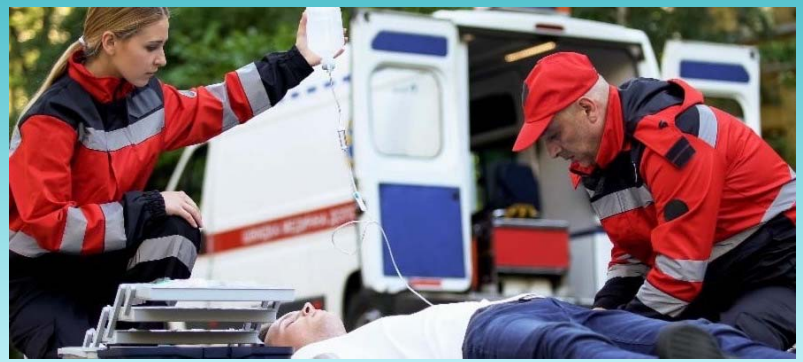
AMLS

Recognizing and Treating Shock in the Prehospital Setting



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Scenario

SCENARIO

Your patient is a 64-year-old woman who presents with generalized weakness and lethargy. Your assessment reveals she is tachypneic and tachycardic, and her skin is cool to the touch. Her past medical history is significant for frequent urinary tract infections, hypothyroidism, type 2 diabetes, and hospitalization for pneumonia 6 months ago. She recently finished a trial of antibiotics for an upper respiratory infection. Her blood pressure is 76/54 mm Hg; pulse rate, 114 beats/min; respirations, 24 breaths/min and regular; and oxygen saturation, 96%.

- What is your initial impression?
- Which differential diagnoses are you considering based on the information you have now?
- Which additional information will you need to narrow your differential diagnosis?
- What are your initial treatment priorities as you continue your patient care?
- On the basis of your findings, what is your refined differential and why?

SHOCK INDEX?? Pulse ÷ Systolic

What is Shock?

Shock is a progressive state of cellular hypoperfusion in which insufficient oxygen is available to meet tissue demands

It is key to understand that when shock occurs, *the body is in distress*. The shock response is mounted by the body to attempt to maintain systolic blood pressure and brain perfusion during times of physiologic distress. This shock response can accompany a broad spectrum of clinical conditions that stress the body, ranging from heart attacks, to major infections, to allergic reactions.

Causes of Shock

Shock may be caused when oxygen intake, absorption, or delivery fails, or when the cells are unable to take up and use the delivered oxygen to generate sufficient energy to carry out cellular functions.

Causes of Shock

Hypovolemic Shock	Distributive Shock
Inadequate circulating fluid leads to a diminished cardiac output, which results in an inadequate delivery of oxygen to the tissues and cells	A precipitous *increase in vascular capacity* as blood vessels dilate and the capillaries leak fluid, translates into too little peripheral vascular resistance and a decrease in preload, which in turn reduces cardiac output

Causes of Shock

Cardiogenic Shock	Obstructive Shock
The heart is *unable to circulate sufficient blood* to meet the metabolic needs of the body. Either right or left ventricular failure can lead to cardiogenic shock and may include dysrhythmias, a cardiac structural disorder, or the action of certain toxins	*Obstruction to the forward flow* of blood exists in the great vessels or heart. Significant causes are pericardial tamponade, massive pulmonary embolism, and tension pneumothorax.

Signs and Symptoms of Shock

Shock occurs in three successive phases—*compensated, decompensated, and irreversible*

Table 4-3 Stages of Shock

Stage	Vital Signs	Signs and Symptoms	Pathophysiology
Compensated	Normal blood pressure Normal to slightly increased heart rate Tachypnea Delayed capillary refill Compensatory reserve index decreases	Cool hands and feet Pale mucous membranes Restlessness, anxiety Oliguria	Vasoconstriction maintains blood flow to essential organs, but tissue ischemia occurs in less essential areas.
Decompensated	Blood pressure decreasing Tachycardia > 120 beats/min Tachypnea > 30–40 breaths/min Pulse pressure increases	Mottled or pale, cool, clammy skin Pale or cyanotic mucous membranes Profound weakness Metabolic (lactic) acidosis Anxiety Absent or decreased peripheral pulses	Blood pressure decreases as vascular tone decreases. Dysfunction to all organs is imminent. Anaerobic metabolism ensues, causing lactic acidosis.
Irreversible	Profound hypotension	Lactate level may be > 8 mEq/L	Metabolic acidosis causes postcapillary sphincters to open and release stagnant and coagulated blood. Excessive potassium and acid cause dysrhythmias. Cellular damage is irreversible. Free radicals released.

