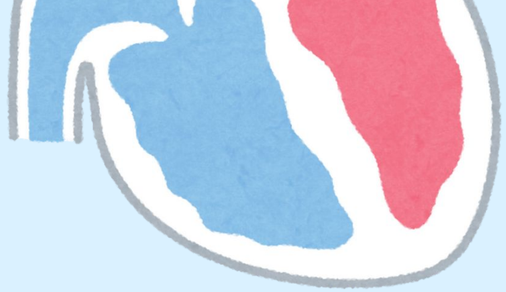
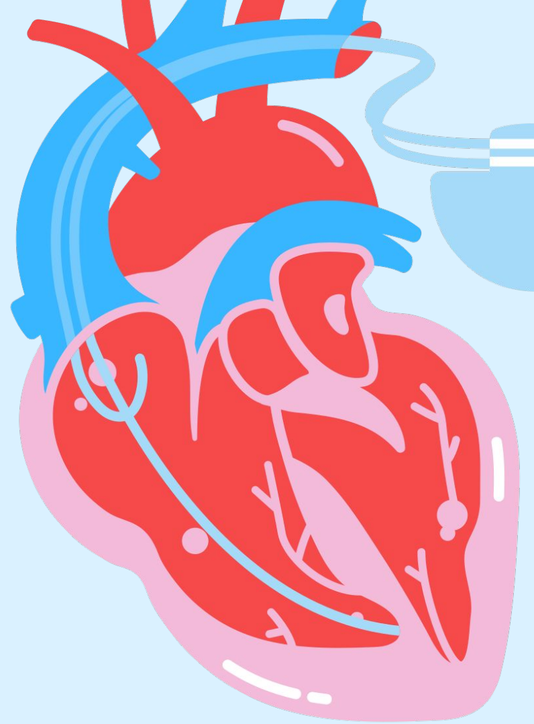
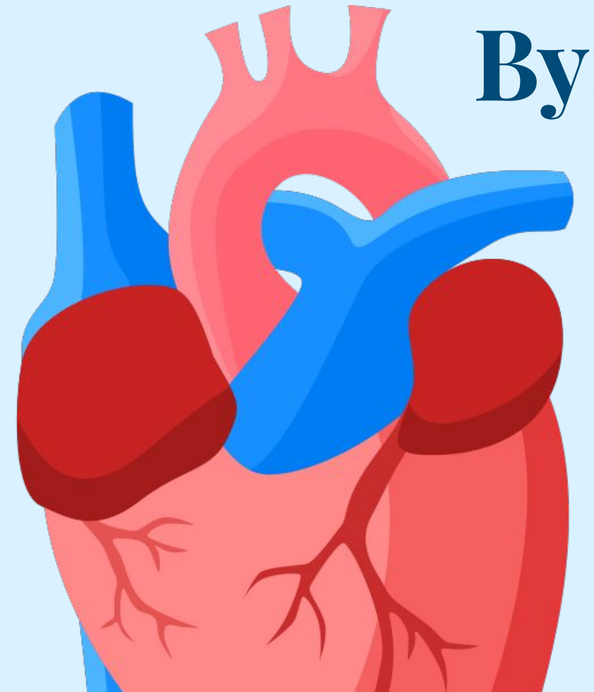
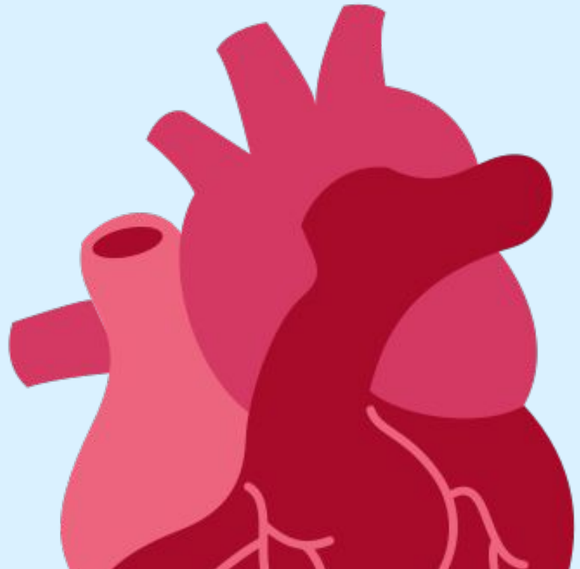


