



• Hypotension, hypoperfusion, or shock in an adult (18 years & older)

#### WARNINGS

- For shock in an infant, child, or adolescent (up to 18 years) refer to C07.4
- For shock after cardiac arrest refer to CO3
- For shock due to nontraumatic hemorrhage refer to C07.2
- For cardiogenic shock refer to C07.3
- For shock due to anaphylaxis refer to E03
- For shock due to adrenal crisis refer to E05
- For shock due to traumatic hemorrhage refer to F01
- For neurogenic shock due to spinal cord injury refer to F06

## NOTES

1. Shock is a life-threatening emergency and options for prehospital management are limited. However, immediate interventions (i.e. optimizing oxygenation and perfusion) may prevent progression to irreversible shock or cardiac arrest.

Establishing the specific underlying cause is usually difficult without access to the advanced investigations available in hospital. However, identifying the general type of shock can help guide prehospital management.

For paramedics, the goals are:

- maintain a high index of suspicion for the presence of shock with symptoms or signs of hypoperfusion.
- improve organ perfusion by the use of fluids, and vasopressor support where necessary.
- promptly transport the patient to the next level of care.
- 2. Hypotension and shock are points on a continuum. The key pathophysiological difference between the two is the presence of inadequate organ perfusion in shock. Depending on the cause, sustained hypotension of longer than one hour prior to hospital arrival is associated with a tripling of in-hospital mortality.

Remember that shock can present with a normal or even elevated blood pressure (BP). Paramedics should assume that hypotension or signs of hypoperfusion indicate a state of shock until proven otherwise.

- 3. The causes of shock in adults are listed in appendix A, some of which are addressed in other care maps. Paramedics will sometimes be confronted with undifferentiated shock, or shock due to more than one cause.
- 4. The imbalance between oxygen supply and demand can be improved by optimizing oxygenation and reducing the work of breathing. Non-invasive ventilation (NIV) may lessen the latter, but should be used with caution. It has the potential to exacerbate hypotension as the rise in intrathoracic pressure may impede venous return to the heart.
- 5. Prompt administration of intravascular (IV) crystalloid is the first step in correcting the hypoperfusion in almost every type of shock. The correct volume to be given will depend on the underlying cause, and will differ from patient to patient (the numbers in the algorithm are guidelines, not absolutes). Under-resuscitation is far more common.
  - In nonhemorrhagic hypovolemia, extracellular fluid (ECF) loss is the causative event, whereas third spacing is the main culprit in distributive causes of shock. The volume deficit can exceed 60 to 100 milliliters per kilogram

(ml/kg) of bodyweight in sepsis or diabetic ketoacidosis (DKA). In hyperglycemic hyperosmolar state (HHS) it may exceed 100 to 200 ml/kg.

- In hemorrhagic shock, crystalloid does not address the reduction in oxygen-carrying capacity from the loss of hemoglobin, but can temporarily restore the intravascular volume necessary to maintain cardiac output (CO), until the blood loss can be stopped and blood volume corrected.
- In some types of cardiogenic shock (e.g. right ventricular infarct) bolus fluids can improve CO by enhancing right ventricular end-diastolic volume (EDV), or preload. The effect in obstructive shock is similar, but usually minor and always temporary.
- 6. If crystalloid administration is ineffective, vasopressor support with norepinephrine may be necessary to maintain coronary and cerebral perfusion. If norepinephrine causes intolerable tachycardia, phenylephrine may be an option.

Keep in mind that vasopressors may make things worse if the intravascular volume deficit is not first corrected. Squeezing nearly empty arteries might "improve the numbers" (i.e. raise the BP) but actually worsen tissue perfusion.

- 7. In shock resuscitation, mean arterial pressure (MAP) is more useful than the systolic blood pressure (SBP) in assessing organ blood flow. Generally speaking, the MAP necessary to maintain adequate coronary and cerebral perfusion is approximately 60 to 65 mmHg, and this should be the target in most cases. However, some patients such as those with chronic uncontrolled hypertension may require a higher target.
- 8. A MAP of less than 45 mmHg is insufficient to maintain any coronary artery perfusion. Emergent intervention is required to prevent hemodynamic collapse and cardiac arrest.

Fluid administration and setting up an infusion takes time. Push-dose vasopressors have been shown to be an effective *temporizing* measure for immediate BP control, and can be safely administered through peripheral IV or IO lines.

	LINKS
•	A01 - Standard Clinical Approach
•	C03 - Return of Spontaneous Circulation
•	C07.2- Nontraumatic Hemorrhagic Shock
•	C07.3 - Cardiogenic Shock
•	E03 - Anaphylaxis & Anaphylactic Shock
•	E04 - ACS & STEMI & NSTE-ACS
•	E05 - Adrenal Crisis
•	F01 - Major Trauma
•	F06 - Spine & Spinal Cord Trauma
•	M05 - Epinephrine
•	M31 - Norepinephrine
•	M32 - Phenylephrine

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# **VERSION CHANGES (refer to X03 for change tracking)**

- New
- Separation into adult & pediatric (C07.4) protocols
- Separate protocols for nontraumatic hemorrhage (C07.2) & cardiogenic shock (C07.3)
- Addition of advanced work scope
- Revised flow chart & notes for greater clarity and ease of use

# TABLE A: TYPES & CAUSES OF ADULT HYPOTENSION / HYPOPERFUSION / SHOCK

#### **HYPOVOLEMIA:**

- Nonhemorrhagic
  - o Decreased oral intake
  - o Gastrointestinal loss from vomiting / diarrhea
  - Renal loss from osmotic diuresis in diabetic ketoacidosis (DKA) / hyperosmolar hyperglycemic state (HHS)
  - Dermal loss from extensive burns, exfoliative dermatitis, heat-related illness
- Nontraumatic hemorrhage (C07.2)
  - Gastrointestinal bleeding
  - o Epistaxis
  - Postpartum hemorrhage (PPH)
- Traumatic hemorrhage (F01)

# CARDIOGENIC (C07.3):

- Myocardial ischemia / infarction (E04)
- Myocarditis or cardiomyopathy
- Dysrhythmia (tachycardia, bradycardia)
- Valvular (e.g. acute aortic regurgitation)
- Impaired cardiac filling due to right ventricular infarct (RVI)

## **OBSTRUCTIVE:**

- Tension pneumothorax (C10)
- Cardiac tamponade
- Pulmonary embolism

## DISTRIBUTIVE:

- Sepsis
- Anaphylaxis (E03)
- Adrenal insufficiency (E05)
- Neurogenic shock (F06)