AMLS Assessment Pathway

1. Initial Observations
- a.Scene Safety Consideration
- b.Patient Cardinal Presentation
- c.Primary Survey
  - i. Consciousness, Airway & Breathing, Circulation/Perfusion

2. First Impression
- a. History Taking
- b. Secondary Survey
  - i. Vital signs and physical exam
- c. Diagnostic
  - i. Pulse Oximetry, Capnography, Electrocardiogram, Laboratory Studies, Compensatory Reserve
- d. Redefine the Differential Diagnosis

3. Ongoing Management
- a. Fluid Resuscitation
- b. Temperature Regulation
- c. Vasopressor Administration
- d. Administration of Blood Products
  - i. Transfusion Reactions
  - ii. Hemolytic Reactions

Initial Observations : Scene Safety

Scene Safety Consideration

Scene safety is critical in approaching any patient.

When dealing with a patient who is critically ill,
it is easy to miss a safety issue!

Take the time to ensure the scene remains safe
for you and all involved.

Initial Observations: Chief Complaint

For the patient suspected of shock you must determine the following:

Do I see any signs of a life threat as I approach my patient?

Are there altered level of consciousness or respiratory distress?

Does the patient's skin show signs of shock?

(Pale, ashen, diaphoretic, mottled, or hives)

Do the surroundings suggest the possibility of shock? Vomitus? Blood?

Initial Observation: Primary Survey

You should focus your assessment and history collection on the components that will help you identify and treat the life threats and complete these interventions once the patient's condition stabilizes:

Always Explain a Tachycardia!!

- Level of Consciousness
- Airway/Breathing/Circulation/Perfusion
- Are the radial, carotid, and femoral pulses strong, or are they weak, thready, absent?
- Is the rate too fast or too slow?
- Is the rate regular or irregular?

First Impression: History Taking

Obtaining a thorough history, including an account of the present illness and a comprehensive past medical history, is essential to determining the “type” of shock.

SAMPLER mnemonic

SAMPLER	
	Signs & Symptoms- What can you see? What is the chief complaint?
	Allergies- What have you come in contact with? Meds, Insects, Pollen, Food, Latex?
	Medications- Prescriptions, OTC, Herbal, Street
	Past Medical History- Has this happened before? Is this a preexisting condition?
	Last Oral Intake- When did you eat last? What was it? Nausea or Vomiting?
	Events- What were you doing when you started to feel this way?
	Risks- Risks to chief complaint (e.g. cardiac disease, COPD, DM)

OPQRST mnemonic

PAIN	
	Onset- When did this start? What were you doing?
	Provocation- What makes it feel better or worse?
	Quality- Can you describe this pain? Dull? Sharp?
	Radiation- Where else does it go?
	Severity- On a scale from one to ten...
	Time- How long has this been going on?

Medications Affecting Shock

Table 4-6 Medications Affecting Shock

Medication	Effect	Shock
Steroids	May mask signs of infection; decrease potential for early recognition	Sepsis
Beta-blockers	Blunts compensatory tachycardia, decreasing ability to compensate	All types
Anticoagulants/antiplatelets	Increases potential for bleeding	Hemorrhagic
Calcium channel blockers	Inhibits vasoconstriction, decreasing ability to compensate	All types
Hypoglycemic agents	May impair blood glucose regulation	All types
Herbal preparations	May exacerbate bleeding May increase workload on the heart	Hemorrhagic Cardiogenic specifically, but all types may be affected
Diuretics	Long-term diuretic therapy may cause hypokalemia and contribute to dehydration.	All types