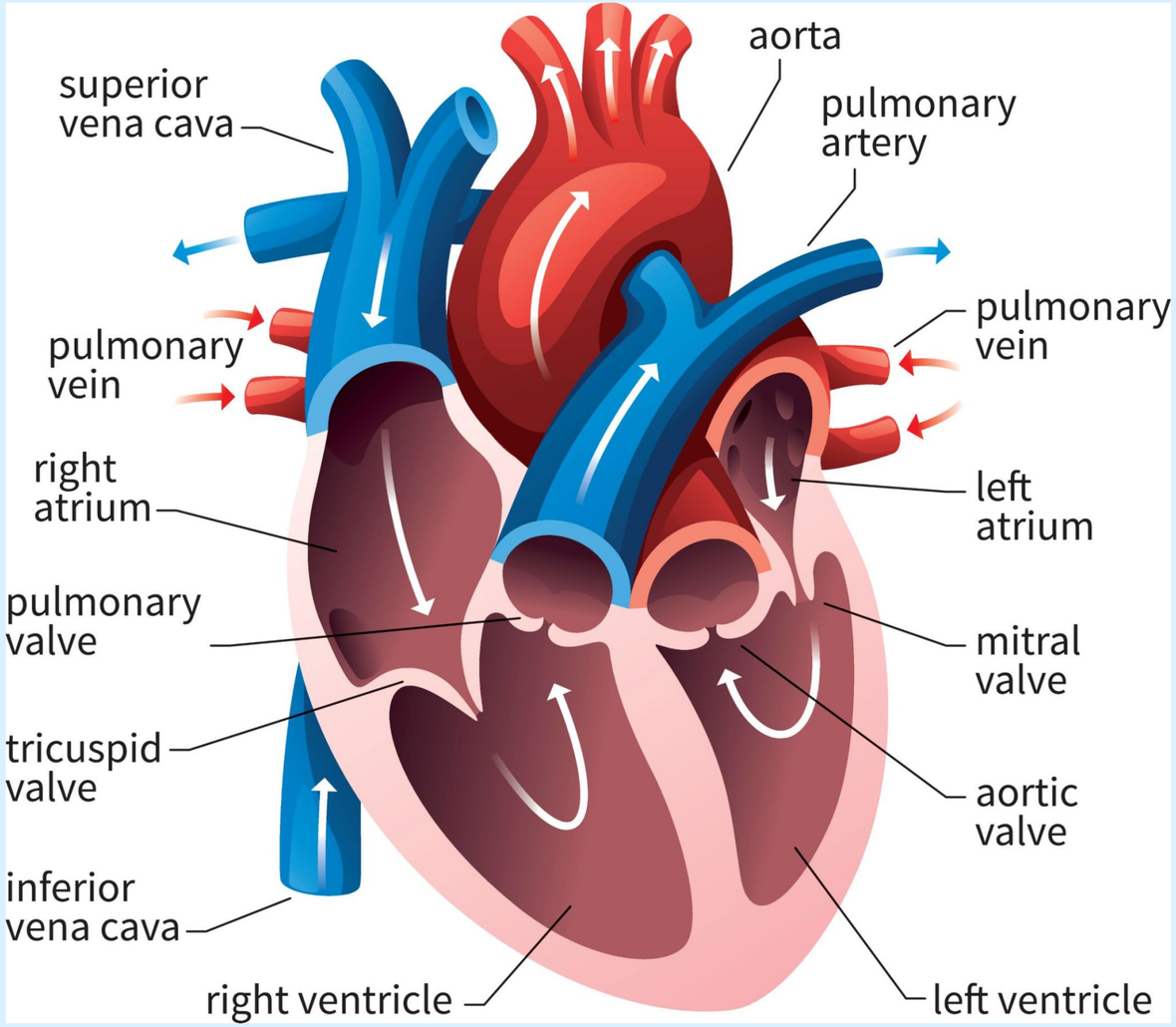


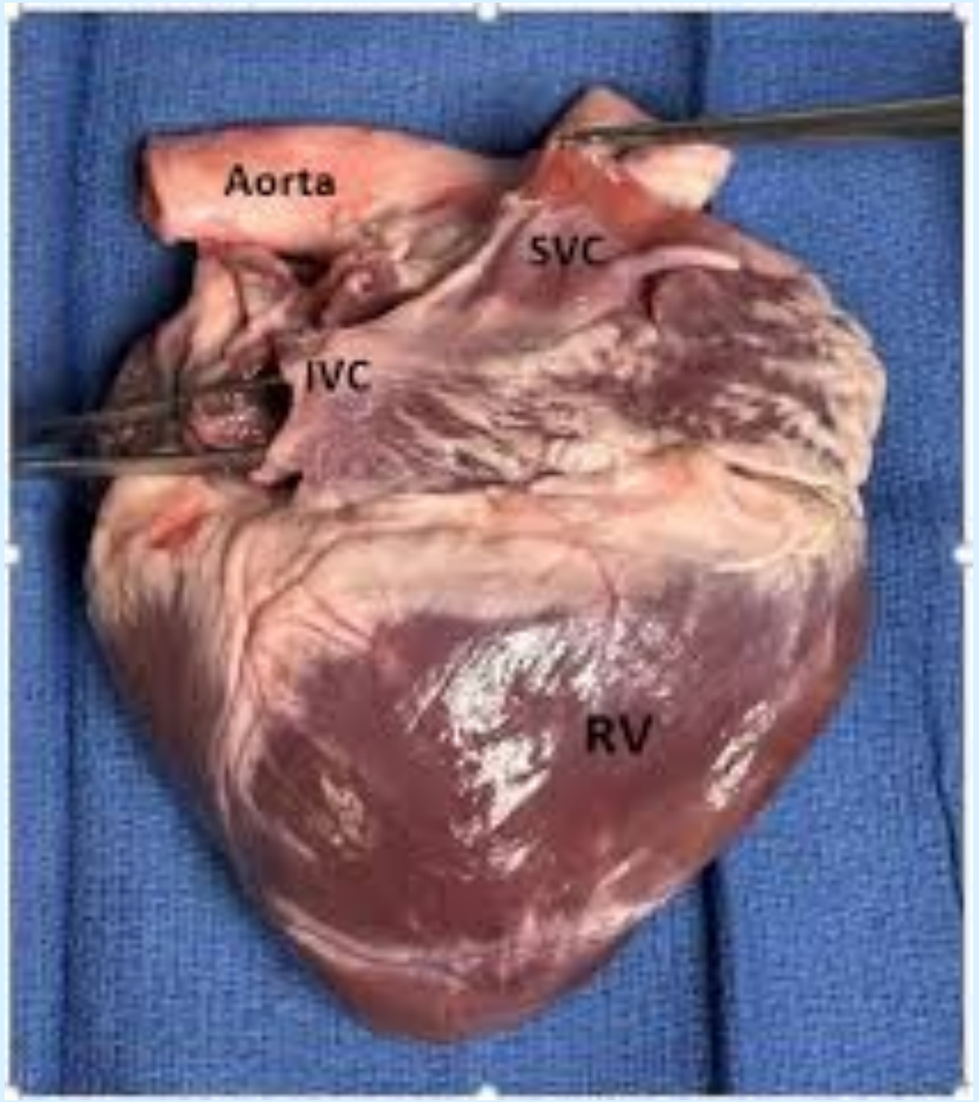
Cardiovascular Emergencies

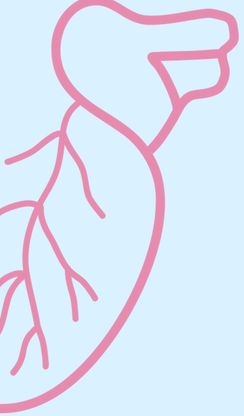
By: Marisa Carillo and Lakshita Kutnikar





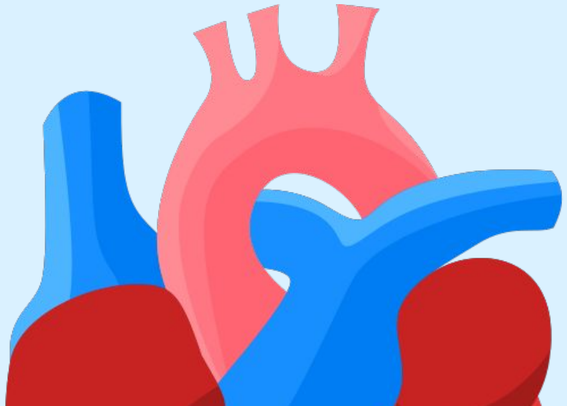

superior
vena cava
aorta
pulmonary
artery
pulmonary
vein
pulmonary
vein
right
atrium
left
atrium
pulmonary
valve
mitral
valve
tricuspid
valve
aortic
valve
inferior
vena cava
right ventricle
left ventricle

