient requires seizure management or has had recent seizure activity within 24 hours. Patient requires chemical sedation. Patient has any fluids or medications running that will continue during transport. (Note that BLS units may transport IV catheters and central IV lines as long as they are capped off and do not have any fluids being administered.)
Exam	The BLS provider will conduct an exam upon arrival, and if, in their opinion, the patient cannot be safely managed within their scope of practice, an ALS unit will be dispatched to conduct the transport.

III. Special Circumstances

- A. BLS ambulances may be used to respond to and transport other types of patients during disaster, EMS Emergencies, or other special circumstances as approved by the REMSA medical director and PCEMS.

IV. Requesting Assistance

- A. Should a patient deteriorate to the point of needing ALS intervention and care, the EMT shall immediately notify Metro Communications. If the ambulance is within 5 minutes of an emergency room, they will upgrade to priority 1 and proceed to that facility. If the ambulance is outside of that transport time, Metro Communications will coordinate an ALS intercept in which the ALS unit will conduct further care and transport.
- B. Should a BLS ambulance come across an emergency, they will immediately notify Metro Communications and may render care at a BLS level until responding units arrive. At no time should a patient be left alone in the patient compartment.