First Impression: Secondary Survey

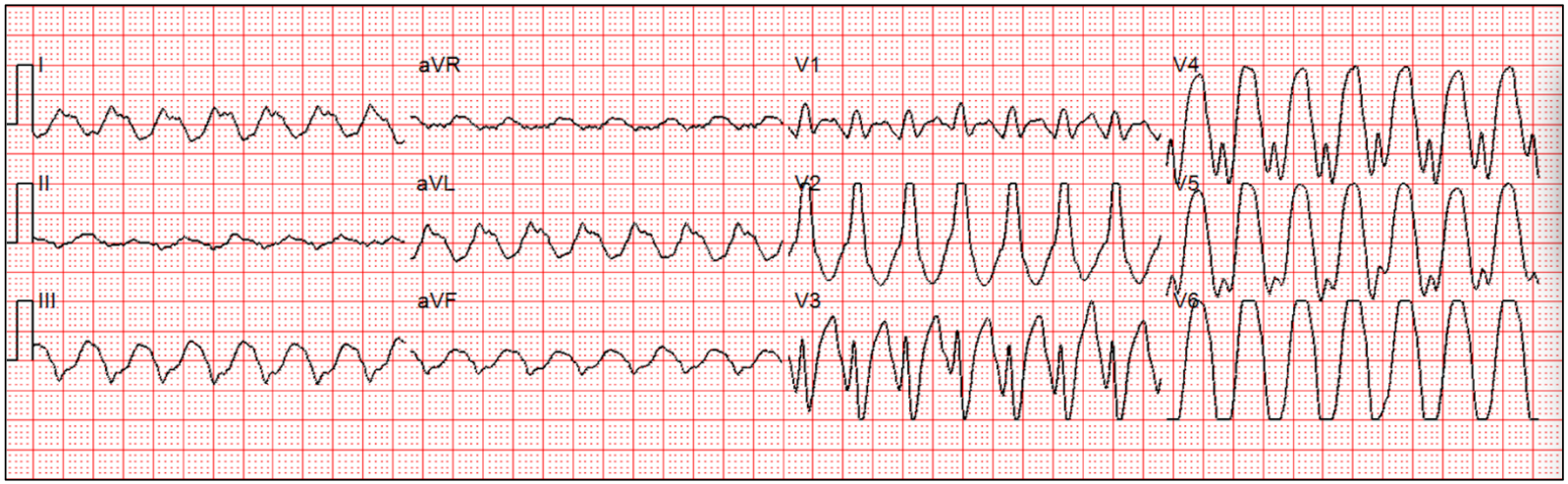
Vital Signs	Physical Exam
Vital signs (blood pressure, pulse rate, respiratory rate, & temperature) are essential to determining the patient's stability and identifying the type of shock. *Most common signs are hypotension, tachycardia, tachypnea, and cool skin.*	Physical exam focuses on determining the cause of the shock and selecting proper intervention