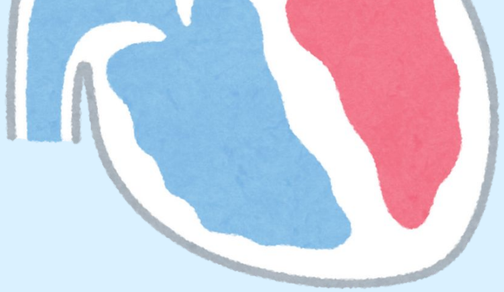

Aorta
SVC
IVC
RV

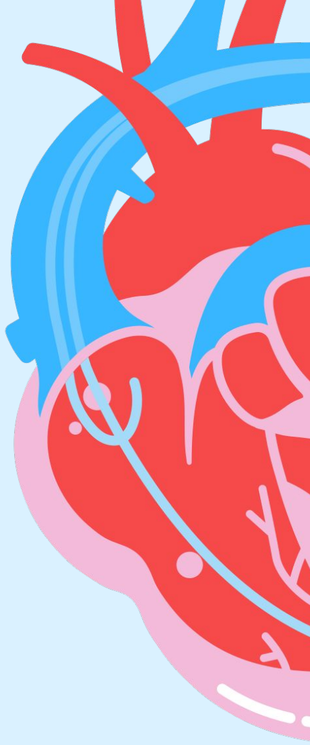


01

Circulation







Circulation

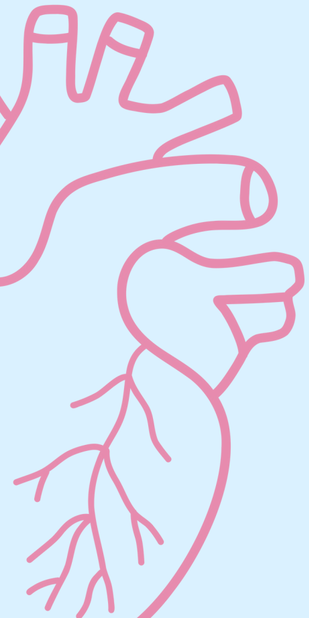
Movement of blood through the heart and body

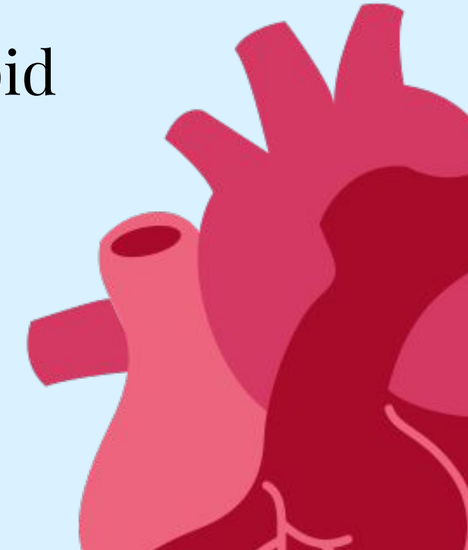
Function:

- Delivers O_2 & nutrients
- Removes CO_2 & wastes

Pathway:

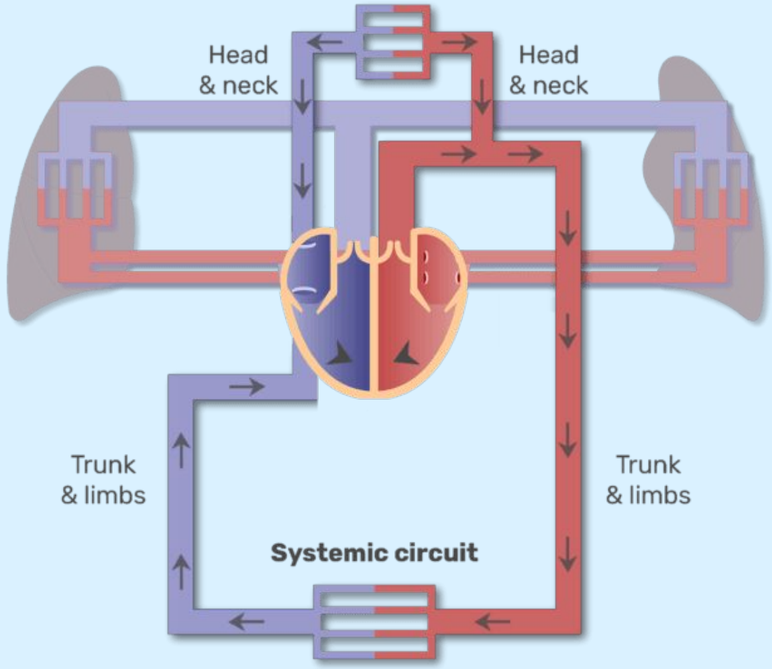
inf/sup vena cava ↠ right atrium ↠ tricuspid valve ↠ right ventricle ↠ pulmonary artery ↠lungs ↠pulmonary vein ↠ left ventricle ↠ bicuspid valve ↠left atrium ↠aorta





