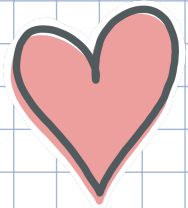


# Cardiovascular Emergencies



## Anatomy and Physiology

**Atrium:** Two upper chambers that receive incoming blood

**Ventricle:** Two lower chambers that pump outgoing blood

**Aorta:** The body's main artery, receives the blood ejected from the left ventricle and delivers it to all other arteries to carry blood to the tissues of the body

**Superior Vena Cava:** Carries deoxygenated blood from the head and upper body to the right atrium

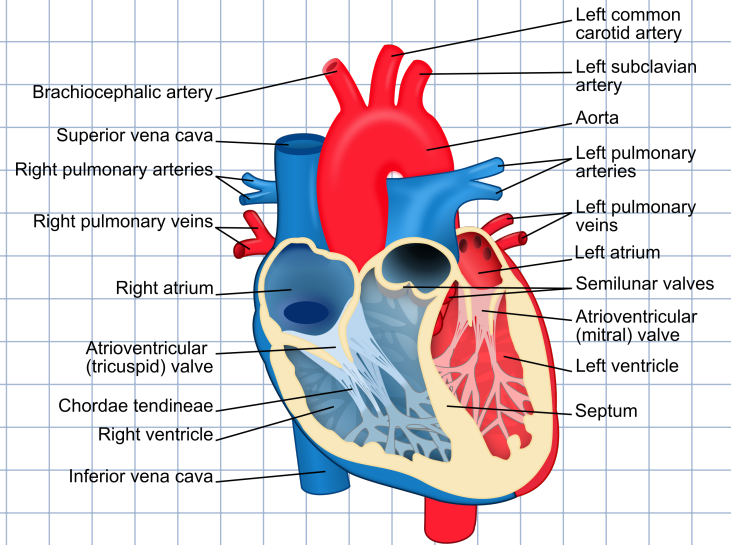
**Inferior Vena Cava:** Carries deoxygenated blood from the lower body to the right atrium

**Left Pulmonary Artery:** Carries blood to the left lung

**Right Pulmonary Artery:** Carries blood to the right lung

**Left Pulmonary Veins:** Carries oxygenated blood from the left lung

**Right Pulmonary Veins:** Carries oxygenated blood from the right lung



## Right Side v. Left Side

**Right Side:** Receives deoxygenated blood from the veins of the body

**Left Side:** Receives oxygenated blood from the lungs through the pulmonary veins

## Autonomic Nervous System

**Sympathetic:** "Fight or Flight". Makes adjustments to the body to compensate for increased physical activity, such as raises HR, increases RR + depth, dilates blood vessels in the muscles, and constricts blood vessels in the digestive system.

**Parasympathetic:** "Rest and Digest". Slows HR + RR, constricts blood vessels in the muscles, and dilates blood vessels in the digestive system.

# Circulation

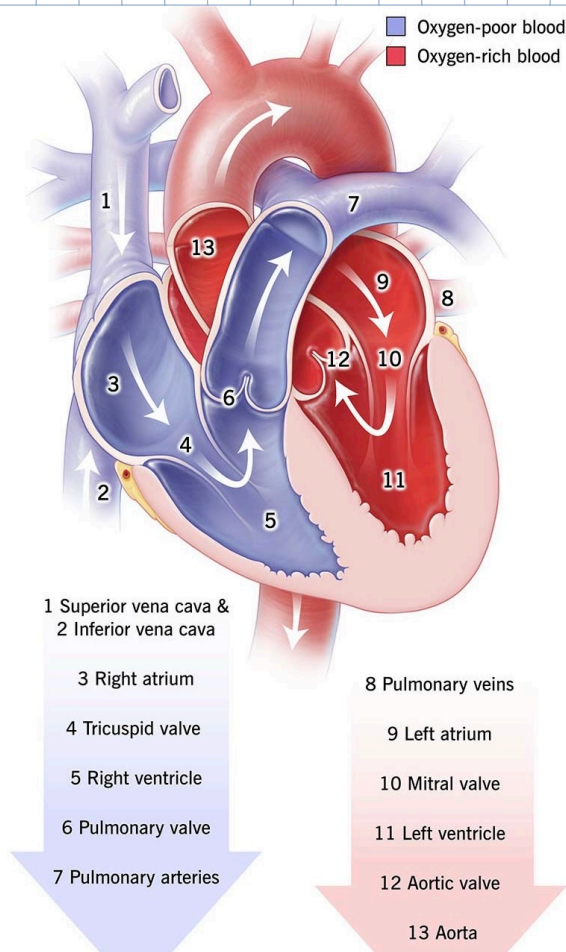
**Myocardium:** The heart muscle. Must have a continuous supply of oxygen and nutrients

**Stroke Volume:** The volume of blood ejected with each ventricular contraction.

**Coronary Arteries:** The blood vessels that supply blood to the heart muscle. Right coronary artery supplies blood to the right atrium/ventricle, while the left coronary artery supplies blood to the left atrium/ventricle.