First Impression: Diagnostic

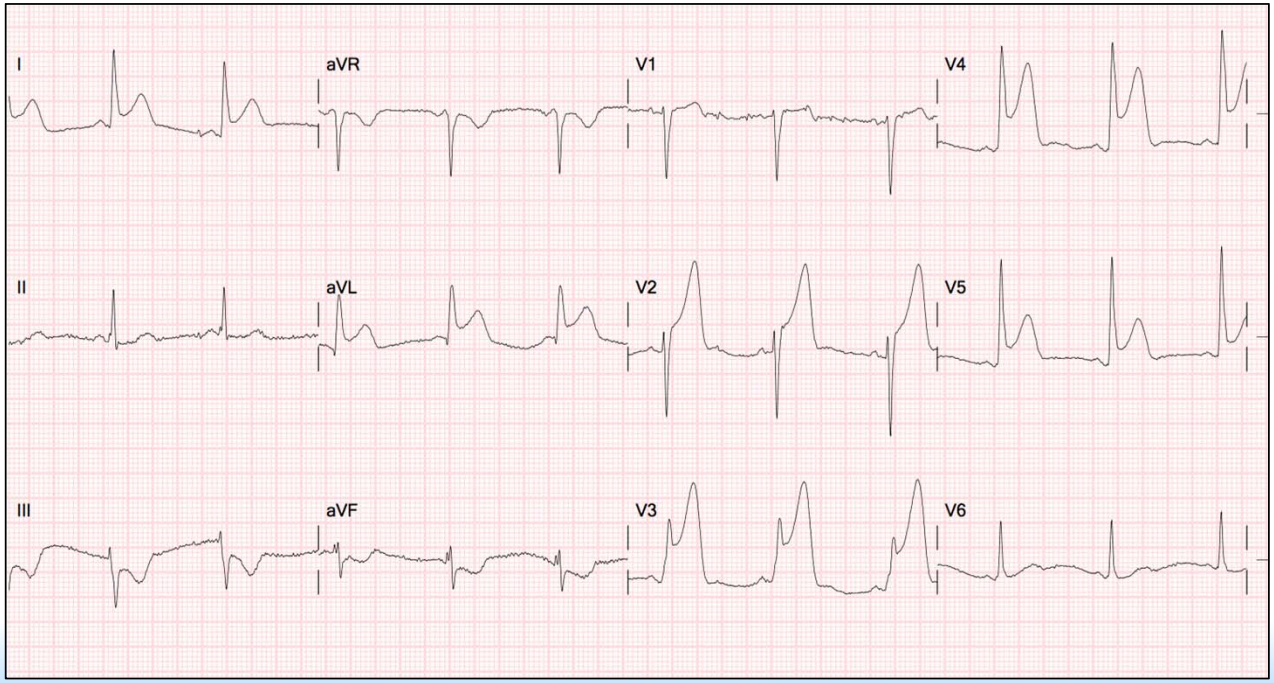
Diagnostic tools used to evaluate patients with signs of shock include the assessment of:

- Pulse Oximetry
- Cardiac Monitor & 12-Lead ECG
- Glucose Monitoring
- Electrocardiography
- Compensatory Reserve Index
- Laboratory Testing

Monitor &/or 12-Lead ECG for Shock



12-Lead ECG for Shock

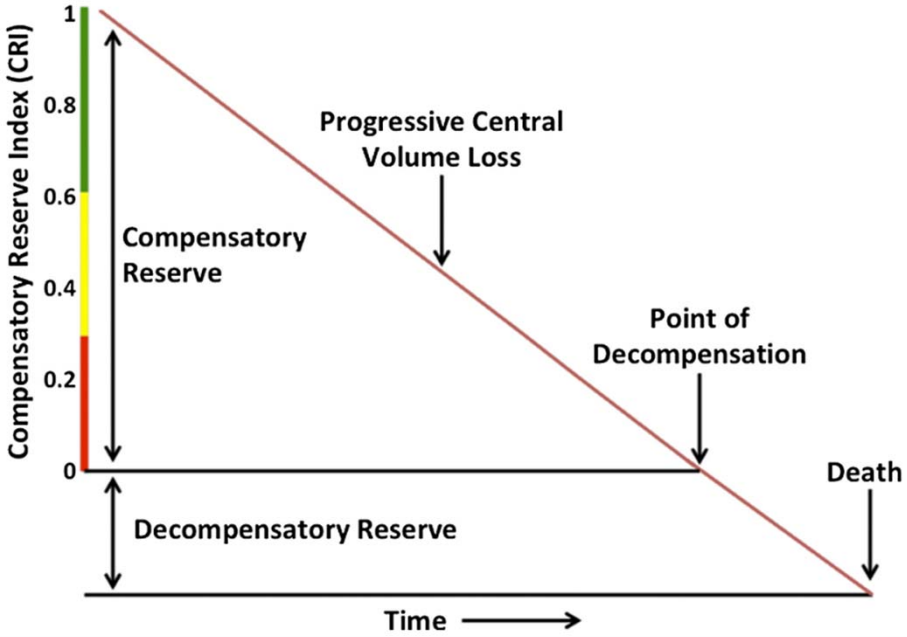


Glucose Monitoring

As part of the routine evaluation of the patient in shock, obtain a random glucose level for assessment and documentation

Significant hypoglycemia or hyperglycemia should be considered in the differential diagnosis of the cause of your patient's clinical shock condition

