

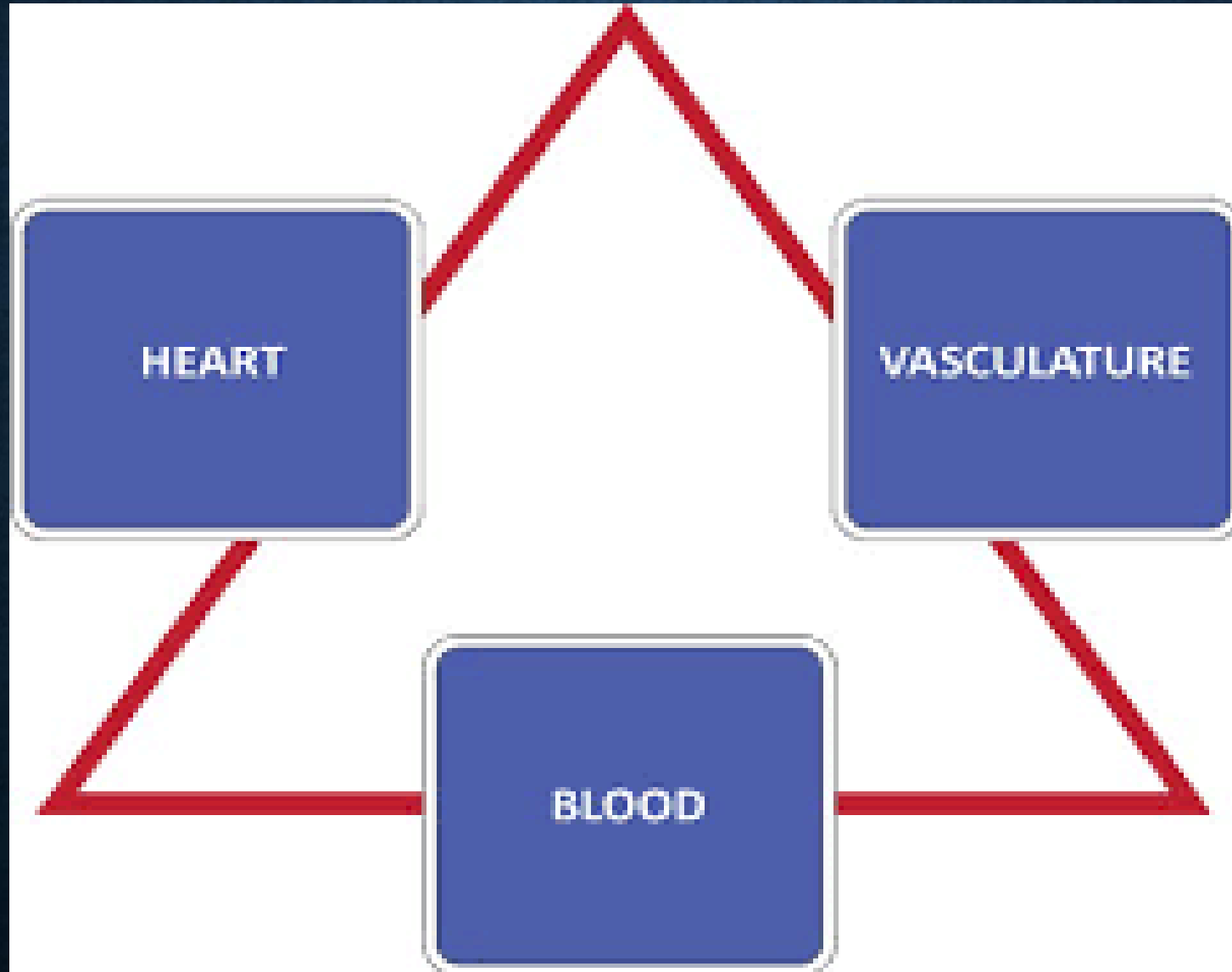
SHOCK REVIEW

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CARDIOVASCULAR SYSTEM



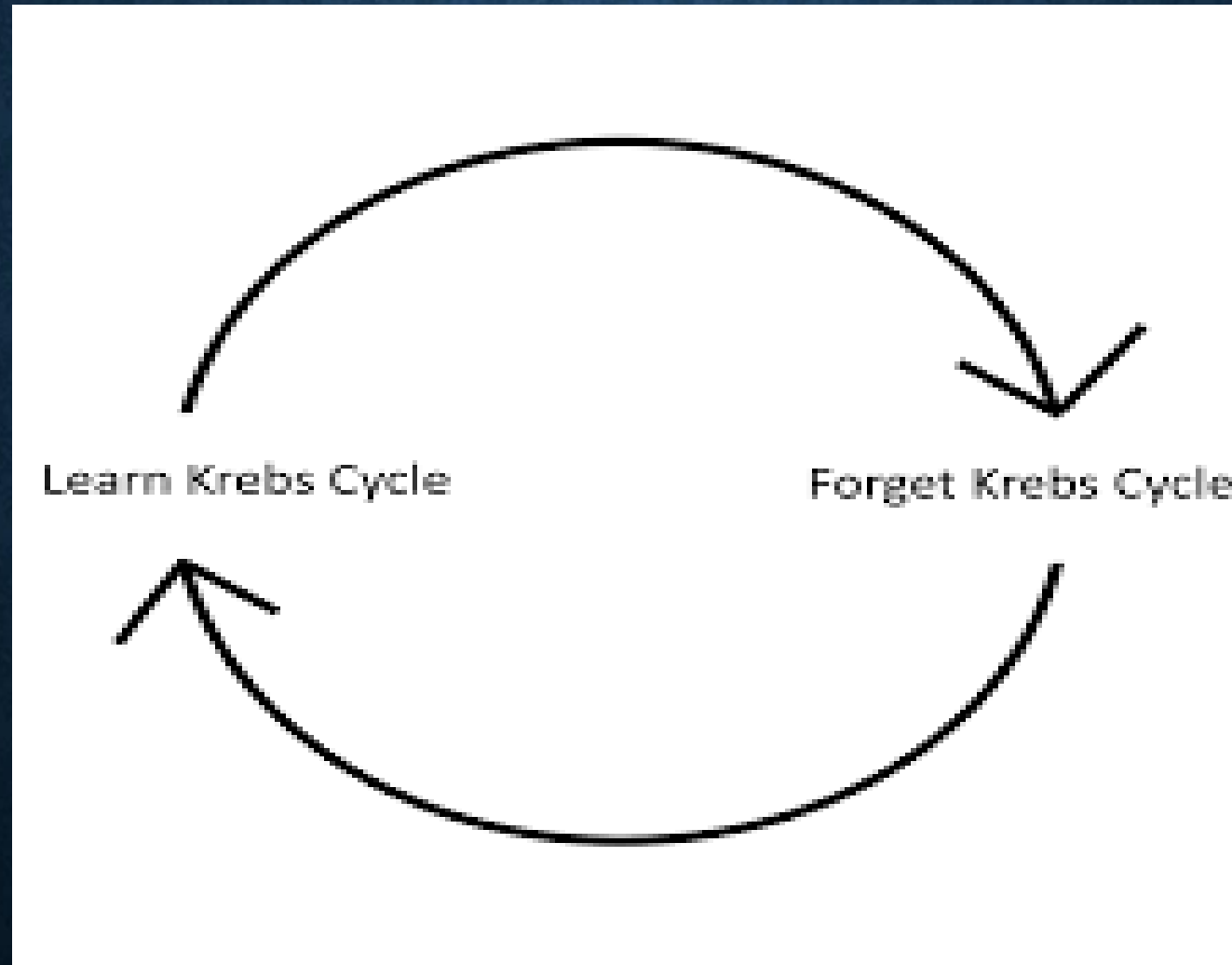
PERFUSION VS SHOCK

- **Perfusion:** Adequate blood flow that delivers oxygen and removes waste products the cellular level which maintains homeostasis.
- **Shock (hypoperfusion)** describes a state of collapse and failure of the cardiovascular system where waste removal and oxygen exchange no longer occurs.
- **Homeostasis** can only occur when the supply of oxygen is sufficient to meet the metabolic demands of the body.

WHY IT MATTERS

- In cases of poor perfusion (shock):
 - Transportation of carbon dioxide out of tissues is impaired. This results in a dangerous buildup of waste products, which causes cellular damage.
 - Delivery of oxygen is also impaired resulting in cells switching to anaerobic respiration, which means a lower rate of energy production and a higher generation of acidic waste products.

THE REAL KREBS CYCLE



SHOCK AND ITS EFFECTS

- The build up of waste products leads to acidosis in the body which greatly increases the chances of a poor outcome from any injury or illness.
- If the conditions causing shock are not promptly addressed, death may soon occur.

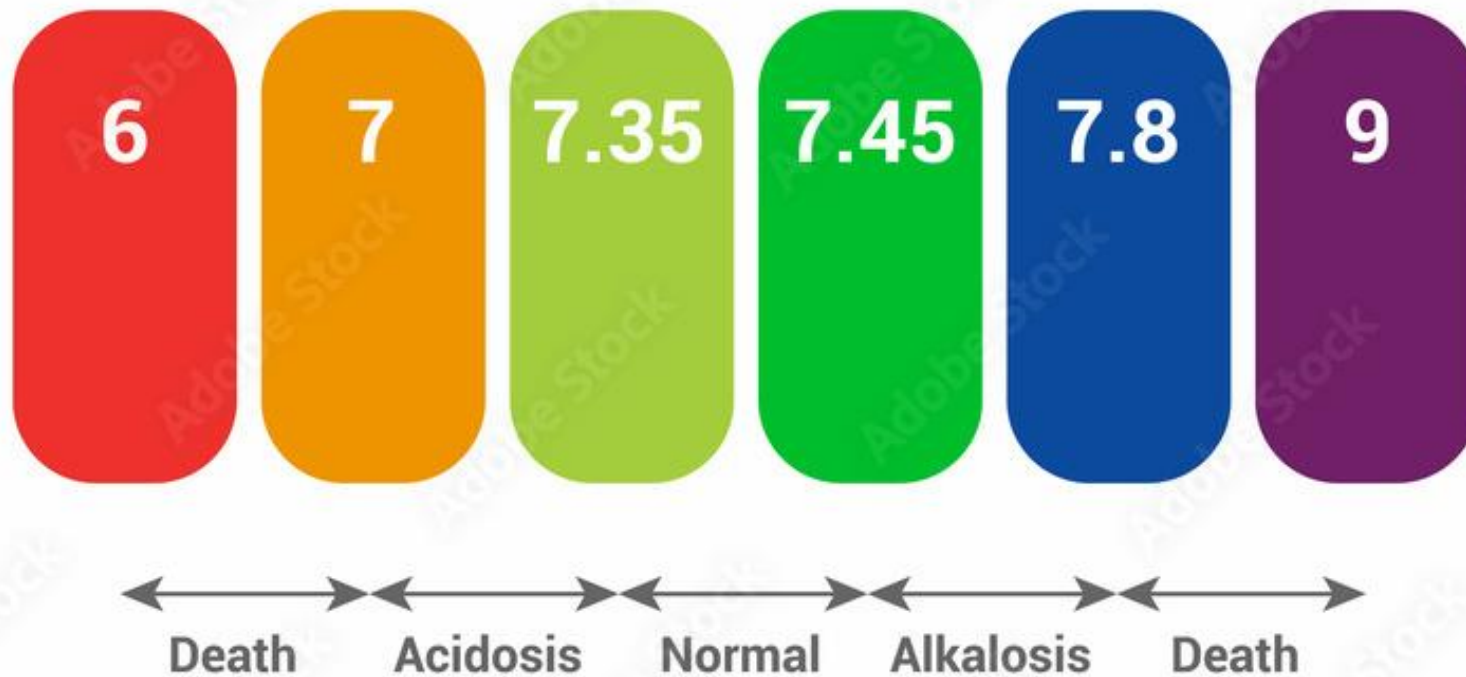
SHOCK PROGRESSION

- In the early stages, the body attempts to maintain homeostasis. This is called compensated shock.
- As shock progresses, the body's internal mechanisms are no longer able to accommodate the demands of the body. Blood circulation slows and eventually ceases.
- Most types of shock require aggressive management and evacuation to a hospital.

PERFUSION

- Perfusion requires more than just having a working cardiovascular system.
 - Adequate oxygen exchange in the lungs
 - Adequate nutrients in the form of glucose in the blood
 - Adequate waste removal, primarily through the lungs and kidneys
- Mechanisms are in place to help support the respiratory and cardiovascular systems when the need for perfusion of vital organs is increased.
 - Mechanisms include the autonomic nervous system and hormones.