Blood Vessels

<u>Arteries</u> - carry blood away from the heart
<u>Arterioles</u> - small arteries that regulate blood flow to tissues
<u>Capillaries</u> - tiny vessels where gas & nutrient exchange occurs
<u>Venules</u> - collect blood from capillaries
<u>Veins</u> - return blood to the heart



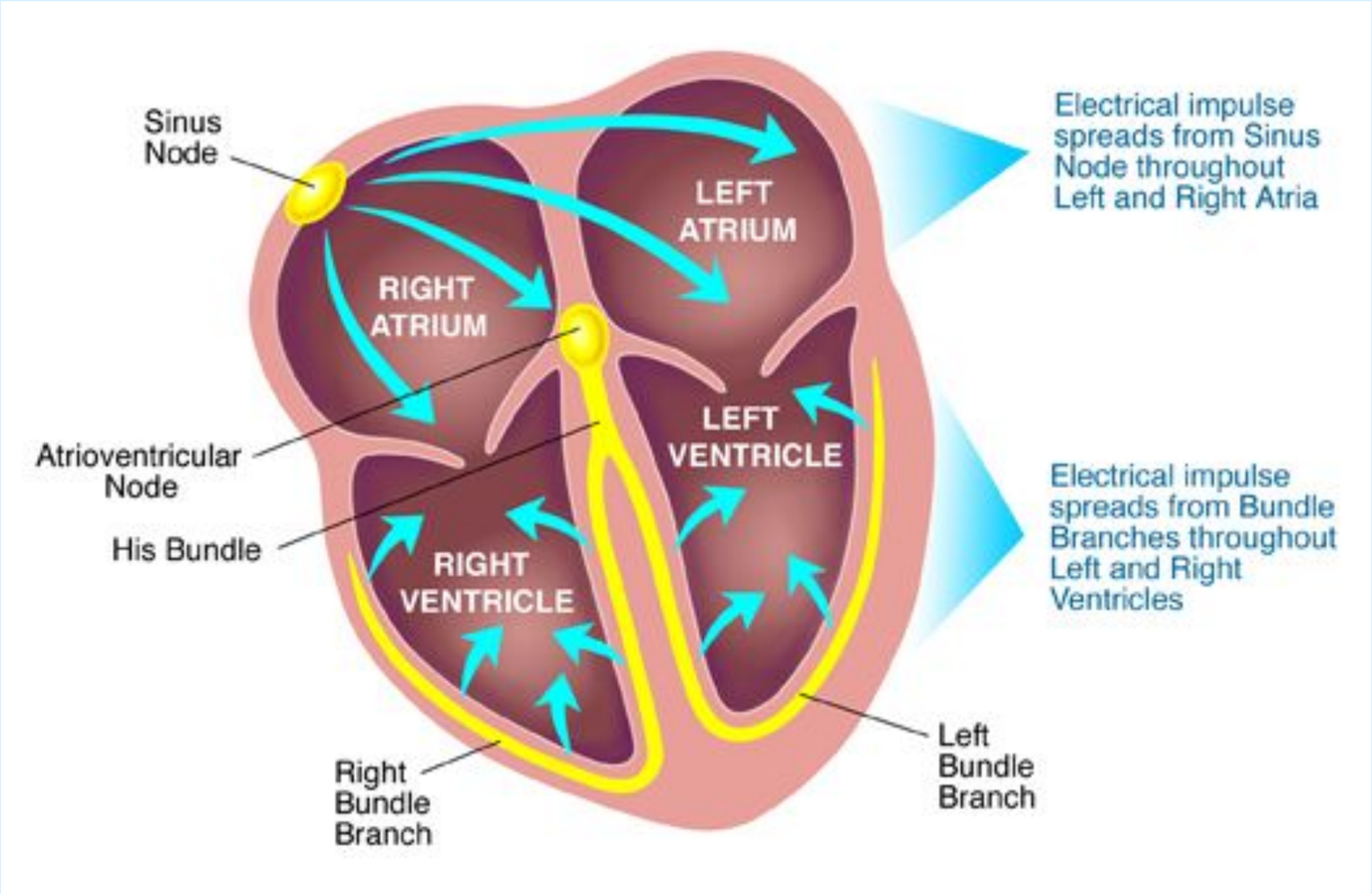
Flow:
Arteries ↠ Arterioles ↠ Capillaries ↠ Venules ↠ Veins

