Shock

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

Aliases

None noted

Patient Care Goals

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

Patient Presentation

Inclusion Criteria

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

Patient Management

Assessment

1. History
    a. History of GI bleeding
    b. Cardiac problems
    c. Stroke
    d. Fever
    e. Nausea and/or 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 and breathing (airway edema, rales, wheezing, pulse oximetry, respiratory rate)
    b. Circulation (heart rate, blood pressure, capillary refill; heart tones)
    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)
        - Neurogenic shock: bradycardia more common than tachycardia
    c. Hypovolemic
    d. Obstructive (e.g. pulmonary embolism, cardiac tamponade, tension pneumothorax)

Treatment and Interventions

1. Check vital signs.
2. Administer **oxygen** as appropriate for dyspnea or distress with a target of achieving 94-98% saturation for most acutely ill patients.
3. Apply ECG cardiac monitor
4. Pulse oximetry and $ETCO_2$ (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. 12-Lead ECG
7. Establish IV/IO access ***[AEMT].***
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 = [(2X diastolic) + (systolic]/3).
    1. Adult
        a. Physiologic target: MAP goal 65 mmHg
        b. 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. **[AEMT]**
        c. If available, the administration of packed red blood cells or whole blood may be indicated for hemorrhagic shock **[PARA-O]**
    2. Pediatric
        a. 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.
        b. 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) **[AEMT]**
        c. If available, the administration of packed red blood cells or whole blood may be indicated for hemorrhagic shock **[PARA-O]**
9. If there is a history of adrenal insufficiency, long-term steroid dependence, or refractory shock requiring vasopressors give:
    1. Assist with patient-prescribed stress-dose steroids
    2. -OR- **Methylprednisolone [PARA] 2mg/kg (Max 125mg) IV/IO**
10. Vasopressors (shock unresponsive to IV fluids): **Target Endpoints include: MAP greater than 65mmHg, Systolic Blood Pressure greater than 90mmHg, improved mentation, urinary output greater than 0.5mL/kg/hr, CVP 8-12mmHg**
    1. **Norepinephrine infusion** (preferred unless noted below) **[PARA]**

    a. **Adult: 0.025-3 mcg/kg/min IV/IO titrated to endpoints**
    b. **Pediatric: 0.1-2 mcg/kg/min IV/IO titrated to age appropriate BP/endpoints**
2. **Push Dose Epinephrine [PARA] 5–20 mcg (0.5 mL to 2mL) IV/IO every 3-5 minutes** Epinephrine [Push Dose Pressor] (mix 1ml of Epinephrine 1mg/10mL in 9ml of NS yielding a new mixture of 100 mcg in 10 ml = 10 mcg/1 mL)
3. **Epinephrine Infusion [PARA]**
    a. **Adult: 0.05-2 mcg/kg/min IV/IO OR 2-10mcg/min**
    b. **Pediatric: 0.05-2 mcg/kg/min IV/IO**
4. Neurogenic Shock:
    a. **Dopamine (preferred) 2-20mcg/kg/min IV/IO [PARA/Interfacility]**
5. Cardiogenic shock
    a. **Dobutamine [PARA/Interfacility] 0.5-1 mcg/kg/min IV/IO then titrate to effect 2-20 mcg/kg/min**. Adults: May increase up to 40mcg/kg/min per medical consultation
6. Anaphylactic shock, treat per the Anaphylaxis and Allergic Reaction guideline

11. Refractory Shock Considerations
    1. Consider adding **Epinephrine** for iontropic effects at 5-10 mcg/kg/min (fixed-dose, continue to titrate primary vasopressor)
    2. Consider Hypocalcemia as factor and treat with **Calcium** IV
    3. Consider stress dose steroid (**Methylprednisolone [PARA] 2mg/kg (Max 125mg) IV/IO)**
    4. Consider **Sodium Bicarbonate** in conjunction with Medical Consultation if below factors met
        a. Respiratory status allows for increased minute volume to eliminate CO2 -AND-
        b. pH less than 7.2 with Acute Kidney Injury -OR-
        c. pH less than 7.15 with lactic acidemia
12. Provide advanced notification to the hospital
13. Antipyretics for fever, if safe to take PO
    1. Acetaminophen [AEMT] Refer to Medication Protocol
    2. Ibuprofen [AEMT] Refer to Medication Protocol
14. Ketorolac IV/IM/IO as alternative to PO Antipyretics. Refer to Medication Protocol.

Patient Safety Considerations

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

Notes and Educational Pearls Key Considerations

- Early, aggressive IV fluid administration is essential in the treatment of suspected shock.
- Patients predisposed to shock include:
    - Immunocompromised (patients undergoing chemotherapy or with a primary or acquired immunodeficiency)
    - Adrenal insufficiency (Addison's disease, congenital adrenal hyperplasia, chronic or recent steroid use)
    - History of a solid organ or bone marrow transplant
    - Infants
    - Elderly
- 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 tachycardia child may be close to cardiovascular collapse.
- Hypotension indicates uncompensated shock, which may progress to cardiopulmonary failure within minutes.

Pertinent Assessment Findings

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

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

Quality Improvement

Associated NEMSIS Protocol(s) (eProtocol.01)

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

Key Documentation Elements

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

Performance Measures

- Percentage of patients who have full vital signs (HR, RR, BP, T, O2) 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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