Blood pH levels



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- As waste products build up in the body the blood becomes more acidic.

PH COMPENSATION-LUNGS

- Carbon dioxide (which is mildly acidic) is a waste product of metabolism. The blood carries carbon dioxide to the lungs, where it is exhaled. As carbon dioxide accumulates in the blood, the pH of the blood decreases (acidity increases).
- The brain regulates the amount of carbon dioxide that is exhaled by controlling the speed and depth of breathing (ventilation).
- The amount of carbon dioxide exhaled, and consequently the pH of the blood, increases as breathing becomes faster and deeper. By adjusting the speed and depth of breathing, the brain and lungs are able to regulate the blood pH minute by minute.

PH COMPENSATION-KIDNEYS

- The kidneys are able to affect blood pH by excreting excess acids or bases. The kidneys have the ability to alter the amount of acid or base that is excreted, but because the kidneys make these adjustments more slowly than the lungs do, full effective compensation generally takes several days.
- In bad cases of shock the body will shunt blood away from the kidneys so they are no longer able to function. This worsens acidosis.

COMPENSATION

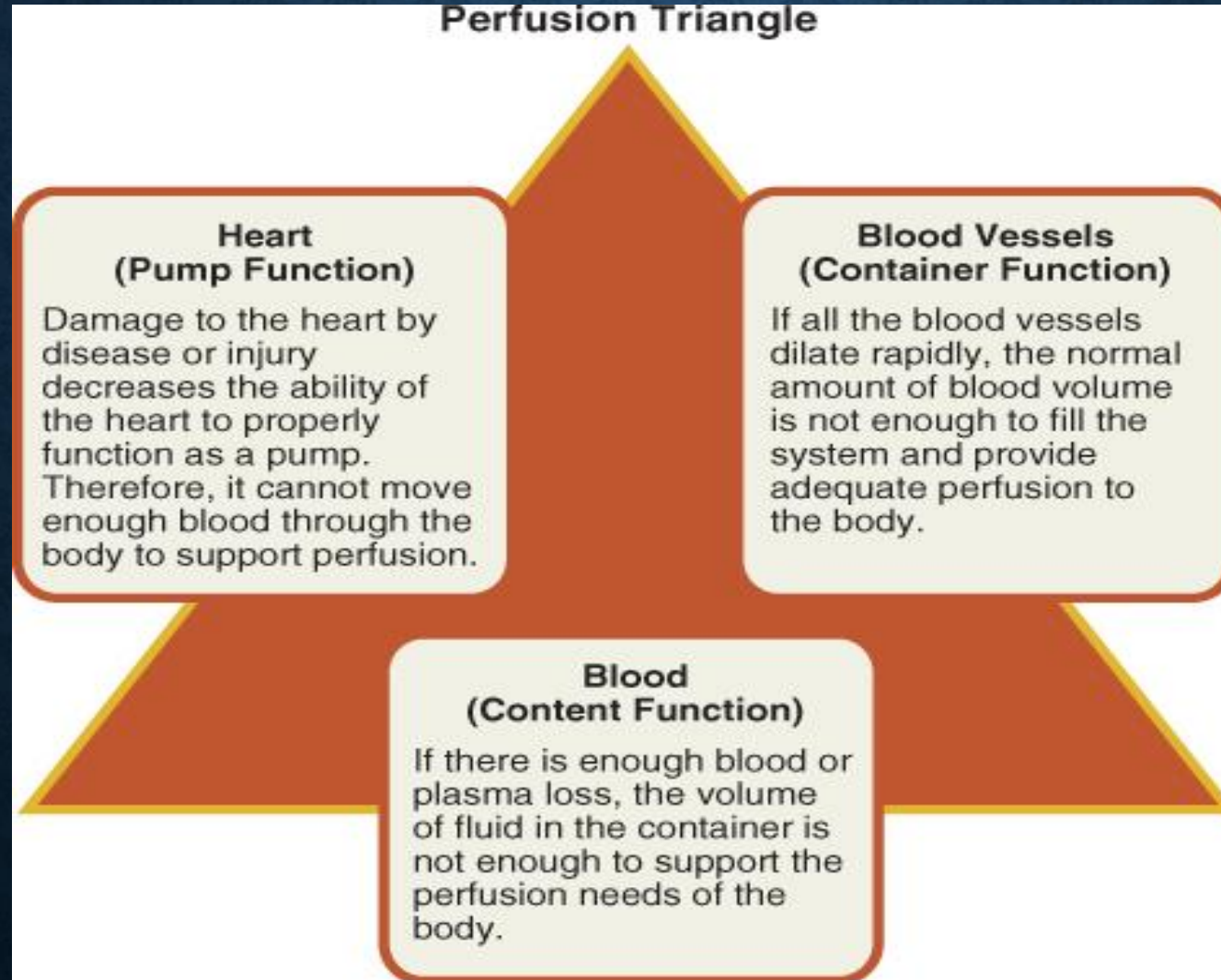
- As the body detects shock it will do things to correct the imbalance.
 - The body will increase:
 - Heart rate
 - Strength of cardiac contractions
 - Peripheral vasoconstriction

If the direct cause of the imbalance is not corrected the body will shunt blood away from non vital areas and only perfuse the heart lungs and brain.

CARDIOVASCULAR SYSTEM

- Cardiovascular system consists of three parts:
 - Pump (heart)
 - Set of pipes (blood vessels, capillaries, arteries)
 - Contents (the blood)

PERFUSION TRIANGLE



HOW WE MEASURE PERFUSION

- Blood pressure is the pressure of blood within the vessels at any moment in time.
 - Systolic: Peak pressure in the arteries during cardiac contraction.
 - Diastolic: Peak pressure in the arteries during cardiac relaxation.

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (upper number)		DIASTOLIC mm Hg (lower number)
NORMAL	LESS THAN 120	and	LESS THAN 80
ELEVATED	120 – 129	and	LESS THAN 80
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 1	130 – 139	or	80 – 89
HIGH BLOOD PRESSURE (HYPERTENSION) STAGE 2	140 OR HIGHER	or	90 OR HIGHER
HYPERTENSIVE CRISIS (consult your doctor immediately)	HIGHER THAN 180	and/or	HIGHER THAN 120

3 PRIMARY CAUSES OF SHOCK



- A Pump failure**
Causes: Heart attack, trauma to heart, obstructive causes (large pulmonary embolus)



- B Low fluid volume**
Causes: Trauma to vessels or tissues, fluid loss from GI tract (vomiting/diarrhea can also lower the fluid component of blood)



- C Poor vessel function**
Causes: Infection, drug overdose (narcotic), spinal cord injury, anaphylaxis

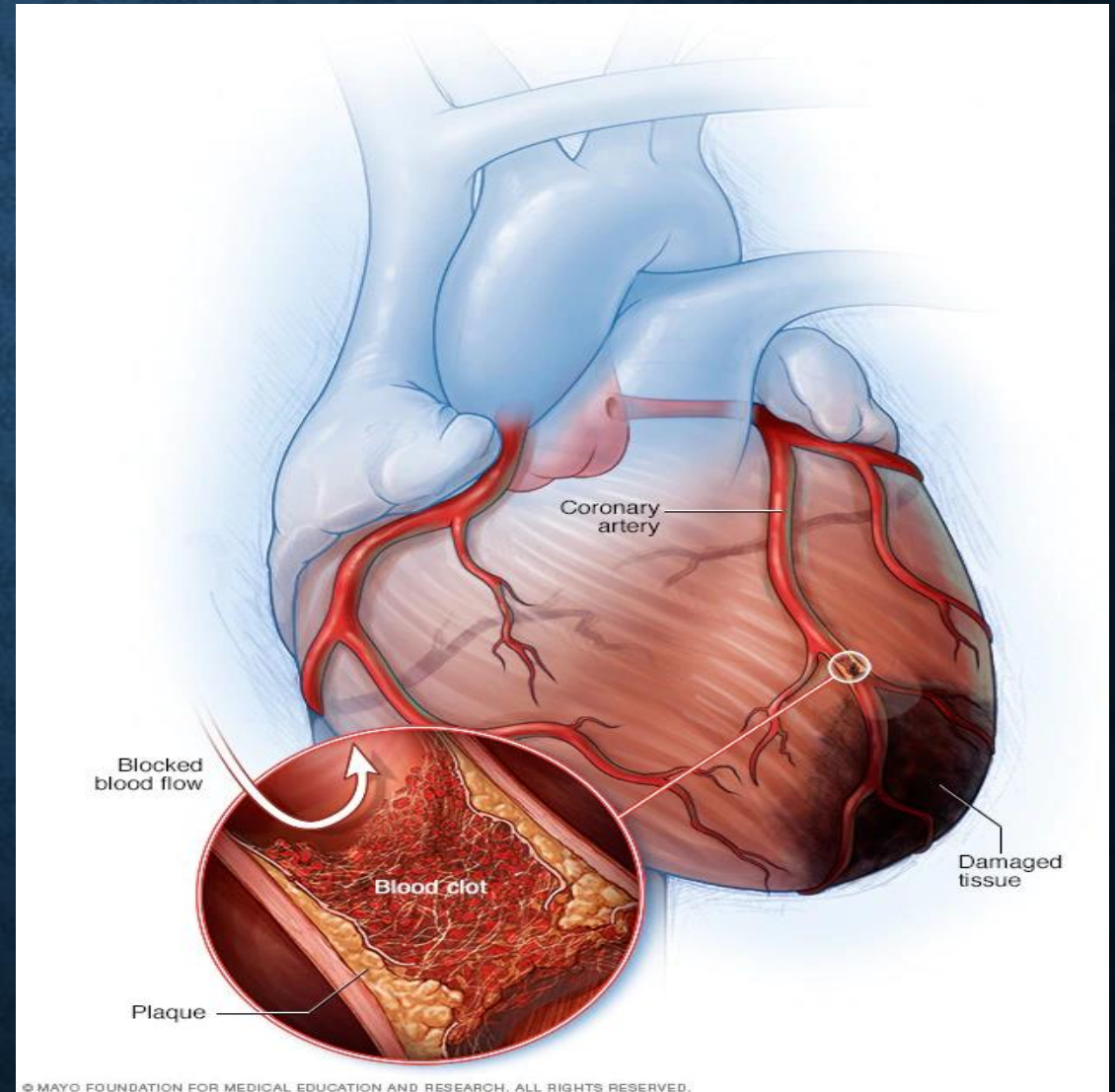
Table 12-1

Causes of Shock

Cause	Type of Shock
Pump Failure	Cardiogenic shock Obstructive shock <ul style="list-style-type: none">■ Tension pneumothorax■ Cardiac tamponade■ Pulmonary embolism
Poor Vessel Function	Distributive shock <ul style="list-style-type: none">■ Septic shock■ Neurogenic shock■ Anaphylactic shock■ Psychogenic shock
Low Fluid Volume	Hypovolemic shock <ul style="list-style-type: none">■ Hemorrhagic shock■ Non-hemorrhagic shock

CARDIOGENIC SHOCK

- Caused by inadequate function of the heart itself so it is unable to maintain sufficient output to meet the demands of the body.
- This severe impairment of myocardial performance results in diminished cardiac output, end-organ hypoperfusion, and hypoxia.



EFFECTS OF CARDIOGENIC SHOCK

- A large section of heart muscle that no longer moves well or does not move at all.
- Dangerous heart rhythms, such as ventricular tachycardia, ventricular fibrillation, or supraventricular tachycardia.
- Very slow heart rhythm (bradycardia) or problem with the electrical system of the heart (heart block).

