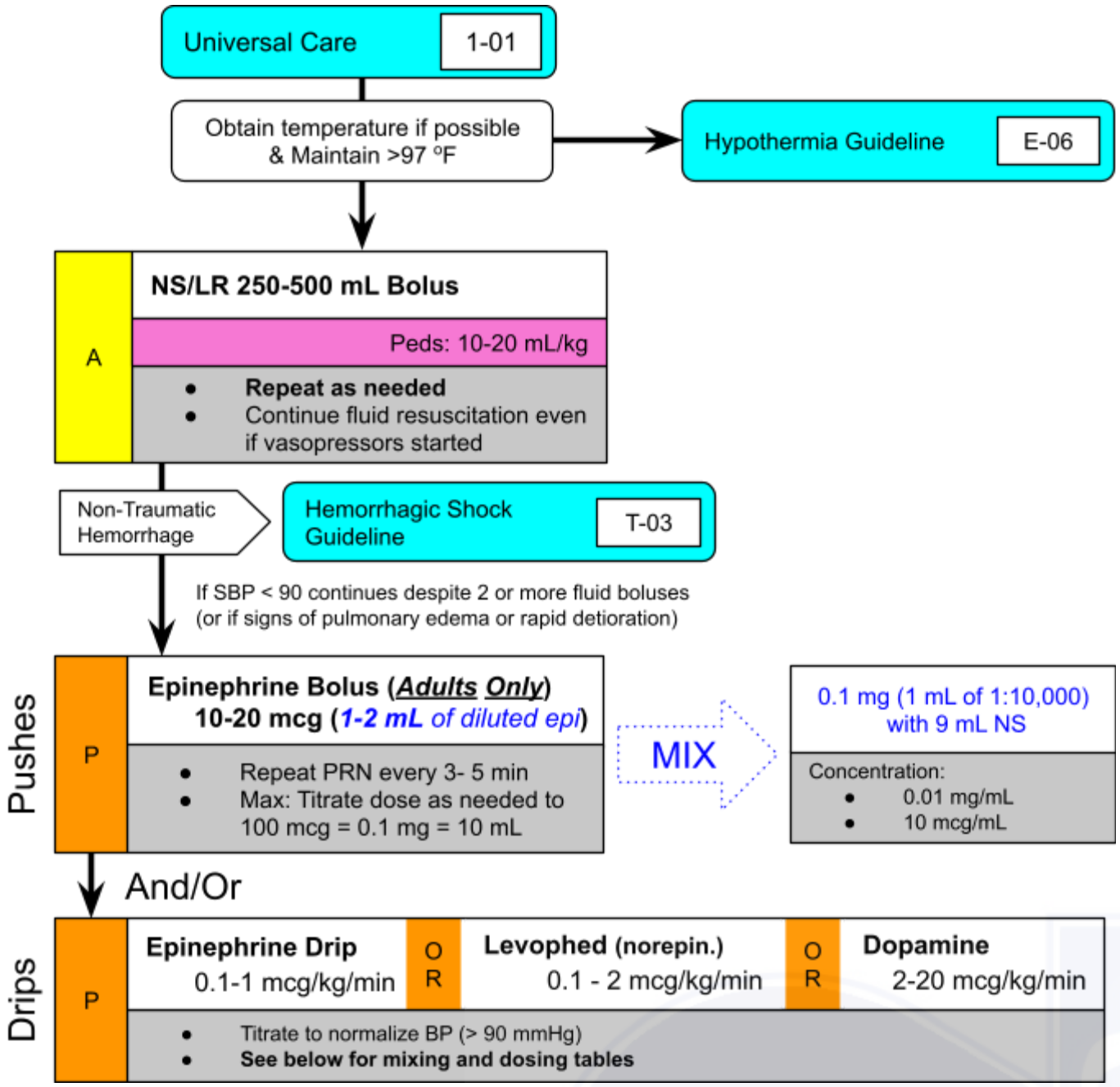
M-06 MEDICAL SHOCK		First Responder EMT AEMT Paramedic