Electrical Pathways

Controls the heartbeat by coordinating contraction

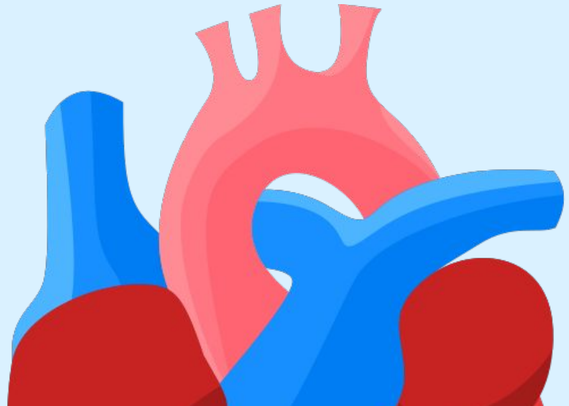
Pathway:
SA node ↠ AV node ↠ Bundle of His ↠ Right & Left bundle branches ↠ Purkinje fibers

Result:
Atria contract ↠ Ventricles contract


Sinus Node
LEFT ATRIUM
RIGHT ATRIUM
Atrioventricular Node
His Bundle
LEFT VENTRICLE
RIGHT VENTRICLE
Right Bundle Branch
Left Bundle Branch
Electrical impulse spreads from Sinus Node throughout Left and Right Atria
Electrical impulse spreads from Bundle Branches throughout Left and Right Ventricles

02

Common Emergencies



Vital Signs

Normal Adult Vitals

Heart rate: 60-100 bpm

Respiratory rate: 12-20/min

Blood pressure: ~120/80 mmHg

Temperature: 36.5-37.5 °C (97.7-99.5 °F)

Oxygen saturation: 95-100%

Abnormal Vitals (Concerning)

HR: <60 or >100 bpm

RR: <12 or >20/min

BP: very low (<90 systolic) or very high (>140 systolic)

Temp: <35 °C (95 °F) or >38 °C (100.4 °F)

SpO_2: <90%

Oxygen used to the be the “wonder drug” but given at the wrong time or in excess, can cause harm. Research showed that raising the oxygen levels of patients with certain conditions (e.g., heart attack and stroke) can make their condition worse.

Protocol states that anything above 94% SPO2 is no oxygen!

Cardiac Emergencies

Acute conditions where the heart cannot pump blood effectively ➳ can be life-threatening without rapid treatment

Examples:

- Heart attack (myocardial infarction)
- Cardiac arrest
- Dangerous arrhythmias
- Severe heart failure
- Hypertensive crisis

Why it matters (stats):

- Heart disease = #1 cause of death worldwide
  ~805,000 heart attacks/year in the U.S.
  - Cardiac arrest survival drops 7–10% per minute without CPR

Difference Between Heart Attack and Cardiac Arrest

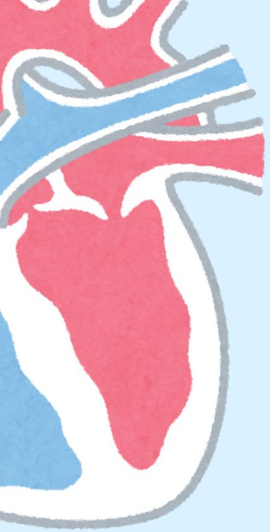
Heart Attack (Myocardial Infarction)

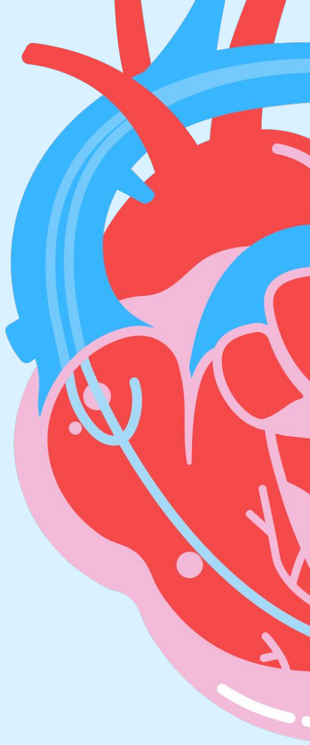
- Caused by a blocked coronary artery
- Heart muscle is damaged from lack of oxygen
- Heart usually still beating
- Person is often conscious

  Symptoms: chest pain, SOB, nausea

Cardiac Arrest

- Caused by electrical failure of the heart
- Heart stops beating effectively
- Person becomes unconscious
  - No pulse, not breathing normally
    - Requires immediate CPR & defibrillation