Compensatory Reserve Index



Compensatory Reserve Index

Lab Tests for Patients in Shock

Table 4-7 Laboratory Tests for Patients in Shock

Test	Normal Values	Abnormal Values	Indications for Test
Glucose	70–110 mg/dL (3.8–6.1 mmol/L)	Increase indicates hyperglycemia, diabetic ketoacidosis, steroid use, stress. Decrease indicates hypoglycemia, decreased glucose reserves.	All types of shock
Hemoglobin (Hb)/ hematocrit (Hct)	Hb, male: 14–18 g/dL (8.7–11.2 mmol/L) Hb, female: 12–16 g/dL (7.4–9.9 mmol/L) Hct, male: 42%–52% (0.42–0.52) Hct, female: 37%–47% (0.37–0.47)	Decrease indicates severe blood loss. Increase indicates plasma loss, dehydration.	All types of shock
Gastric/fecal occult blood	Negative	Positive result indicates GI bleeding.	Suspected GI bleeding
Lactic acid	Venous: 5–20 mg/dL (0.6–2.2 mmol/L)	Increase indicates tissue hypoperfusion and acidosis, prolonged use of tourniquet.	All types of shock
Complete blood cell count	Total WBC count 5,000–10,000/mm^3 (5–10 × 10^9/L)	Increased WBC count suggests infection.	Septic shock

Lab Tests for Patients in Shock

Table 4-7 Laboratory Tests for Patients in Shock (*continued*)

Test	Normal Values	Abnormal Values	Indications for Test
Acid-base balance	pH 7.35–7.45	Increased pH indicates alkalosis. Decreased pH indicates acidosis and impaired perfusion.	All types of shock
	HCO_3^- 21–28 mEq/L	Decreased bicarbonate levels indicate it is being lost or used up rapidly in conditions such as diarrhea, intestinal fistula, or in response to increased acid production such as shock, renal failure, DKA, salicylate overdose. Increased bicarbonate levels indicate excessive intake of bicarbonate or antacids or loss of acid from conditions such as vomiting, gastric suctioning, potassium deficiency, diuretic use.	
Arterial blood gases	PCO_2 35–45 mm Hg PO_2 80–100 mm Hg	Increased PCO_2 levels indicate CO_2 retention, hypoventilation, pneumonia, pulmonary infections, pulmonary emboli, CHF, conditions that impair respiratory effort. Decreased PCO_2 levels indicate decrease in CO_2 levels, hyperventilation, anxiety, fear, pain, CNS lesions, pregnancy, conditions that increase ventilation. Also occurs in response to metabolic acidosis (e.g., DKA) Decrease in O_2 levels indicates hypoxia.	All types of shock

Lab Tests for Patients in Shock

Table 4-7 Laboratory Tests for Patients in Shock (*continued*)

Test	Normal Values	Abnormal Values	Indications for Test
Serum electrolytes	Na^+ 136–145 mEq/L (136–145 mmol/L) K^+ 3.5–5 mEq/L (3.5–5 mmol/L)	Increased Na^+ levels may be present with osmotic diuresis. Increased K^+ levels are common in acidosis, vomiting, diarrhea, and DKA. Increased K^+ levels (hyperkalemia) may cause an abnormal ECG; peaked T waves, wide QRS complexes, bradycardia, or tachycardia may be present.	All types of shock
Renal function	Serum urea nitrogen 10–20 mg/dL (3.6–7.1 mmol/L) Creatinine 0.5–1.2 mg/dL (44–97 mmol/L)	Increased levels of serum urea nitrogen indicate severe dehydration, shock, sepsis. Increased serum creatinine levels (> 4 mg/dL [0.2 mmol/L]) indicate impaired renal function.	All types of shock
Blood/urine cultures	Negative	Positive result indicates infection.	Septic shock
Compensatory reserve	0.7–1.0	0.3–0.6 or trending downward indicates hypovolemia or blood loss. 0.1–0.3 nearing decompensated shock. 0 is decompensated shock.	Volume loss due to blood or fluids. Septic shock characteristics are unknown at this time.