CARDIOGENIC SHOCK

- The most common cause of shock is left ventricular failure due to a heart attack.
- Other causes can be from internal or external causes:

Internal causes:

- Right ventricular failure
- Sustained arrhythmias
- Valvular disorders
- Septal defects

External (Obstructive shock) causes:

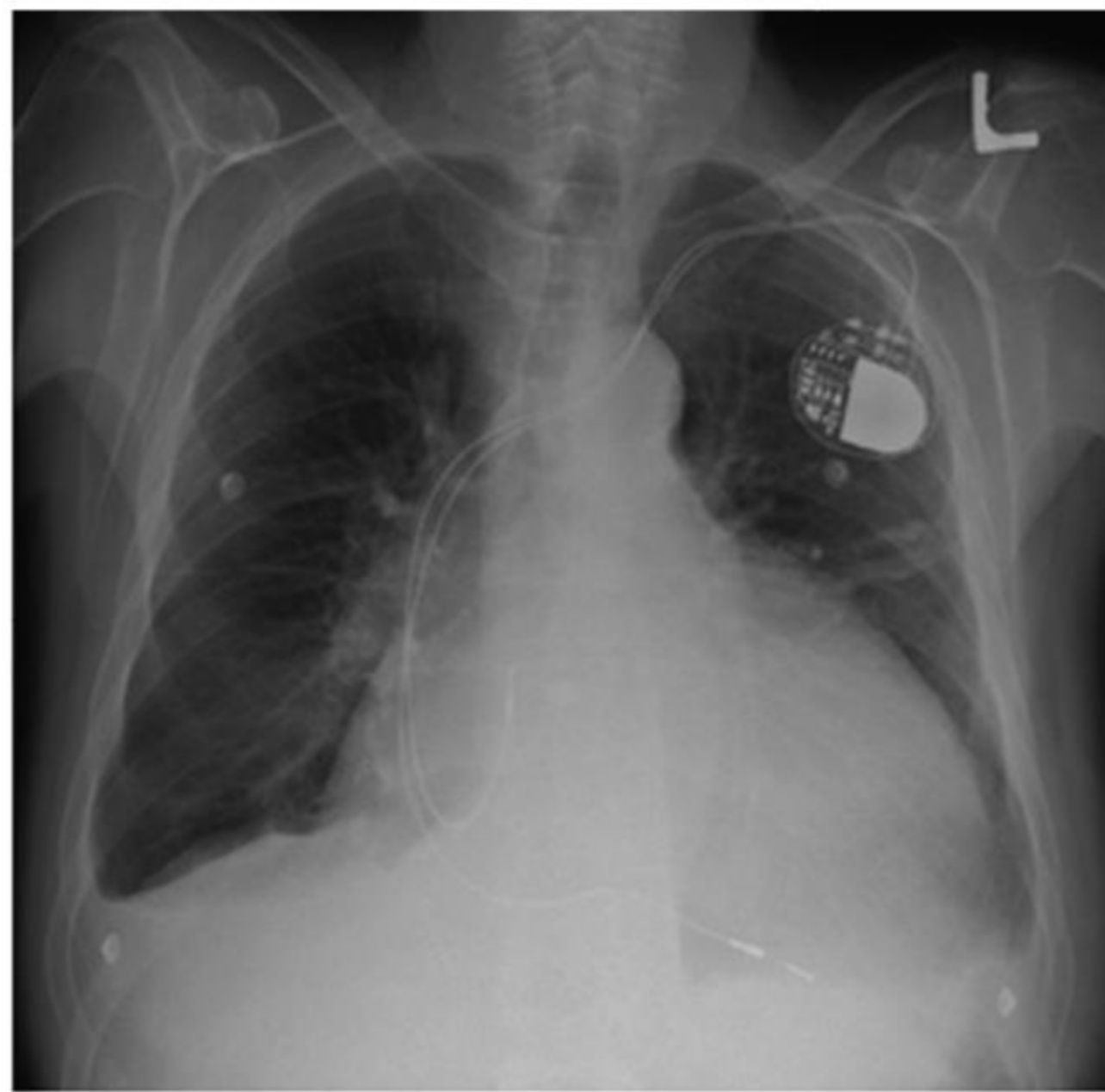
- Tension Pneumothorax
- Cardiac tamponade
- Pulmonary embolism

CARDIOGENIC SIGNS AND SYMPTOMS

- Tachycardia initially, then weak and thready as heart failure increases.
- Left sided heart failure will cause pulmonary edema due to blood backing up into the lungs.
- Right sided heart failure will cause jugular vein distention as blood backs up superiorly.
- Cool, clammy pale skin due to peripheral vasoconstriction.
- Increased respirations as the body compensates for metabolic acidosis.
- Cardiomegaly (Next slide)

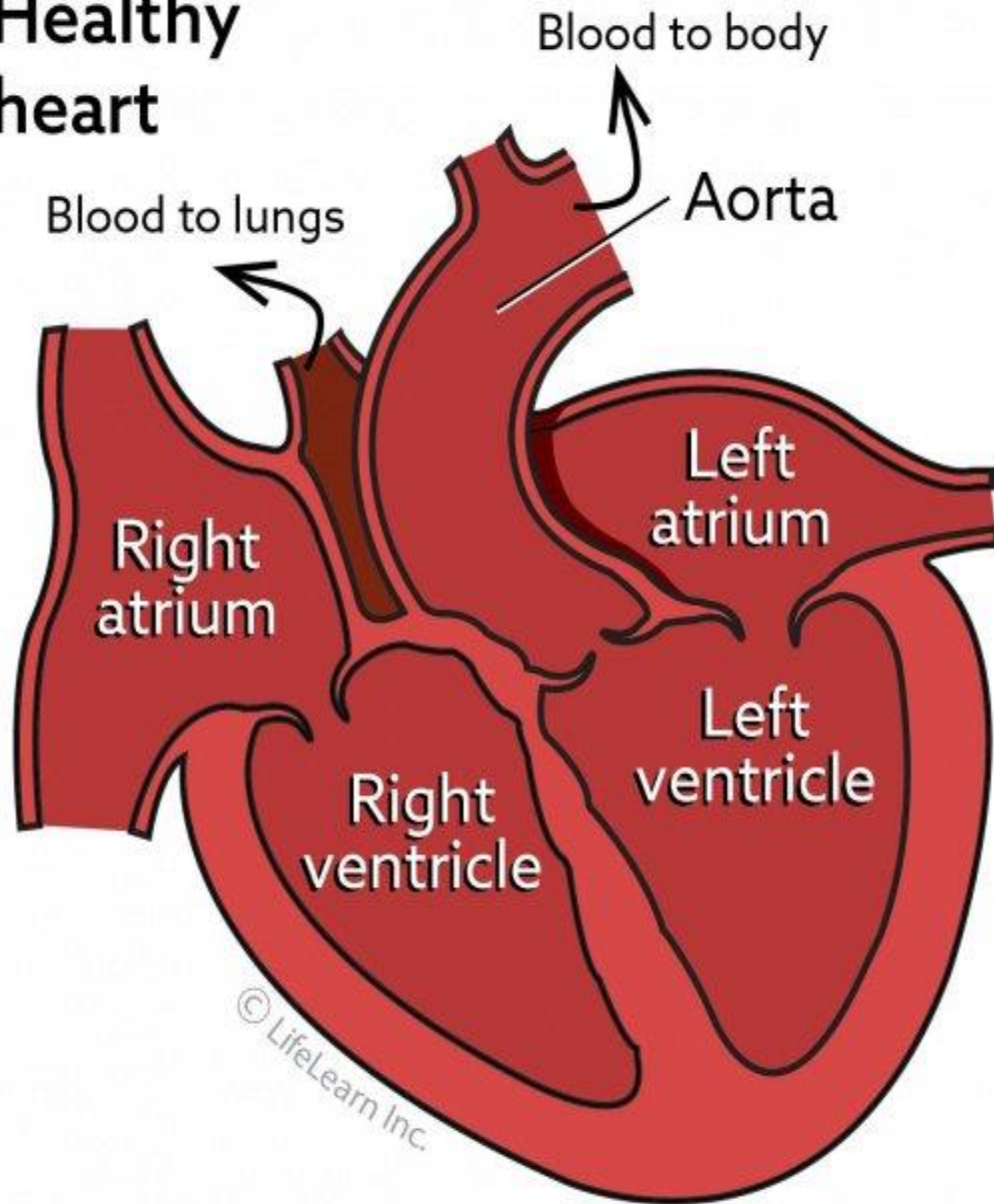


Normal Size Heart on Chest X-ray



Cardiomegaly on Chest x-ray

Healthy heart



Heart Failure:

Left Sided VS Right Sided

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LEFT




- Usually caused by hypertension, coronary artery disease, & valvular disease
- Divided into two subtypes:
 - Systolic heart failure: HF with reduced EF
 - Diastolic heart failure: HF with preserved ventricular function

RIGHT

- Can be caused by left ventricular failure, right MI, or pulmonary hypertension
- Right ventricle cannot empty completely
- May be secondary to pulmonary problems (COPD)

SYMPTOMS

- Pulmonary congestion:
 - Cough 
 - Crackles
 - Pink-tinged sputum
 - Tachypnea
- Tachycardia
- Fatigue
- Cyanosis
- Exertional dyspnea

- Peripheral edema 
- Ascites 
- Enlarged liver & spleen 
- JVD
- Weight gain
- Increased peripheral venous pressure



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CARDIOGENIC SHOCK: OBSTRUCTIVE CAUSES

- Caused by a mechanical obstruction that prevents an adequate volume of blood from filling the heart chambers.
- Three of the most common examples:
 - Cardiac tamponade
 - Tension pneumothorax
 - Pulmonary embolism

CARDIAC TAMPONADE

- The pericardium consists of two thin layers of tissue. This area usually contains a small amount of fluid to prevent friction between the layers.
- However, an abnormally high level of fluid puts pressure on the heart and affects its ability to pump blood around the body properly. If the level of fluid builds up quickly, the condition can be life threatening.

Can be caused by:

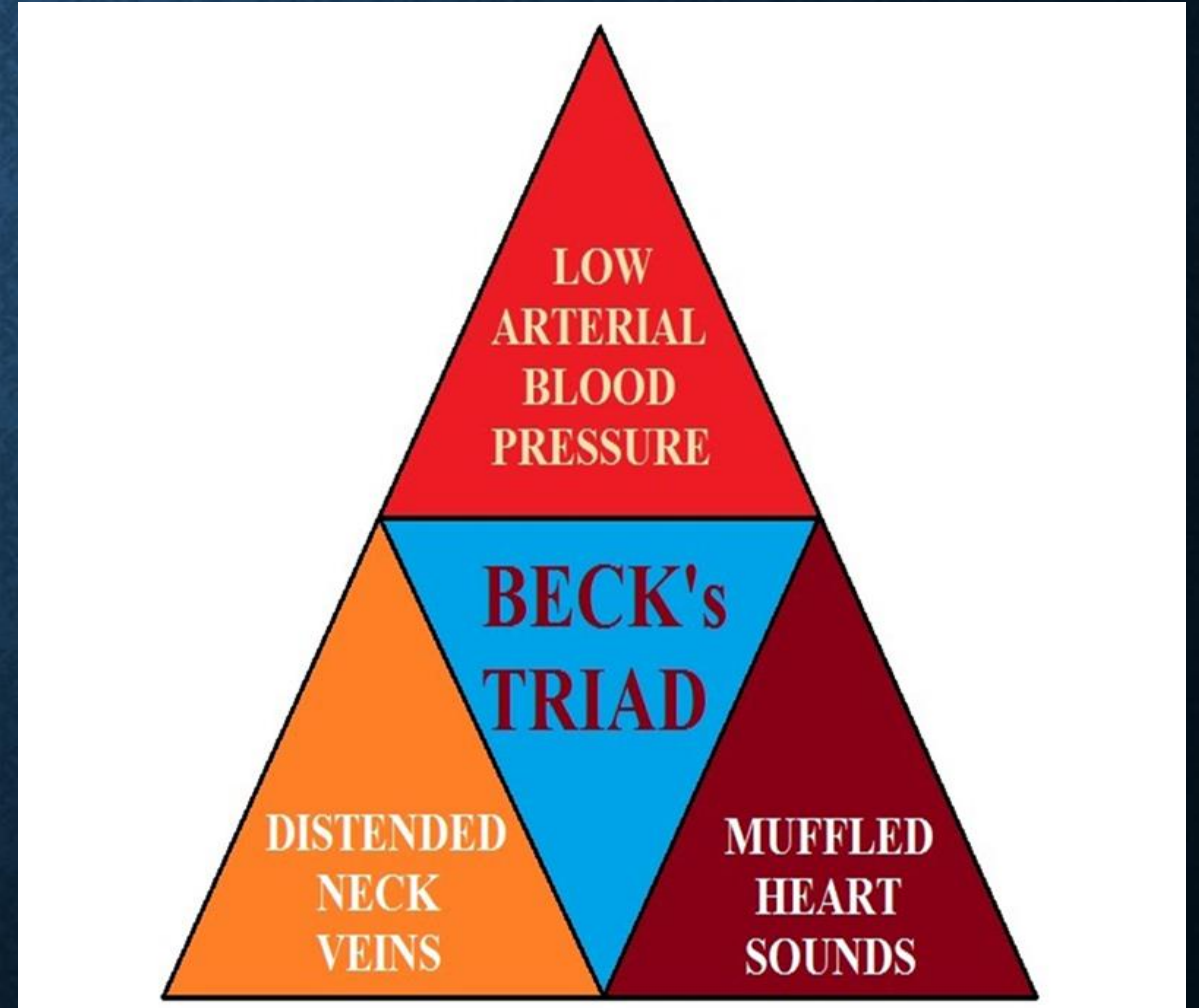
- Severe chest injury
- Heart attack
- Pericarditis
- Aortic dissection