**Blood Pressure:** The force of circulating blood against the walls of the arteries

**Perfusion:** The constant flow of oxygenated blood to the tissues



## Pathophysiology

**Ischemia:** The decrease in blood flow, in this case to the heart, which is due to the partial or complete blockage of blood through the coronary arteries. This causes heart tissue to not get enough oxygen and nutrients

**Atherosclerosis:** A disorder in which calcium and cholesterol build up and form plaque inside the walls of blood vessels, obstructing flow and interfering with their ability to dilate or contract

**Occlusion:** The complete blockage of a coronary artery

**Thromboembolism:** A blood clot that is floating through blood vessels until it reaches an area too narrow for it to pass, causing it to stop blood flow from that point on

**Infarction = Death of Tissue**

## Emergencies

**Acute Myocardial Infarction (AMI):** A blockage due to a thromboembolism in a coronary artery.

**Angina Pectoris:** Chest pain that occurs when the heart tissues do not get enough oxygen for a BRIEF period of time. This occurs when the heart's need for oxygen exceeds its supply.

**Stable Angina:** Pain in the chest of coronary origin that is relieved with rest.

**Unstable Angina:** Pain or discomfort in the chest of coronary origin that persists with rest.

**Cardiac Arrest:** Severe death of the heart muscle, causing the heart to stop completely.

**Acute Coronary Syndrome (ACS):** Describes the group of symptoms caused by myocardial ischemia.

**Cardiogenic Shock:** Occurs when the heart lacks enough power to force the proper volume of blood through the circulatory system. This is often caused by an AMI.

**Congestive Heart Failure:** A disorder in which the heart loses part of its ability to effectively pump blood, usually as a result of damage to the heart muscle and usually resulting in a backup of fluid to the lungs.

## Ventricular Tachycardia

and

## Ventricular Fibrillation

are the **ONLY** two shockable rhythms

## Acute Myocardial Infarctions

### Signs + Symptoms

- Sudden onset of weakness, nausea, and sweating without an obvious cause
- Chest pain, discomfort, or pressure that is often crushing/squeezing and does not change with each breath
- Pain, discomfort, or pressure in the lower jaw, arms, back, abdomen, or neck
- Irregular heartbeat + syncope
- Dyspnea, nausea, and vomiting
- Pink frothy sputum (indicates pulmonary edema)
- Sudden death

### Physical Findings of AMI's

- General Appearance- Skin is often pale/ashen gray due to poor cardiac output. Occasionally cyanotic.
- Pulse- Typically irregular and slow due to dysrhythmias. Damage to the inferior area of the heart presents with bradycardia.
- Blood Pressure- Hypotension due to diminished cardiac output and diminished capability of the left ventricle to pump.
- Respiration- Normal RR, unless the patient has CHF. If the patient has CHF, they will likely present with rapid and labored respirations, leading to a complaint of difficulty breathing.
- Mental Status- Confusion + Agitation present. Overwhelming feelings of impending doom could also occur. **PAY**

**ATTENTION TO THIS!**

## Vocabulary

- **Tachycardia:** 100 beats/min or more.
- **Bradycardia:** 60 beats/min or less.
- **Ventricular Tachycardia (V-Tach):** Rapid heart rhythm, usually from 150-200bpm, that causes the electrical activity to start in the ventricle instead of the atrium. This rhythm does not allow adequate time between beats for the left ventricle to fill with blood, causing pulse to be lost. This could lead to V-Fib.
- **Ventricular Fibrillation (V-FIB):** Ineffective quivering of the ventricles that causes no blood to be pumped through the body.
- **Asystole:** The absence of all heart electrical activity. This reflects a long period of ischemia.

### Consequences of AMI's

- Sudden death
- Cardiogenic shock
- Congestive heart failure (CHF)

## Cardiogenic Shock

### Signs + Symptoms

- Anxiety/restlessness due to the brain becoming starved of oxygen. The patient may state they cannot breathe, due to the patient's brain sensing it not getting enough oxygen.
- Hypotension. If systolic BP is under 90 mm Hg, decompensated shock is indicated.