First Impression: Refine the Differential Diagnosis

You may have determined in your primary survey
that the patient was in shock,
but you may not have determined
the underlying cause

It is important to move ***quickly***
through this assessment with a ***calculated purpose***
in order to identify the cause of shock
and initiate the necessary treatment

Ongoing Management

The rule of thumb is to assess, intervene, and reassess

During your ongoing management, repeat the primary survey and vital signs, revisit the chief complaint, and monitor the patient's response to any treatment you have administered

<u>Always consider the possibility of trauma</u>

Management: Fluid Resuscitation

An initial bolus of 20 to 30 mL/kg (1,000 to 2,000 mL) of isotonic fluid should be given if the patient shows no signs of fluid overload

If the patient is at risk for fluid overload, a more modest bolus of 250 to 500 mL, followed by a reassessment, is appropriate

The purpose of fluid resuscitation should be to enhance perfusion to maintain a MAP at 60 to 70 mm Hg or a systolic pressure at 80 to 90 mmHg

If bleeding is suspected, administration of blood products is indicated

If massive transfusions are required, early administration of fresh-frozen plasma and platelets has been shown to improve survival

Management: Temperature Regulation

The body expends a great deal of energy to maintain a normal temperature. Vasoconstriction shunts blood away from peripheral tissues, and the body will expend valuable energy trying to stay warm. **Keep the patient warm!**

The ambulance or resuscitation room should be kept warm, and the patient should be covered with a blanket when practical.

Administration of warmed fluids will assist in maintaining body temperature and should be initiated when feasible.

Management: Vasopressor Administration

Vasopressors, which are medications augmenting blood pressure, are an efficient adjunct treatment in patients with certain types of shock

The following vasopressors and inotropes may be administered:

Vasopressors	**Inotropes**
• *Norepinephrine (preferred agent in most shock scenarios requiring vasopressors)* • *Epinephrine* • *Phenylephrine* • *Dopamine (less preferred)*	• *Dobutamine* • *Norepinephrine* • *Epinephrine* • *Dopamine (less preferred)*

Management: Administration of Blood Products

Blood administration may be a viable option in the prehospital setting

When the patient is *actively bleeding, is anemic, is in shock, and/or has a serious bleeding disorder*, administration of blood products is indicated

Table 4-8 Blood Products

Product	Clinical Application
Whole blood, low titer O cold stored	Normal hemoglobin, platelets, and plasma in one unit Short shelf life
Packed red blood cells	Low hemoglobin (usually < 7.0)
Platelets	Facilitates clotting, prevents bleeding Thrombocytopenia
Fresh-frozen plasma (FFP)	Coagulation deficiencies in liver failure, warfarin overdose, disseminated intravascular coagulation, or massive transfusion

Table 4-8 Blood Products

Product	Clinical Application
Freeze-dried plasma (not yet available in the United States; multiple products undergoing FDA submission)	As above, stable shelf life, room temperature, requires reconstitution but easier administration process
Cryoprecipitate (cold FFP with fibrinogen, factor VIII, and von Willebrand factor)	Bleeding disorders, massive transfusion
Massive transfusion	Aggressively bleeding patients where > 10 units of blood are given over 24 hours; coagulation factors and platelets added Patient at risk for hypothermia, hypocalcemia

Transfusion Reactions

There are generally two complications of blood product administration: *infection and immune reactions*

Improved methods of screening donors and blood products have decreased problems with the spread of infections

There remains a small risk, especially for cytomegalovirus, which is a common virus that is rarely serious in the general population

Hemolytic Reactions

When the recipient's antibodies recognize and react to transfused blood as an antigen, the donor RBCs may be destroyed or hemolyzed. This hemolytic reaction can be quick and aggressive or slower, depending on the immune response

Errors in the blood administration process can create fatal hemolytic reactions. When this occurs, most transfused cells are destroyed in an overwhelming immune response

Treatment of Hypovolemic Shock

Inadequate circulating fluid leads to a diminished cardiac output, which results in an inadequate delivery of oxygen to the tissues and cells

Category	Initial Signs	Causes	Management
		Hypovolemic Shock	
Hemorrhagic/ nonhemorrhagic	Cool, clammy skin Pale, cyanotic skin Decreased BP Altered LOC Decreased capillary refill Tachypnea	Hemorrhage: trauma, GI bleeding, ruptured aortic aneurysm pregnancy-related bleeding Severe dehydration: gastroenteritis, diabetic ketoacidosis, adrenal crisis	Stop the bleeding Consider blood product transfusion if appropriate