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250 mL Vasopressor Drip Mixing Guide:

	Epinephrine 0.1 - 1 mcg/kg/min	Norepinephrine 0.1 - 2 mcg/kg/min	Dopamine 5 - 20 mcg/kg/min
Med/Dose:	1 mg	4 mg	400 mg
Volume (NS/D5W):	250 mL	250 mL	250 mL
Concentration:	**4 mcg/mL**	**16 mcg/mL**	**1600 mcg/mL**

Drops per minute (displayed in **BOLD**) on a 60-drop set
(*drops/second ALSO displayed in italics if > 60 gtt/min*)

	Epinephrine 4 mcg/mL		**Norepinephrine (Levophed)** 16 mcg/mL		**Dopamine** 1600 mcg/mL	
Broselow Color/ Weight (kg)	START (**gtt/min**)	Max (**gtt/min**)	START (**gtt/min**)	Max (**gtt/min**)	START (**gtt/min**)	Max (**gtt/min**)
Gray (3-5)	**6**	**60**	**1.5**	**30**	**0.8**	**3**
Pink (6-7)	**11**	**105** (*1.7*)	**2.6**	**52.5**	**1.3**	**5**
Red (8-9)	**14**	**135** (*2.2*)	**3.5**	**67.5** (*1.1*)	**1.7**	**6.7**
Purple (10-11)	**17**	**165** (*2.7*)	**4**	**82** (*1.4*)	**2**	**8.2**
Yellow (12-14)	**21**	**210** (*3.5*)	**5**	**105** (*1.7*)	**2.6**	**10.5**
White (15-18)	**27**	**270** (*4.5*)	**7**	**270** (*4.5*)	**3.4**	**13.5**
Blue (19-23)	**35**	**345** (*5.8*)	**9**	**172** (*2.8*)	**4.3**	**17**
Orange (24-29)	**44**	**435** (*7.2*)	**11**	**218** (*3.6*)	**5.4**	**22**
Green (30-36)	**54**	**540** (*9*)	**14**	**270** (*4.5*)	**7**	**27**
Small Adult (50)	**75** (*1.2*)	**750** (*13*)	**19**	**375** (*6.2*)	**10**	38
Large Adult (100)	**150** (*2.5*)	**1500** (*25*)	**38**	**750** (*13*)	**19**	75 (*1.2*)

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500 mL Vasopressor Drip Mixing Guide:

	Epinephrine 0.1 - 1 mcg/kg/min	Norepinephrine 0.1 - 2 mcg/kg/min	Dopamine 5 - 20 mcg/kg/min
Med/Dose:	1 mg	4 mg	400 mg
Volume (NS/D5W):	500 mL	500 mL	500 mL
Concentration:	**2 mcg/mL**	**8 mcg/mL**	**800 mcg/mL**

Drops per minute (displayed in **BOLD**) on a 60-drop set
(*drops/second ALSO displayed in italics if > 60 gtt/min*)

	Epinephrine 2 mcg/mL		**Norepinephrine (Levophed)** 8 mcg/mL		**Dopamine** 800 mcg/mL	
Broselow Color/ Weight (kg)	START (**gtt/min**)	Max (**gtt/min**)	START (**gtt/min**)	Max (**gtt/min**)	START (**gtt/min**)	Max (**gtt/min**)
Gray (3-5)	**12**	**120** (*2*)	**3**	**60**	**1.5**	**6**
Pink (6-7)	**21**	**210** (*3.5*)	**5**	**105** (*1.8*)	**2.5**	**10**
Red (8-9)	**27**	**270** (*4.5*)	**7**	**135** (*2.3*)	**3.5**	**13**
Purple (10-11)	**33**	**330** (*5.5*)	**8**	**165** (*2.6*)	**4**	**16**
Yellow (12-14)	**42**	**420** (*7*)	**11**	**210** (*3.5*)	**5**	**21**
White (15-18)	**54**	**540** (*9*)	**14**	**270** (*4.5*)	**7**	**27**
Blue (19-23)	**69** (*1.1*)	**690** (*11.5*)	**17**	**345** (*5.8*)	**9**	**34**
Orange (24-29)	**87** (*1.4*)	**870** (*14.5*)	**22**	**435** (*7.3*)	**11**	**43**
Green (30-36)	**108** (*1.8*)	**1080** (*18*)	**27**	**540** (*9*)	**14**	**54**
Small Adult (50)	**150** (*2.5*)	**1500** (*26*)	**37**	**750** (*13*)	**19**	75 (*1.2*)
Large Adult (100)	**300** (*5*)	**3000** (*50*)	**75** (***1.2***)	**1500** (*25*)	**38**	150 (*2.5*)

