



Shock

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

Aliases

None noted

Patient Care Goals

1. Initiate early fluid resuscitation and vasopressors to maintain/restore adequate perfusion to vital organs
2. Differentiate between possible underlying causes of shock 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 VIII. 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. Check lactate, if available (greater than 2 mmol/L is abnormal)
8. Establish IV access. If unable to obtain within two attempts or less than 90 seconds, place an IO needle
9. 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.
 - iii. If available, the administration of packed red blood cells or whole blood may be indicated for hemorrhagic shock
 - 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)
 - iii. If available, the administration of packed red blood cells or whole blood may be indicated for hemorrhagic shock
10. If there is a history of adrenal insufficiency, long-term steroid dependence, or fluid-refractory shock requiring vasopressors give:
 - a. Hydrocortisone succinate, 2 mg/kg (maximum 100 mg) IV/IM (preferred)
OR
 - b. Methylprednisolone 2 mg/kg IV (maximum 125 mg)
OR
 - c. Dexamethasone 0.6 mg/kg IV/IM (maximum dose of 16 mg)
11. Vasopressors (shock unresponsive to IV fluids) titrated to physiologic targets:
 - a. Cardiogenic, hypovolemic, obstructive shock and distributive shock:
 - i. Norepinephrine 0.05–0.5 mcg/kg/minute
 1. Preference in both neurogenic and infectious (sepsis) causes of distributive shock
 - ii. Epinephrine, 0.05–0.3 mcg/kg/minute
 1. Alternative to a drip, push dose epinephrine may be administered:
 - a. Prepare 10 mcg/mL by diluting 1 mL of epinephrine 0.1 mg/mL (1:10,000) in 9 mL of normal saline
 - b. Administer 0.01 mg/kg (0.1 mL/kg) up to a maximum single dose of 10 mcg (1 mL) q 3–5 minutes titrated to maintain goal MAP. An example is shown below:
 - 10 kg child receives 1 mL of the diluted epinephrine
 - 20 kg child receives 2 mL of the diluted epinephrine
 - 30 kg child receives 3 mL of the diluted epinephrine
 - iii. Dopamine, 2–20 mcg/kg/minute if norepinephrine or epinephrine is not available or for other specific causes of shock.
12. For anaphylactic shock, treat per the [Anaphylaxis and Allergic Reaction Guideline](#)
13. Provide advanced notification to the hospital
14. Consider empiric antibiotics for suspected septic shock if transport time is anticipated to be prolonged, if blood cultures can be obtained in advance, and/or EMS has coordinated with regional receiving hospitals about choice of antibiotic therapy
15. Antipyretics for fever – nonsteroidal anti-inflammatory agents are contraindicated in infants less than 6 months of age
 - a. Acetaminophen (15 mg/kg; maximum dose of 1000 mg)
 - b. Ibuprofen (10 mg/kg; maximum dose of 800 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, 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 VII. 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

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