Treatment of Distributive shock

Distributive shock stems from a *precipitous increase in vascular capacity* as blood vessels dilate and the capillaries leak fluid

Too much vascular space translates into too little peripheral vascular resistance and a decrease in preload, which in turn reduces cardiac output and results in shock

Causes of Distributive shock include: sepsis, anaphylaxis, neurogenic shock, and toxins

Treatment of Distributive Shock

Category	Initial Signs	Causes	Management
		Distributive Shock	
Septic	Hyperthermia or hypothermia Decreased BP Tachycardia Altered LOC	Infection	Give IV fluid bolus Administer antibiotics Consider vasopressors
Anaphylactic	Pruritus, erythema, urticaria, angioedema Increased pulse rate Decreased BP Anxiety Respiratory distress, wheezing Vomiting, diarrhea	Antibody-antigen hypersensitivity response	Give epinephrine 1:1,000, 0.3–0.5 mg IM (Epi 1 mg/mL) May repeat as needed Epinephrine 1:10,000, 0.3–0.5 mg IV (Epi 1 mg/mL) if no response to IM administration over 3–10 min, and repeat every 15 min as needed. Epinephrine should not be withheld in order to start an IV Intravenous fluid bolus Diphenhydramine, 1–2 mg/kg IV (max, 50 mg) Consider corticosteroid treatment Consider vasopressor treatment Consider H_2 receptor blocker administration
Neurogenic	Warm, dry, pink skin Decreased BP Alert Normal capillary refill time	Trauma	Give IV fluid bolus Consider norepinephrine
Toxins	Based on specific agent (See Chapter 10 for a discussion of toxic agents.)	(See Chapter 10.)	Based on specific agent (See Chapter 10.)

Treatment of Cardiogenic Shock

Occurs when the heart is *unable to circulate sufficient blood* to meet the metabolic needs of the body

Either right or left ventricular failure can lead to cardiogenic shock and may include dysrhythmias, a cardiac structural disorder, or the action of certain toxins

Initial treatment of a patient in cardiogenic shock must focus on *stabilization of airway, breathing, and circulation*

Treatment of Cardiogenic Shock

Category	Initial Signs	Causes	Management
		Cardiogenic Shock	
	Cool, clammy skin Pale or cyanotic skin Tachypnea Tachycardia or other abnormal cardiac rhythm Decreased BP Altered LOC Decreased capillary refill time	Pump failure: AMI, cardiomyopathy, myocarditis, ruptured chordae tendineae, papillary muscle dysfunction/rupture, toxins, myocardial contusion, acute aortic insufficiency, ruptured ventricular septum Dysrhythmias	Administer oxygen as needed Give IV fluid bolus Rate correction (medication or pacing/cardioversion) Inotropes Vasopressors Intra-aortic balloon pump or other left ventricular support pump

Treatment of Obstructive Shock

Obstructive shock occurs when an *obstruction to the forward flow* of blood exists in the great vessels or heart

Significant causes are pericardial tamponade, massive pulmonary embolism, and tension pneumothorax

Initial management should focus on *increasing vascular volume* with fluid resuscitation and vasopressors as needed to maintain perfusion until a definitive diagnosis and treatment plan can be established

Treatment of Obstructive Shock

Category	Initial Signs	Causes	Management
		Obstructive Shock	
	Decreased blood pressure Difficulty breathing, tachycardia, tachypnea JVD, unilateral decreased or absent breath sounds, muffled heart tones Cyanosis may be present	Massive pulmonary embolus, tension pneumothorax, acute pericardial tamponade	Perform needle decompression to the appropriate side of the thorax for tension pneumothorax Perform a pericardiocentesis for a pericardial tamponade Transport to appropriate facility

Putting it All Together

Early, accurate identification of the patient's stage and type of shock is essential in managing this condition

Sound clinical reasoning skills, a thorough assessment, and careful but expedient interpretation of diagnostic findings are necessary to provide effective treatment for the patient in shock

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