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Pediatric Abnormal Vital Signs			
Hypotension for Age		Abnormal **Heart Rate** for Age	
< 1 year	< 70 mmHg	< 1 year	> 160
1-10 years	< 70 mmHg *plus* (2 * age in years)	1 - 2 years	> 150
		2 - 5 years	> 140
		5 - 12 years	> 120
> 10 years	< 90 mmHg	> 12 years	> 100

KEY POINTS:

- Hypotension can be defined as a systolic blood pressure (SBP) of < 90 mmHg, or mean arterial pressure (MAP) < 60 mmHg.
  - Automatic measurements should be approached with suspicion if they do not appear consistent with clinic context
  - Always verify (or disprove) with manual blood pressure as soon as possible.
- Blood pressures less than 90 do not always correlate with clinical shock
  - They should be interpreted in context with the patients typical blood pressure if known and with clinical symptoms if they do not correlate with a shock state.
  - **Conversely**, clinically significant low perfusion/shock states can occur with “normal” blood pressures--especially early on, and can often deteriorate rapidly.
  - In the early stages of shock, alterations in mentation and/or tachycardia may be the only symptoms.

- Always ensure that patients have adequate intravascular fluid load prior to the use of vasopressors .
  - Adequate treatment of shock commonly requires multiple 20 mL/kg (adults = 1 Liter) fluid boluses.
  - At least 1 full bolus (and preferably 2) should be attempted prior to initiating vasopressor therapy (unless profound pulmonary edema).
- Treatment goal is normalization of vital signs in the first hour.

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SHOCK TYPES

HYPOVOLEMIC SHOCK

- Main treatment goal is to restore/maintain intravascular volume to allow for adequate perfusion/oxygenation of tissues.
- Hemorrhagic Causes: traumatic (internal or external bleeding) or non-traumatic (i.e GI bleeding, ruptured aortic aneurysm, pregnancy-related bleeding, etc.)
    - Tx: per Hemorrhagic Shock Guideline [**TA-03**]
    - Goal: SBP 90-100 mmHg to perfuse organs but minimize additional bleeding
- Non-Hemorrhagic Causes: vomiting, diarrhea, sweating/hyperthermia, etc.
    - Tx: Focus on repleting fluid losses with NS/LR boluses as needed

DISTRIBUTIVE SHOCK

- Vasodilation (due to loss of vascular tone) leads to decreased preload (blood returning to heart) which leads to decreased cardiac output.
    - This creates a **"warm shock"** state (vasodilation → **pink, warm skin**), which can distinguish distributive shock from the typical cool and mottled appearance of other low-flow shock states.
- Causes:
    - **Septic Shock** (most common)
    - Anaphylaxis (**Anaphylactic Shock**)
    - Loss of neurovascular control (**Neurogenic Shock**) -- although this is generally seen later in the course (>24 hrs) of brain or spinal injuries.
- Treatment is <u>both</u> with **fluids and vasopressors**.
    - Start as usual with 1-2 boluses of NS/LR as the patient is relatively hypovolemic (dilated blood vessels = more fluid required to maintain a "full tank").
    - Vasopressors should be started if blood pressure and/or clinical symptoms do not improve after the fluid bolus. This will help combat the vasodilatory effect seen during distributive shock. Vasopressors will also improve the decreased cardiac output (Cardiogenic Shock) that may be part of the clinical picture in sepsis or similar processes.