CARDIAC TAMPONADE S/S

Signs and symptoms are referred to as Beck's triad:

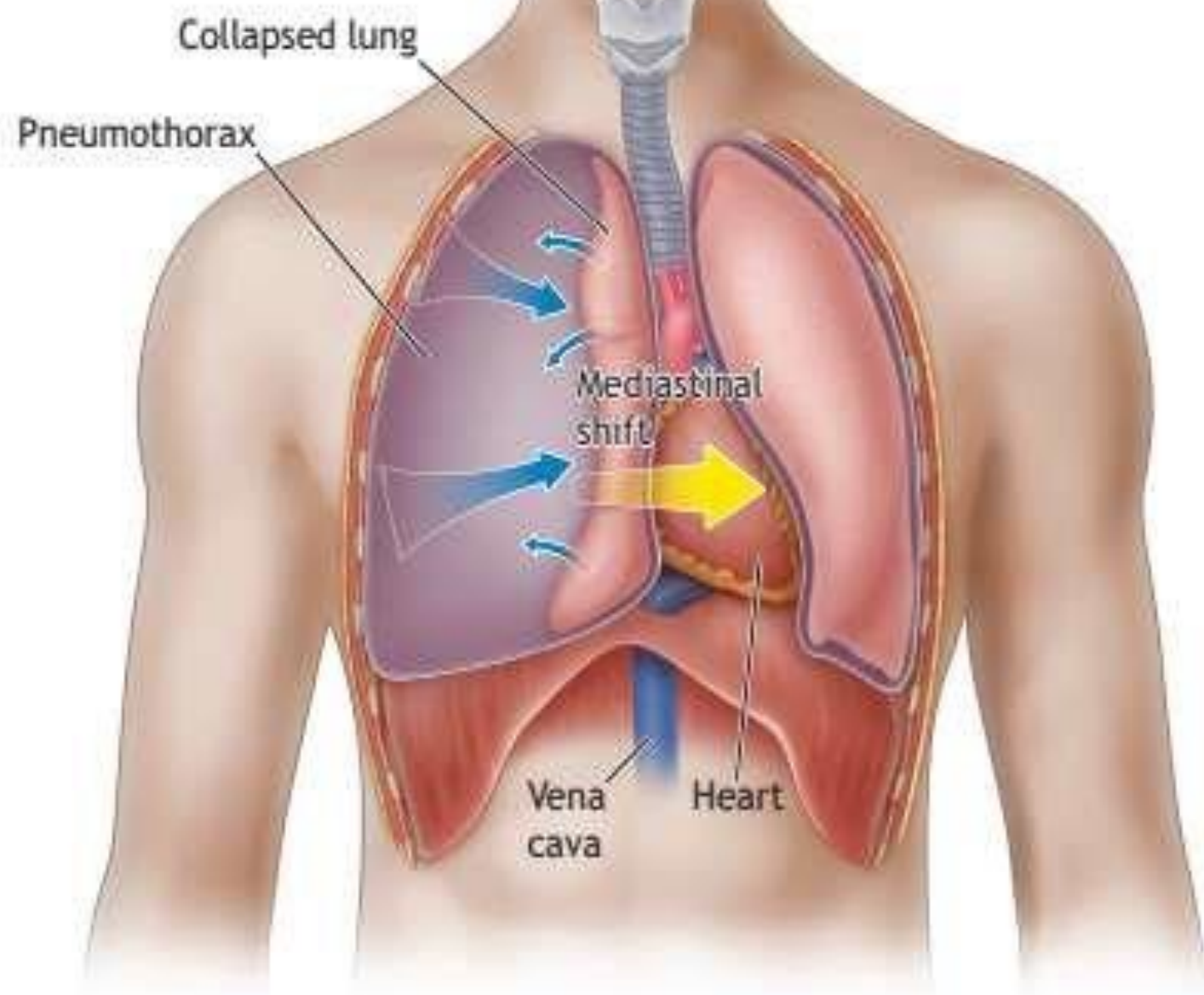
- Hypotension
 - Jugular venous distention
 - Muffled heart sounds
-
- Tachycardia
 - Anxiety
 - Sharp pain in the chest, back, abdomen, or shoulder
 - Shortness of breath
 - Weak pulse

CARDIAC TAMPONADE



TENSION PNEUMOTHORAX

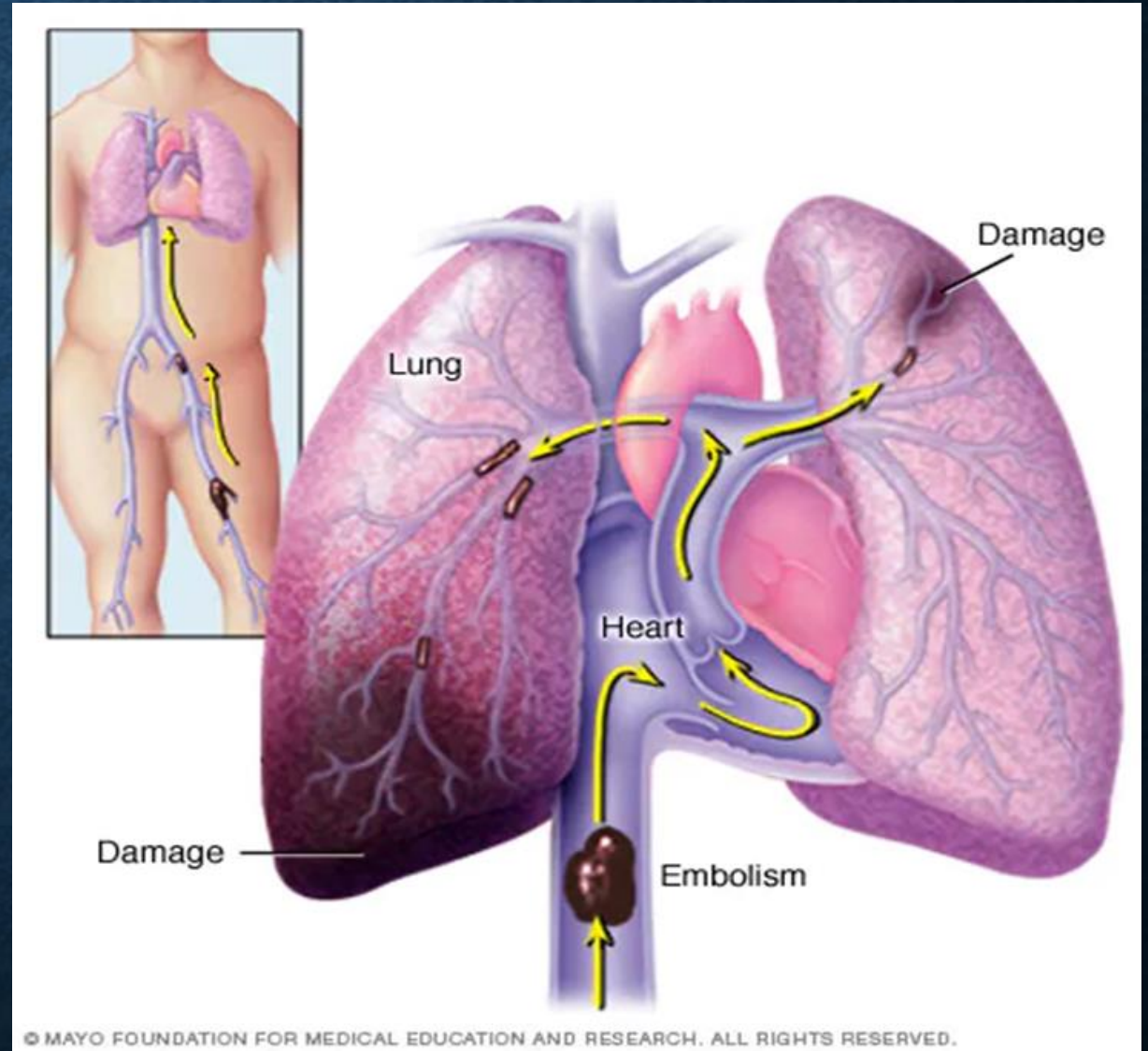
- Usually caused by penetrating trauma to the chest but can be from internal causes. The negative pressure created by our diaphragm pulls air into the chest cavity through the opening in the chest.
- Air is trapped in the chest cavity displacing mediastinal structures and compromising cardiopulmonary function.
- Signs and Symptoms:
 - Jugular vein distension.
 - Hypotension.
 - Diminished breath sounds/difficulty breathing.
 - Tracheal deviation (late sign).



■ **FIGURE 4-1** Tension Pneumothorax. A "one-way valve" air leak occurs from the lung or through the chest wall, and air is forced into the thoracic cavity, eventually collapsing the affected lung.

PULMONARY EMBOLISM

- A blood clot that developed somewhere else in the body (often in the leg) travels to the lungs and gets stuck in the pulmonary artery, restricting blood flow.



PULMONARY EMBOLISM S/S

- Sudden shortness of breath.
- Chest pain.
- Irregular heartbeat.
- Tachycardia.
- Coughing up blood.
- Hypotension.

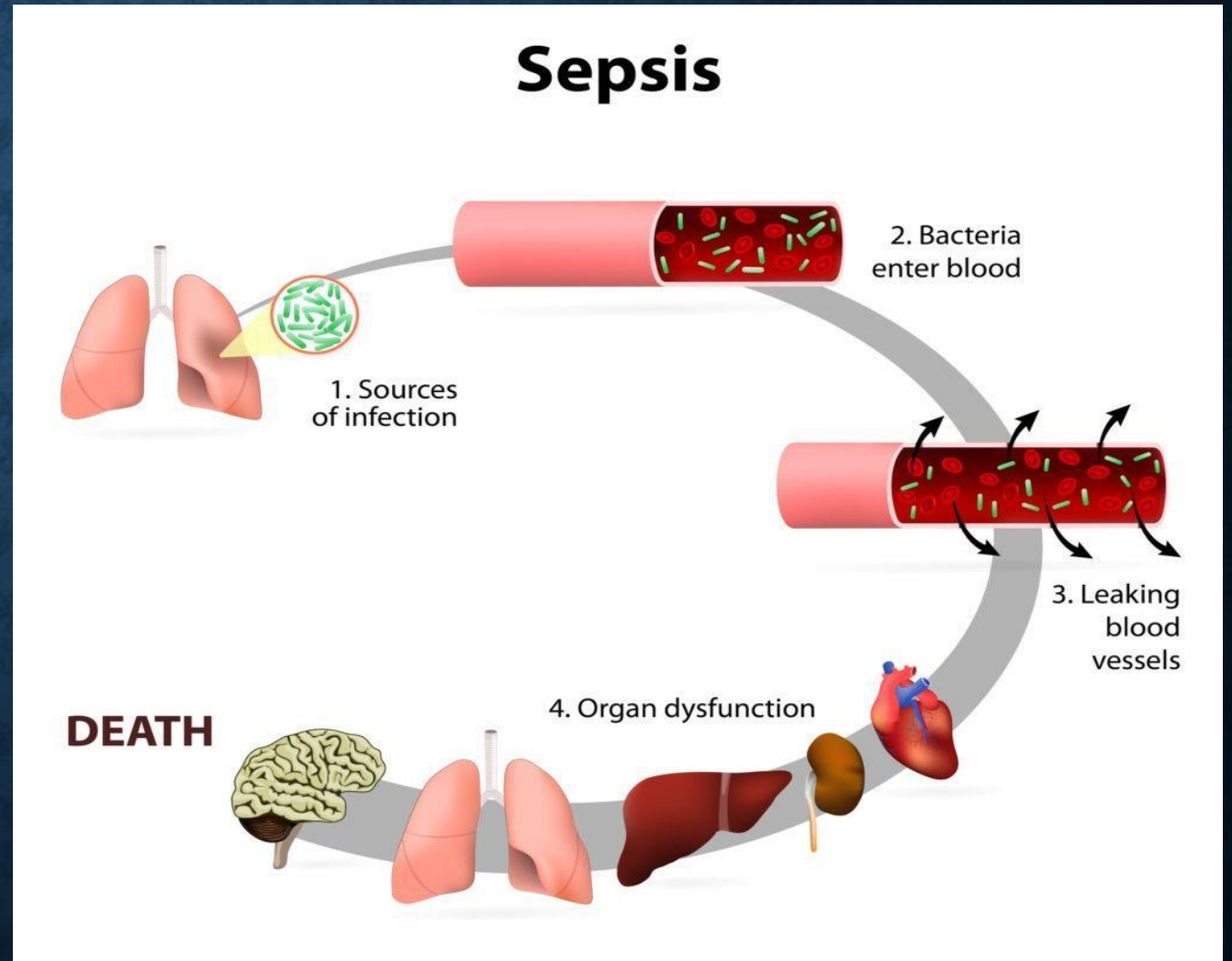


DISTRIBUTIVE SHOCK

- Results from widespread dilation of small arterioles, small venules, or both.
- The circulating blood volume pools in the expanded vascular beds, causing tissue perfusion to decrease.
- Caused by an
 - Severe infection.
 - Allergic reaction.
 - Spinal cord injury.
 - Psychological reaction.