## BLS Treatment for Cardiogenic Shock

- Position patient comfortably. Some patients with hypotension may prefer lying supine + may be more alert lying supine v. semi-fowlers.
- Administer high-flow oxygen.
- Cover the patient with blankets
- Prompt transport to hospital.

## Congestive Heart Failure

### Signs + Symptoms

- Easier to breathe when sitting up. This is because when the patient is lying down, more blood is returned to the right ventricle and lungs, causing further pulmonary congestion.
- Agitation
- Chest pain may/may not be present.
- Distended neck veins/ JVD that does not collapse even when resting.
- Pedal edema
- Hypertension, rapid HR, and rapid respirations.
- CTC- Pale/cyanotic + diaphoretic
- Lung sounds- Rales (crackles) due to fluid surrounding small airways. Best heard when auscultating the sides of the chest, as well as, midway down the back.

### BLS Treatment for Hypotensive Emergencies

- Monitor BP regularly
- Position the patient with their head elevated
- ALS + transport to hospital

- CTC- Pale, cool, and clammy skin due to blood being sent to the most important organs (brain + heart).
- Pulse will increase in attempts to compensate by increasing the amount of blood pumped through the heart. Severe shock presents with a HR of > 120 bpm.
- Rapid + shallow breathing, nausea + vomiting, and decrease in body temperature.

### BLS Treatment

- Obtain vital signs + administer oxygen via NRB with flow rate from 10-15 l/min. CPAP may be utilized as well.
- Sit patient in an upright position with the legs down.
- Reassure the patient to calm their anxiety and control their breathing.
- Get SAMPLE history.
- With medical control and a prescription, nitroglycerin may be used to reduce pulmonary edema. If allowable, obtain BP and administer if systolic is greater than 100 mm Hg.
- Prompt transport to the hospital.

### Hypertensive Emergencies

- Hypertensive = Greater than 140/90
- Hypertensive Emergency: Occurs with a systolic pressure greater than 180 mm Hg OR a rapid rise in the systolic pressure.

### Signs + Symptoms

- Sudden severe headache
- Strong bounding pulse
- Dizziness, nausea, and vomiting

## Blood Pressure Ranges

BLOOD PRESSURE CATEGORY	SYSTOLIC (mm Hg)	DIASTOLIC (mm Hg)
Healthy	less than 120	and less than 80
Elevated	120–129	and less than 80
Stage 1 hypertension	130–139	or 80–89
Stage 2 hypertension	140 or higher	or 90 or higher
Hypertension crisis	over 180	or over 120

healthline

- Ringing in the ears
- CTC- Warm skin (dry or moist)
- Nosebleeds
- Altered mental status
- Sudden development of pulmonary edema

## Potential Consequences if Left Untreated

- Stroke
- Dissecting aortic aneurysm

## Aneurysm's

- **Aortic Aneurysm:** A weakness in the wall of the aorta. This causes the aorta to dilate at the weakened area, making it susceptible to rupture.
- **Dissecting Aneurysm:** Occurs when the inner layers of the aorta become separated, allowing blood (at high pressures) to flow between the layers. Uncontrolled hypertension is the primary cause for dissecting aortic aneurysms.

### Signs + Symptoms of a Dissecting Aortic Aneurysm

- Sudden chest pain in the anterior part of chest + between the shoulder blade
- Difference in BP's between both arms
- Diminished pulses in the lower extremities

## Cardiac Assistive Devices

### Automatic Implantable Cardiac Defibrillators

Small defibrillators typically implanted in patients who survive cardiac arrest due to V-Fib. They are attached to the heart directly and continuously monitor the heart rhythm. Shocks are delivered as needed. These shocks are so low in energy that they do not pose a risk on rescuers.

### External Defibrillator Vest

A vest with built-in monitoring electrodes and defibrillation pads that is worn under the patient's clothing. Large defibrillation pads are worn as well, and secrete a blue gel to indicate at least one shock was delivered. The vest should remain on if CPR is needed UNLESS it interferes with compressions.

### Left Ventricular Assist Devices (LVADs)

Used to enhance the pumping of the left ventricle in patients with severe heart failure or in patients who need a temporary boost due to an MI. Some patient's may not have a palpable pulse due to their LVAD pumping continuously.

### Automated External Defibrillator (AED)

Analyzes the electrical signals from the heart and delivers electrical energy from one pad to the other, and then back, if V-fib or V-tach is present.