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CARDIOGENIC SHOCK

- Left ventricular (left-sided) dysfunction will generally cause fluid to back up from the left side/left atrium into the lungs causing acute pulmonary edema/CHF.
    - Most commonly this is seen with an **Anterior STEMI**.
    - Other problems that affect generalized cardiac contractility may cause left-sided failure as well (i.e toxins, sepsis, myocardial contusion, etc.).
    - Problems with obstruction of left ventricular outflow (i.e. valve stenosis or aortic dissection) or regurgitation of blood into the left side of the heart (i.e valve failure or chordae tendineae rupture) will present and are treated similarly.
- Treatment = improve cardiac contractility/cardiac output = **needs vasopressors**
    - If breath sounds are relatively clear, you may consider a fluid challenge (250-500 mL) before using vasopressors to correct hypotension.
- Start CPAP or more advanced ventilatory support as needed per Airway [**A-01**] and CHF [**A-05**] guidelines.
- Caution: Vasopressors also increase vascular tone which leads to increased afterload. This creates more pressure for the heart to pump against and can worsen cardiac output or cardiac ischemia.

- Right ventricular (right-side) dysfunction will generally cause fluid to back up into the body. This decreases cardiac output due to a drop in preload (decreased left ventricular filling) and generally should not cause pulmonary edema.
    - Most commonly this is seen with an **Inferior STEMI**.
    - Other problems that obstruct right ventricular outflow (i.e. pulmonary embolism) will present and are treated similarly.
- Treatment = increase preload = **needs fluids**
- Fluid resuscitation (potentially 1 liter or more) is the primary goal, although vasopressors can be used if shock does not respond to fluids or if CHF develops.

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OBSTRUCTIVE SHOCK

- This is due to something physically obstructing blood flow to the left side of the heart, leading to decreased cardiac output.
- This can be caused by problems that inhibit blood return to the right side of the heart (i.e tension pneumothorax), inhibit the ability of the ventricles to adequately fill with blood (i.e. pericardial tamponade), or block flow out of the heart (i.e. pulmonary embolism or aortic dissection).
- This generally leads to signs of right-sided heart failure with distended neck veins (JVD) and tachycardia, as well as cause-specific history or symptoms (trauma, cancer, leg swelling, etc.).
- Prehospital **treatment is mostly supportive**.
    - Ensure that the patient has adequate intravascular volume by providing typical fluid resuscitation/boluses.
    - Vasopressors may be used for fluid-resistant shock similar to other etiologies.
- *Tension Pneumothorax* → Needle Decompression [**T-P2**] per guidelines.
- Other obstructive pathologies generally require interventions only available in the emergency department.
    - *Pericardial Tamponade* → Pericardiocentesis (almost never done in the field or without ultrasound verification).
    - *Pulmonary Embolism* → generally supportive, although can be given TPA (clot-busting drug) in cases with hemodynamic instability.

ADRENAL INSUFFICIENCY ("Adrenal/Addisonian Crisis")

- Is due to primary (inability of the body to produce steroids) or secondary (suppression of normal production of steroids) adrenal insufficiency.
    - May be precipitated by an injury or illness creating a scenario where the body needs more glucocorticoids or mineralocorticoids than can be provided.
    - This can also be seen in cases of patients who **suddenly stop taking a steroid** (without tapering it off and allowing the body to resume normal steroid production).
- Usually presents with hypotension, abdominal pain, nausea, vomiting and dehydration.
- Commonly this is difficult to discern from other causes of shock, but should be suspected with
- Any patient on long term steroids, or
- Any case of shock that is not responding as expected to fluids and vasopressors.
- Treatment (if suspected):
    - *Hydrocortisone (Cortef or Solu-Cortef) 100 mg* in adults is preferred
        - Generally not carried prehospital, but may be given if carried by the patient and discussed with online medical control.
    - May consider **methylprednisolone (Solu-Medrol) 125 mg** or **dexamethasone (Decadron) 10 mg IV/IO/IM**
        - Should be discussed as well with online medical control if possible.

QI Review Parameters:

1. {PENDING}