SEPTIC SHOCK

- Occurs as a result of severe infections in which toxins are generated by bacteria or by infected body tissues.
- Toxins damage vessel walls, causing increased cellular permeability, causing fluid to leak and are the inability to contract well.





[Journal List](#) > [HHS Author Manuscripts](#) > PMC3488423



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Sepsis, severe sepsis and septic shock: changes in incidence, pathogens and outcomes

[Greg S Martin](#)

OTHER

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ACTION

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RESOU

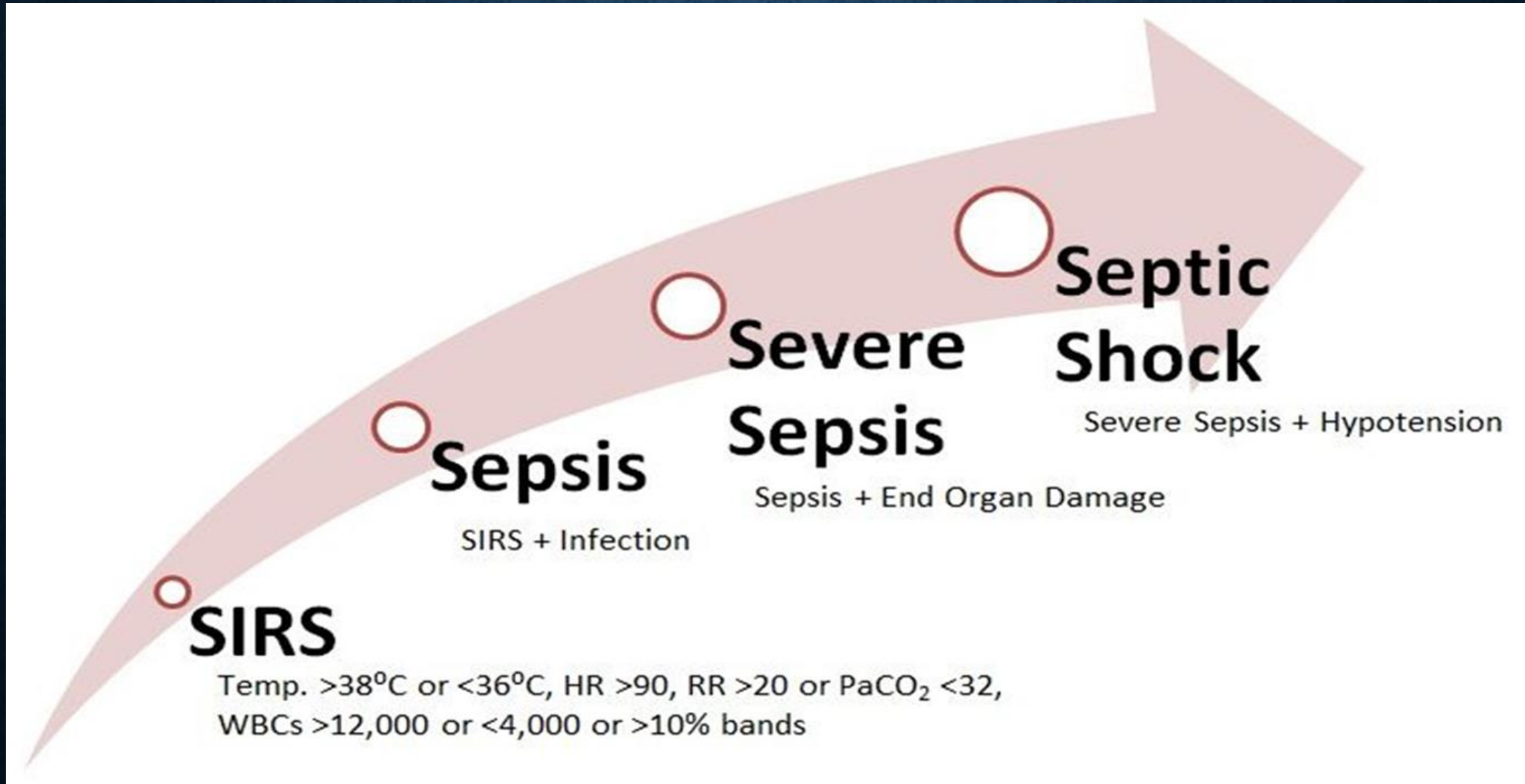
KEY POINTS

- Renaissance author Niccolo Machiavelli (1469–1527), he said: 'hectic fever, at its inception, is difficult to recognize but easy to treat; left unattended it becomes easy to recognize and difficult to treat.'
- Severe sepsis is present in between half and three-quarters of critically ill patients
- It is estimated that there are more than 1,000,000 cases of sepsis among hospitalized patients each year in the USA.
- The risk of dying increases by approximately 10% for every hour of delay in receiving antibiotics.

SIRS-SEPSIS-SEPTIC SHOCK

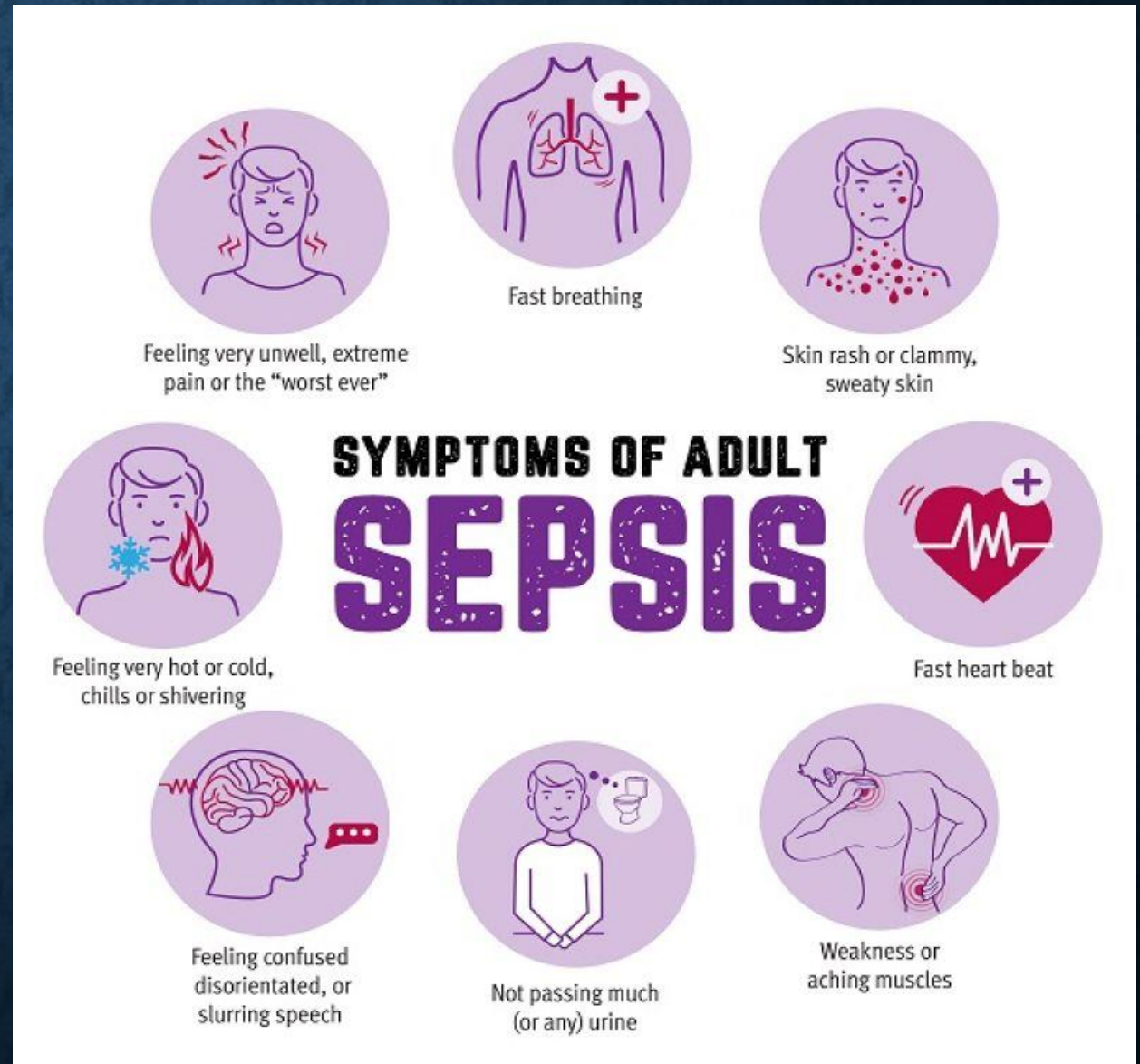
- **SIRS** (Systemic inflammatory response syndrome): The infection is severe enough to affect organ function.
- **Sepsis:** An infection reaches the bloodstream and causes inflammation in the body.
- **Septic shock:** There's a significant drop in blood pressure that can lead to respiratory or heart failure, stroke, dysfunction of other organs, and possibly death.
- Sepsis must be treated quickly and efficiently as soon as healthcare providers suspect it. If it isn't recognized and treated quickly, sepsis can progress to severe sepsis and then to septic shock.

SEPTIC PROGRESSION



SEPSIS S/S

- High fever or chills
- Intense body pain
- Fast heart rate
- Rapid breathing
- Rash
- Hypotension
- Noticeably lower amounts of urine
- Acute confusion



SEPSIS

When it comes to sepsis, remember
IT'S ABOUT TIME™. Watch for:



TEMPERATURE
higher or lower
than normal

INFECTION
may have signs
and symptoms of
an infection

MENTAL DECLINE
confused, sleepy,
difficult to rouse

EXTREMELY ILL
severe pain,
discomfort,
shortness of breath

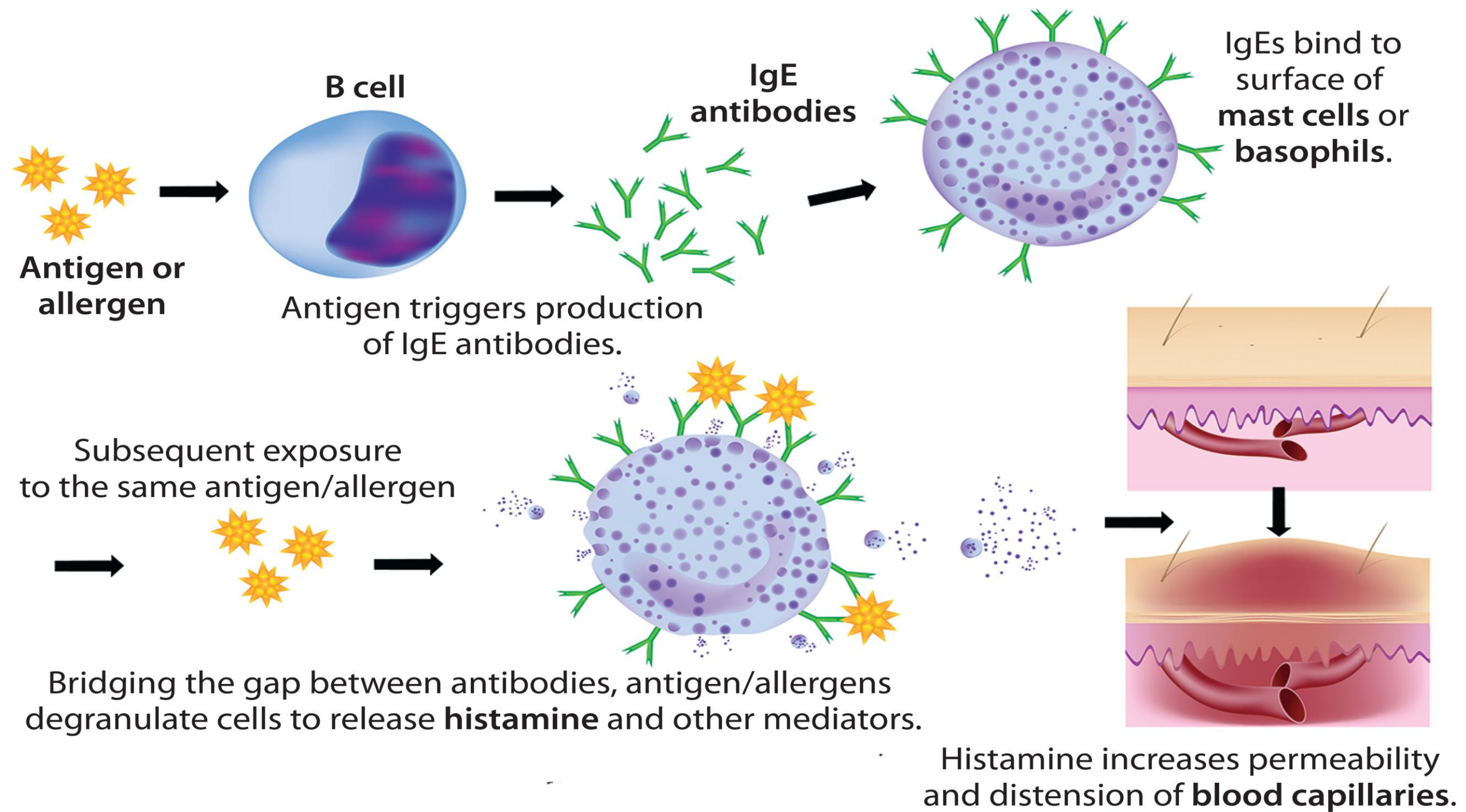
If you experience a combination of these symptoms: seek urgent medical care, call 911, or go to the hospital with an advocate. Ask: "Could it be sepsis?"

ANAPHYLACTIC SHOCK

- Severe, life-threatening allergic reaction producing systemic vasodilation in response to a histamine release.
- Can come from a variety of sources:
 - Injections (tetanus antitoxin, penicillin)
 - Stings (wasps, bees, hornets, ants)
 - Ingestion (fish, shellfish, nuts, eggs, medication)
 - Inhalation (dust, pollen, mold)

ANAPHYLACTIC SHOCK

- The body releases histamine in response to exposure to a substance.
- In anaphylactic shock the body secretes too much histamine which is responsible for widespread vasodilation, increased capillary permeability (both causing hypotension) and smooth muscle constriction (causing airway problems).
- Histamine is a primary mediator of allergic rhinitis, urticaria (hives), anaphylaxis, and asthma.



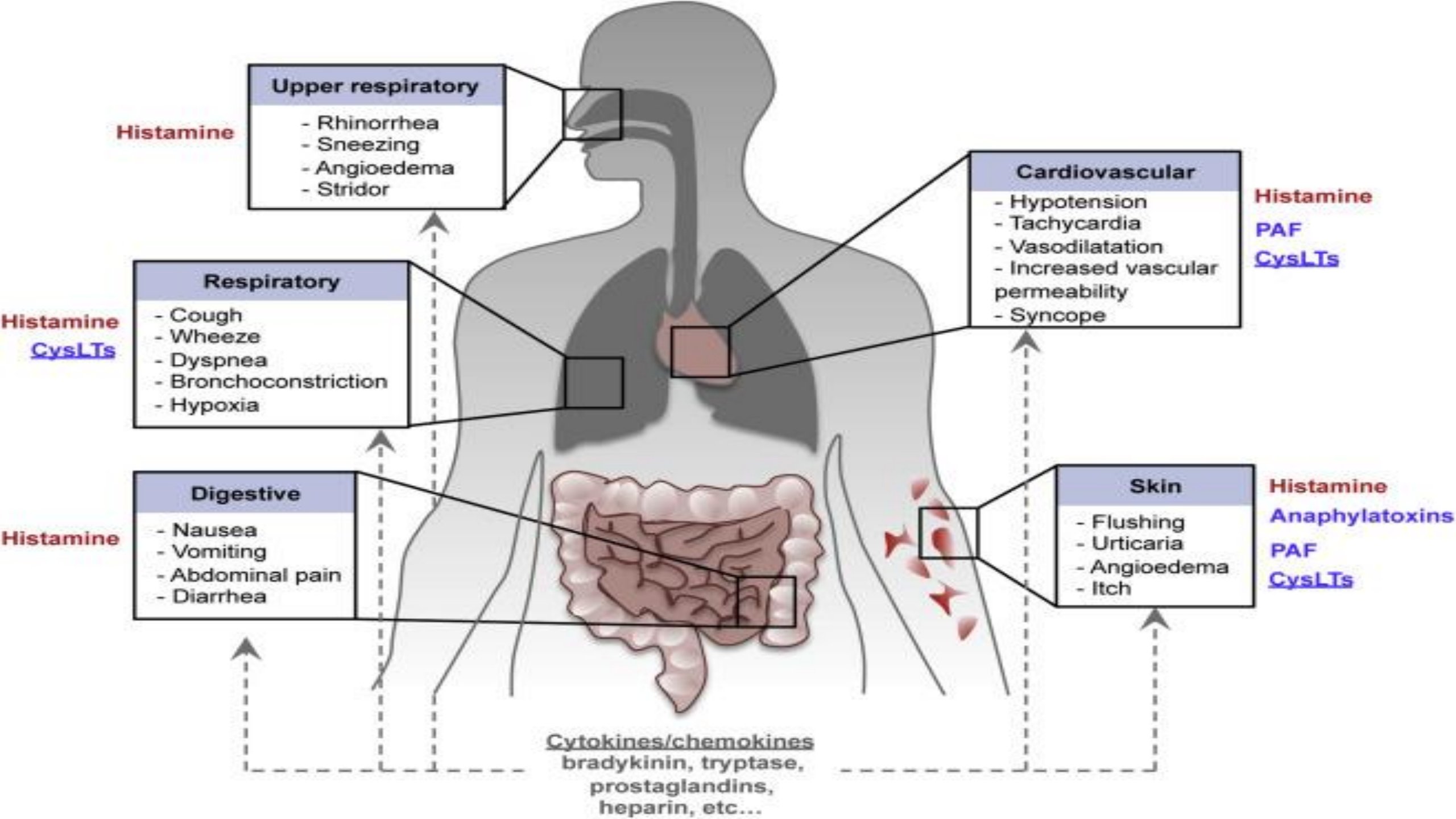
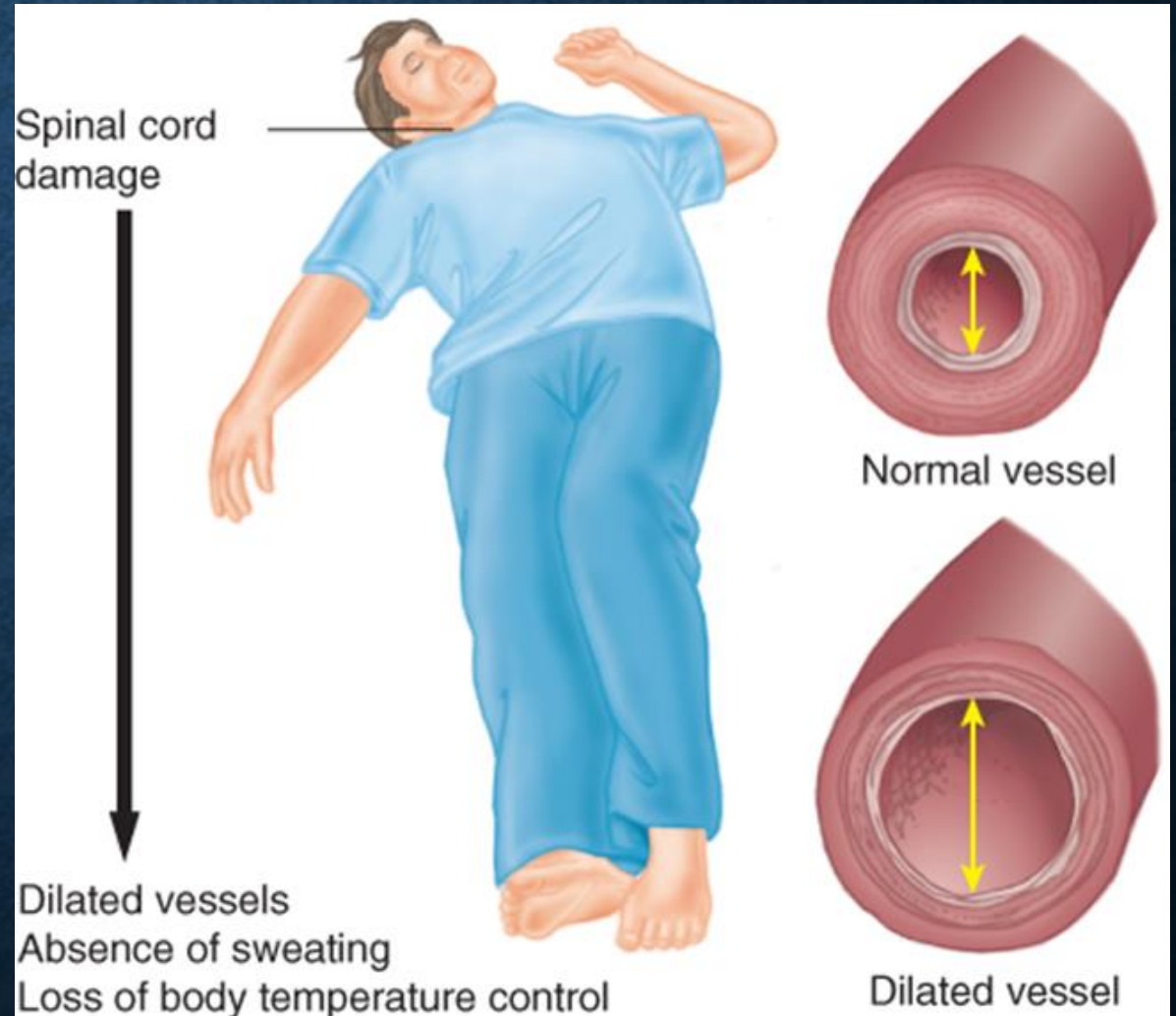


Table 12-2**Signs and Symptoms of Anaphylactic Shock**

System	Signs and Symptoms
Skin	<ul style="list-style-type: none">■ Flushed, itchy, or burning, especially over the face and upper part of the chest■ Urticaria (hives), which may spread over large areas of the body■ Edema, especially of the face, tongue, and lips■ Pallor■ Cyanosis (a bluish cast to the skin resulting from poor oxygenation of circulating blood) about the lips
Circulatory System	<ul style="list-style-type: none">■ Dilated peripheral blood vessels■ Increased vessel permeability■ Drop in blood pressure■ Weak, barely palpable pulse
Respiratory System	<ul style="list-style-type: none">■ Sneezing or itching in the nasal passages■ Stridor■ Upper airway obstruction■ Tightness in the chest, with a persistent dry cough■ Wheezing and dyspnea (difficulty breathing)■ Secretions of fluid and mucus into the bronchial passages, alveoli, and lung tissue, causing coughing■ Constriction of the bronchi; difficulty drawing air into the lungs■ Forced expiration, requiring exertion and accompanied by wheezing■ Cessation of breathing
Other	<ul style="list-style-type: none">■ Abdominal cramping■ Nausea■ Vomiting■ Altered mental status■ Dizziness■ Fainting and coma

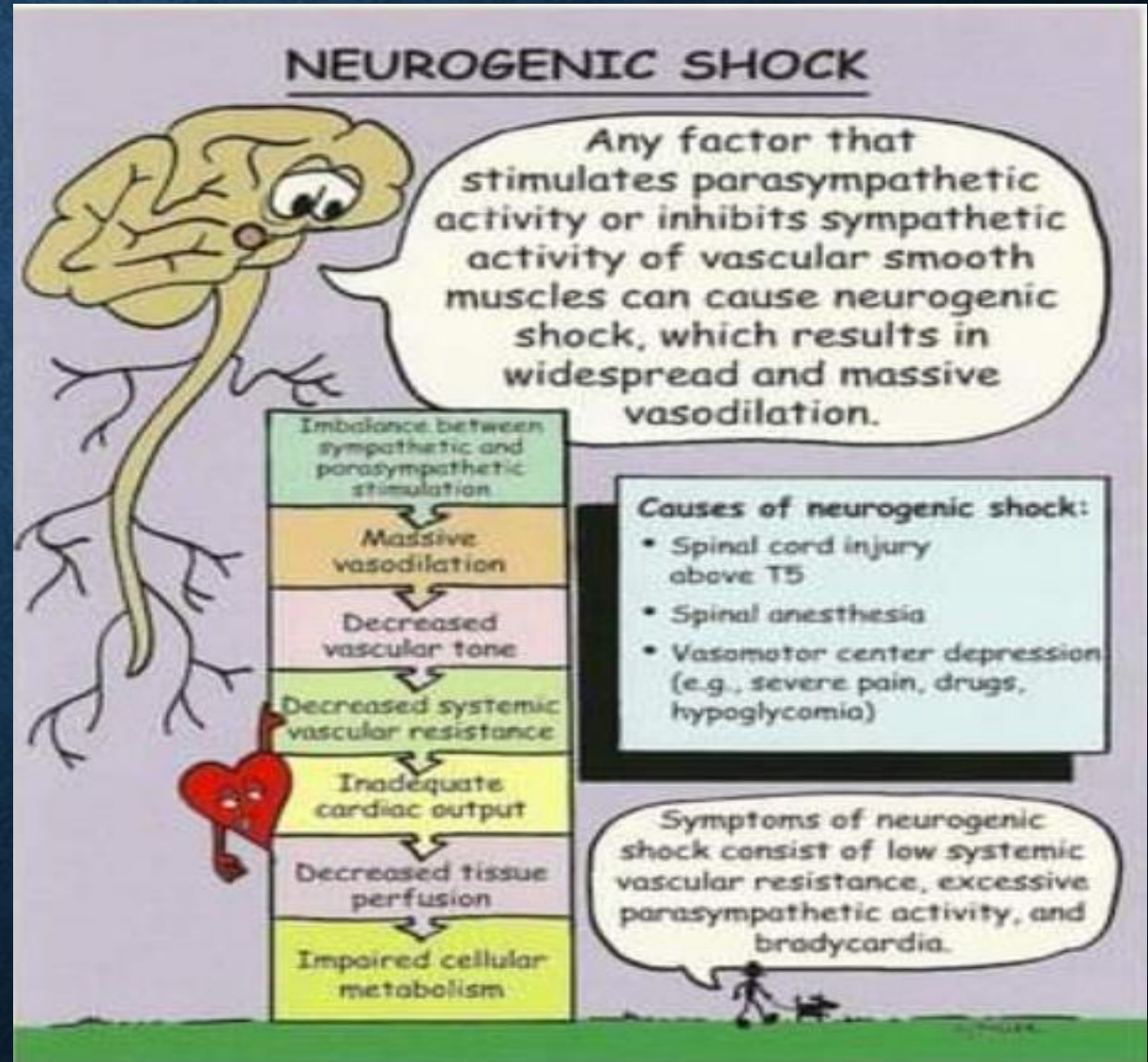
NEUROGENIC SHOCK

- Usually the result of high spinal cord injury
- Can also include:
 - Brain conditions
 - Tumors
 - Traumatic injuries
 - Pressure on the spinal cord



NEUROGENIC SHOCK

- Muscles in the blood vessel walls are cut off from the nerve impulses that regulate contraction.
- Studies estimate that 19% to 31% of people with a spinal cord injury get neurogenic shock.
- Each year, about 8,000 to 10,000 people in America injure their spinal cord — mostly through car crashes and falls.



NEUROGENIC SHOCK MECHANISM

- Neurogenic shock is a combination of both primary and secondary injuries that lead to loss of sympathetic tone and thus unopposed parasympathetic response driven by the vagus nerve.
- Consequently, patients suffer from instability in blood pressure, heart rate, and temperature regulation.
- Bradycardia, hypotension, flushed warm skin are the classic signs associated with neurogenic shock.

NEUROGENIC SHOCK S/S

- Low blood pressure (hypotension).
- Slow heart rhythm (bradyarrhythmia).
- Inability to regulate body temperature distal to injury.
- Lips and fingernail cyanosis.

PSYCHOGENIC SHOCK

- Caused by a sudden reaction of the nervous system which produces a temporary, generalized vascular dilation which results in fainting (syncope).
- Some causes are serious and others are not.
- Life-threatening causes include irregular heartbeat and brain aneurysm.
- Non-life-threatening events include receipt of bad news or experiencing fear or unpleasant sights (such as blood).

HYPOVOLEMIC SHOCK

- Result of an inadequate amount of fluid or volume in the circulatory system.
- Hemorrhagic causes like blood loss and non-hemorrhagic causes like diarrhea, vomiting and dehydration.
- Can also occurs with severe thermal burns.

HYPOVOLEMIC SHOCK S/S

- Anxiety or agitation.
- Cool, clammy skin.
- Confusion.
- Decreased or no urine output.
- Generalized weakness.
- Pale skin color (pallor)
- Rapid breathing.
- Sweating, moist skin

SHOCK PROGRESSION

- The stages in the progression of shock:
 - Compensated shock: early stage when the body can still compensate for blood loss.
 - Decompensated shock: late stage when blood pressure is falling
 - No way to assess when effects are irreversible.
- Must recognize and treat shock early.

Table 12-3**Progression of Shock****Progression****Signs and Symptoms**

Compensated Shock

- Agitation
- Anxiety
- Restlessness
- Feeling of impending doom
- Altered mental status
- Weak, rapid (thready), or absent pulse
- Clammy (pale, cool, moist) skin
- Pallor, with cyanosis about the lips
- Shallow, rapid breathing
- Air hunger (shortness of breath), especially if there is a chest injury
- Nausea or vomiting
- Capillary refill of longer than 2 seconds in infants and children
- Marked thirst
- Narrowing pulse pressure

Decompensated Shock

- Falling blood pressure (systolic blood pressure of 90 mm Hg or lower in an adult)
- Labored or irregular breathing
- Ashen, mottled, or cyanotic skin
- Thready or absent peripheral pulses
- Dull eyes, dilated pupils
- Poor urinary output

SIGNS AND SYMPTOMS

- Blood pressure may be the last measurable factor to change in shock.
 - When a drop in blood pressure is evident, shock is well developed.
 - Particularly true in infants and children
- Expect shock if a patient has any one of the following conditions:
 - Multiple severe fractures
 - Abdominal or chest injury
 - Spinal injury
 - A severe infection
 - A major heart attack
 - Anaphylaxis

GENERAL GUIDELINES

- Control all obvious bleeding.
- Comfort, calm, and reassure the patient.
- If spinal immobilization is indicated, splint the patient on a backboard.
- Provide oxygen and monitor patient's breathing.
- Place blankets under and over the patient.
- Do not give the patient anything by mouth, no matter how urgently you are asked.
- Accurately record the patient's vital signs approximately every 5 minutes throughout treatment and transport.

CARDIOGENIC SHOCK TREATMENT

- Place the patient in a position that eases breathing as you give high-flow oxygen.
- Assist ventilations as necessary.
- Provide prompt transport.
- Provide calm reassurance to a patient with a suspected heart attack.

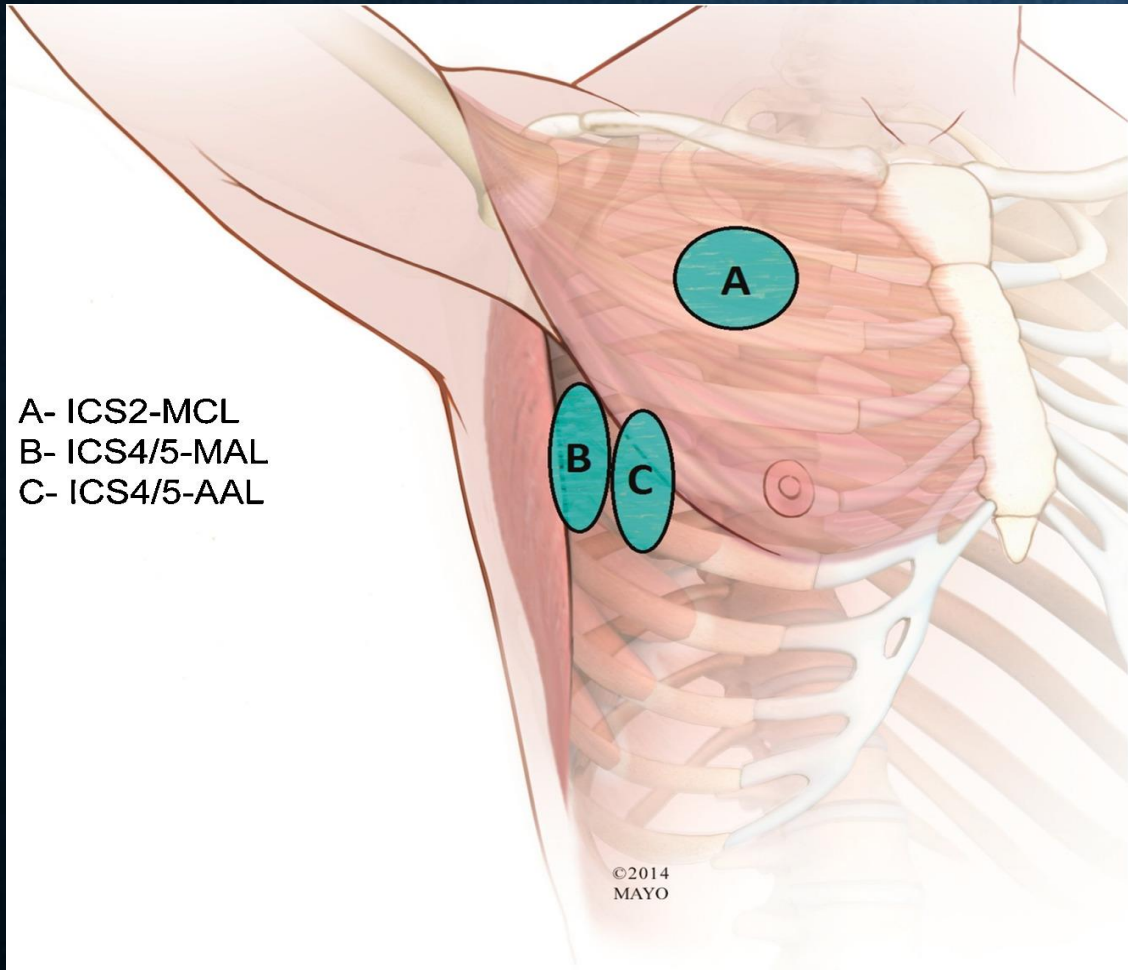
OBSTRUCTIVE SHOCK TREATMENT- CARDIAC TAMPONADE

- Increasing cardiac output is the priority.
- Apply high-flow oxygen.
- Surgery is the only definitive treatment.
- Pericardiocentesis uses a needle to withdraw blood.
 - Advanced skill; rarely performed in the field

OBSTRUCTIVE SHOCK TREATMENT- TENSION PNEUMOTHORAX

- Apply high-flow oxygen to prevent hypoxia.
- Chest decompression is required.
- Ask for ALS early in call if available, but do not delay transport.

NEEDLE DECOMPRESSION



- A needle decompression involves inserting a large bore needle in the second intercostal space, at the midclavicular line.
- Once this is done, there should be an audible release as the trapped air, and as the tension is released the patient should begin to improve.

OBSTRUCTIVE SHOCK TREATMENT- PULMONARY EMBOLISM

- Treatment of a pulmonary embolism focuses on keeping the blood clot from getting bigger and preventing new clots from forming.
- Prompt treatment is essential to prevent serious complications or death.
- Treatment can include “clot busting” medications or surgical removal.

SEPTIC SHOCK TREATMENT

- Hospital management is required.
- Administer high-flow oxygen.
- Ventilatory support may be necessary.
- Use blankets to conserve body heat.
- Alert sepsis team if available.

BARRIERS TO TREATMENT

Urine Culture and Sensitivity

Pus cells /H.P.F. 6-7/HPF
Colony Count > 100,000 / ml [Pathogenic Bacter

Sensitivity Result: **Pseudomonas aeruginosa**

Sulphamethazone & Trimthoprim (SXT)	Resistant
Ampicillin (AMP)	Resistant
Cefotaxime (CTX)	Resistant
Amoxycillin & Clavulanic Acid (AMC)	Resistant
Ampicillin & sulbactam (SAM)	Resistant
Amoxycillin (AML)	Resistant
Tetracycline (TE)	Resistant
Oxacillin (OX)	Resistant
Ceftriaxone (CRO)	Resistant
Amikacin (AK)	Resistant
Doxycycline (DO)	Resistant
Tigecycline (TGC)	Resistant
Ertapenem (ERT)	Resistant
Gentamicin (CN)	Resistant
Imipenem (IPM)	Resistant
Meropenem (MEM)	Resistant
Nitrofurantion (F)	Resistant
Cefepime(FEP)	Resistant
Ciprofloxacin (CIP)	Resistant
Norfloxacin (NOR)	Resistant
Levofloxacin (LEV)	Resistant
Colistin (CT)	Resistant
Cefoxitin (FOX)	Resistant
Piperacillin (PRL)	Resistant

CAUSES OF ANTIBIOTIC RESISTANCE



Antibiotic resistance happens when bacteria change and become resistant to the antibiotics used to treat the infections they cause.



Over-prescribing of antibiotics



Patients not finishing their treatment



Over-use of antibiotics in livestock and fish farming



Poor infection control in hospitals and clinics



Lack of hygiene and poor sanitation



Lack of new antibiotics being developed

www.who.int/drugresistance

#AntibioticResistance



NEUROGENIC SHOCK TREATMENT

- For the spinal cord injury patient, use a combination of all known supportive measures.
- Hospitalization will be required for a long time.
- Emergency treatment:
 - Provide spinal immobilization.
 - Assist inadequate breathing.
 - Conserve body heat.
 - Ensure the most effective circulation.
 - Transport promptly.

ANAPHYLACTIC SHOCK TREATMENT

- Administer epinephrine. Epinephrine reverses the symptoms of the allergic reaction by providing vasoconstriction and bronchial dilation.
- Promptly transport the patient.
- Provide high-flow oxygen and ventilatory assistance en route.
- A mild reaction may worsen suddenly.
- Consider requesting ALS backup, if available.

What does epinephrine do?

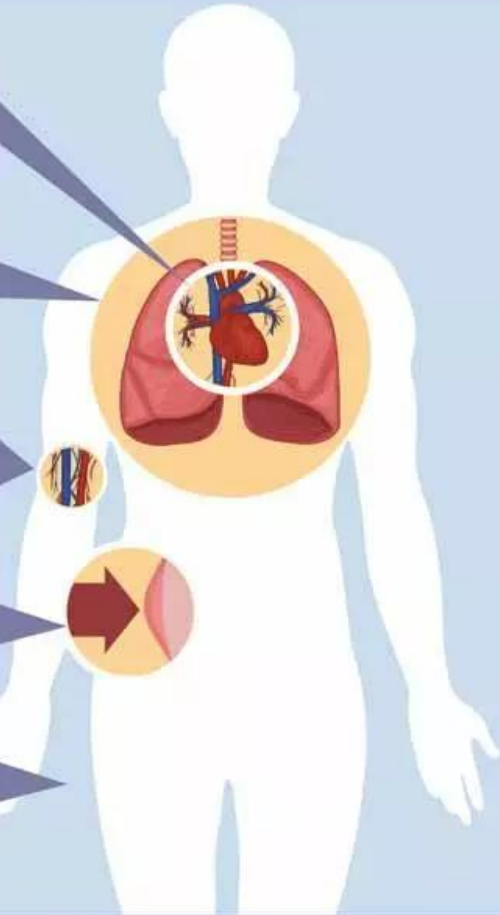
Increases heart rate
and blood pressure

Relaxes muscles that are
blocking the airways

Increases blood flow
through veins by
narrowing blood vessels

Reverses swelling

Suppresses the
body's response to
allergic reactions



Epinephrine is safe to use for most people.
**Epinephrine is the first line of
defense to treat anaphylaxis.**

HOW EPI HELPS OUR PATIENTS



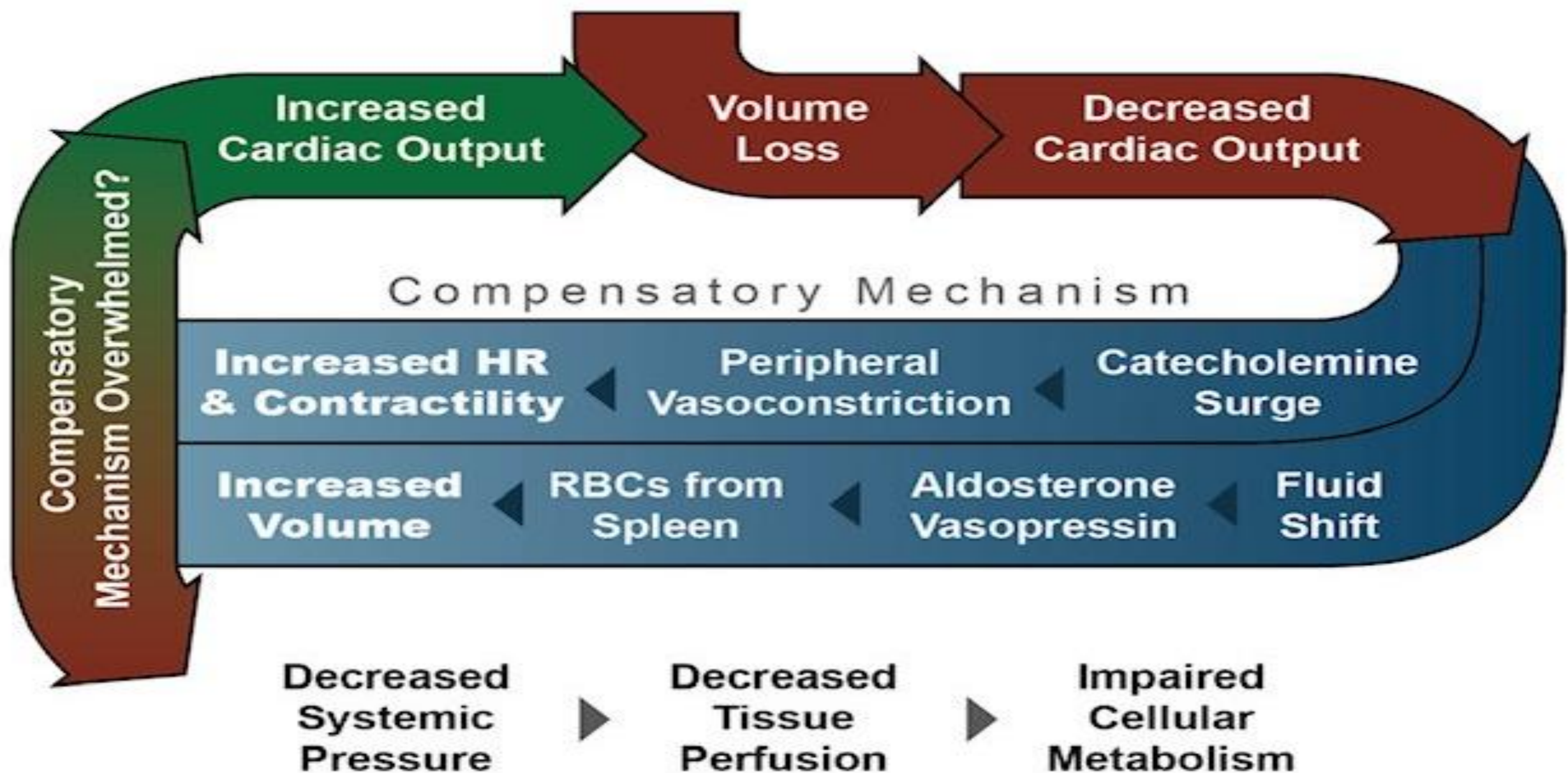
PSYCHOGENIC SHOCK TREATMENT

- In an uncomplicated case of fainting, once the patient collapses, circulation to the brain is restored and the patient should recover.
- Psychogenic shock can worsen other types of shock.
- If the patient falls, check for injuries and prevent them from standing up immediately.




































HYPOVOLEMIC SHOCK TREATMENT

- Control all obvious external bleeding.
- BLOOD TRANSFUSION (or components like FDP, PRBC's etc)
- Keep the patient warm.
- Recognize internal bleeding and provide aggressive support.
- Secure and maintain an airway, and provide respiratory support.
- Transport as rapidly as possible.

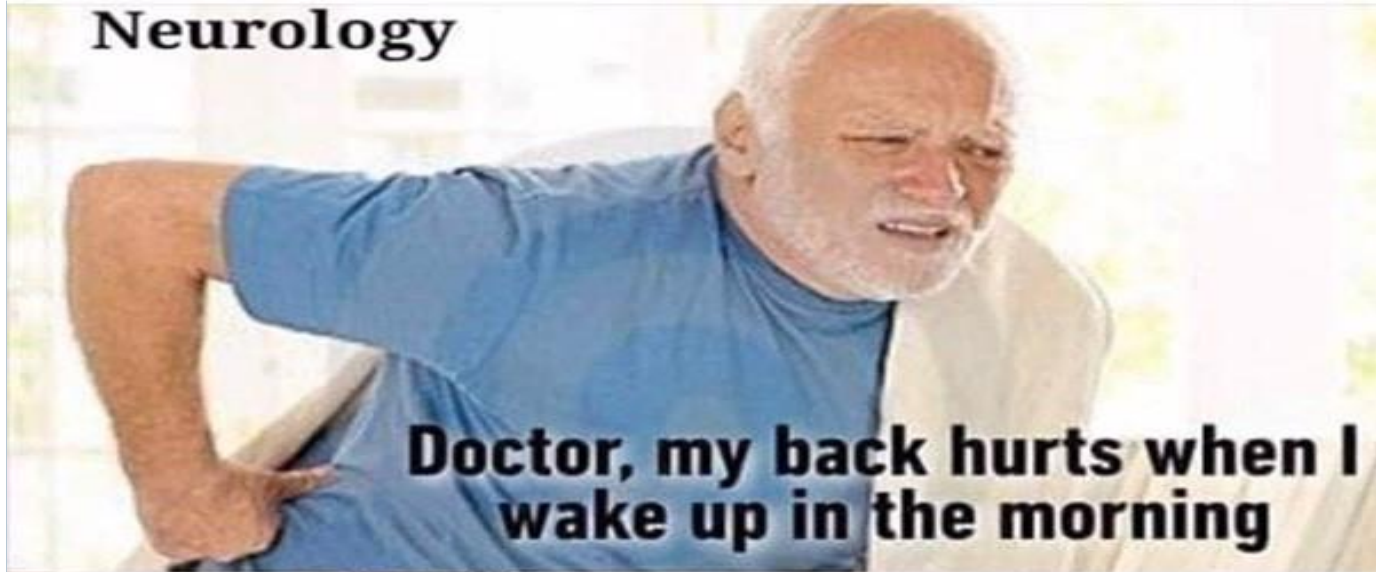
Hypovolemic Shock



SIGNS & SYMPTOMS OF SHOCK

	RR 	HR 	BP 	SKIN 	TEMP 	URINE 	OTHER S&S 
ANAPHYLACTIC Severe allergic reaction.				Flushed Swollen Itchy			Urticaria, Pruritus, Decreased LOC, Bronchoconstriction
CARDIOGENIC Failing pumping ability of the heart.				Pale Cool Clammy			Chest Discomfort, Syncope, JVD, Pulmonary Edema, Orthopnea
HYPOVOLEMIC Reduced circulating blood volume.				Pale Cool Clammy			Anxiety, Thirst, Syncope, Weakness, Confusion, Dizziness, Syncope, Weak Pulse
OBSTRUCTIVE Physical obstruction of great vessels or the heart.				Extremities: Pale Cool			Muffled Heart Sounds, JVD, Decreased LOC, Signs of Poor Perfusion
NEUROGENIC Severe central nervous system damage.				Warm Flushed Dry		No Bladder Control	Paralysis Distal to Injury Site, Priapism
SEPTIC Extreme immune system response to an infection.				Flushed then Pale & Cool	≥38°C OR <36°C		Bounding Pulse, Altered LOC

Neurology



**Doctor, my back hurts when I
wake up in the morning**

**VA
Doctor**



**Wake up in the
afternoon then**

QUESTIONS?