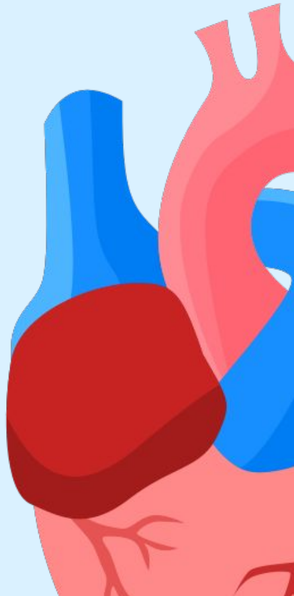
Relation to PEDS

- Rare
- Usually due to congenital heart defects, Kawasaki disease, or trauma

Symptoms may be atypical (fatigue, vomiting, irritability)

<u>Cardiac Arrest in children:</u>

- More often caused by respiratory failure or shock (not coronary blockage)
- Common triggers:
  - Drowning
  - Choking
  - Severe asthma

Cardiac Arrest

- Sudden electrical failure of the heart
- Heart stops pumping ↠ no pulse, no breathing
- Immediate action needed to prevent death

CPR (Cardiopulmonary Resuscitation)

- Manual chest compressions + rescue breaths
- Maintains blood flow to brain & heart until heart restarts

AED (Automated External Defibrillator)

- Delivers electric shock to correct lethal arrhythmias
- Works with CPR to restore normal heartbeat

Myocardial Infarction vs Angina Pectoris

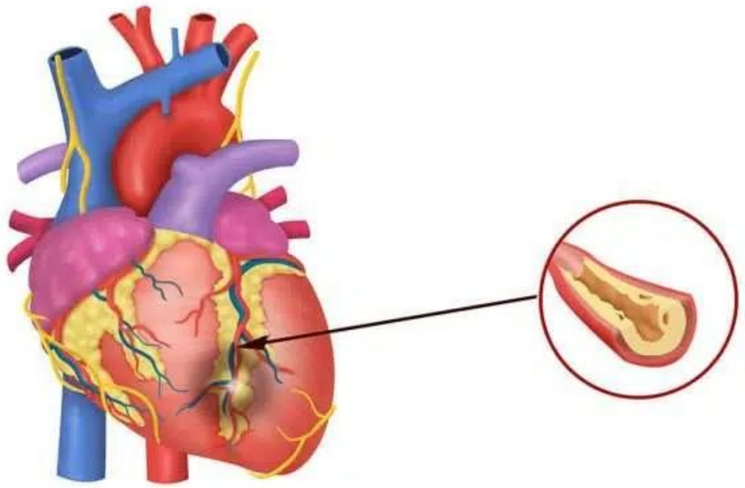
Myocardial Infarction (Heart Attack):

- Caused by blocked coronary artery ↠ heart muscle damage
- Chest pain >20 min, may radiate to arm/jaw/back
- Permanent heart muscle injury
  - Symptoms: chest pain, shortness of breath, nausea, sweating, fatigue
- Elevated cardiac enzymes (troponin)
- Emergency treatment required

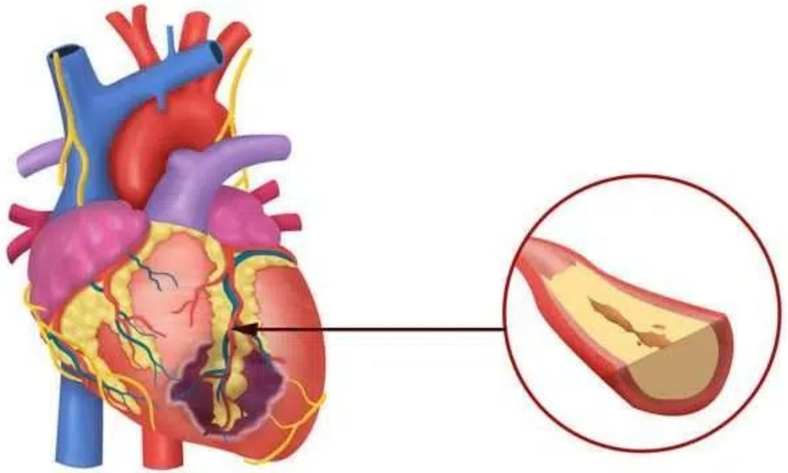
Angina Pectoris:

- Caused by temporary reduced blood flow to heart
- Chest discomfort with exertion, relieved by rest
- No permanent damage
- Symptoms: chest tightness, shortness of breath with activity
- Normal cardiac enzymes
- Managed with rest, nitroglycerin, lifestyle changes

Angina pectoris



Myocardial infarction



Commotio Cordis

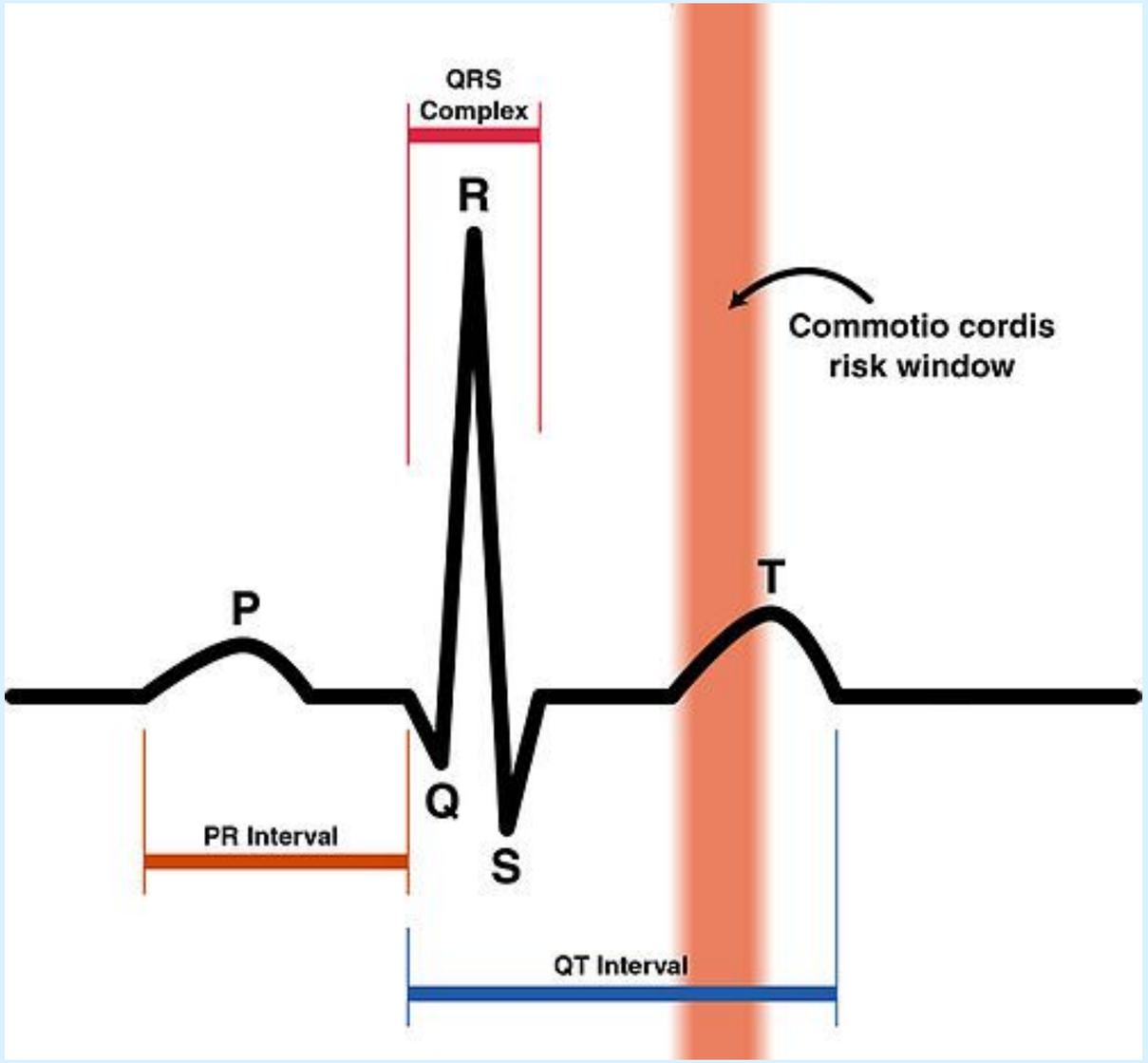
- Sudden cardiac arrest from a blunt impact to the chest
- Heart is structurally normal
- Causes: Sports injuries (football, baseball, hockey, lacrosse)
- Usually occurs during critical moment of heart cycle

Signs & Symptoms:

- Sudden collapse
- No pulse
- Unconsciousness

Management:

- Immediate CPR + AED
- Quick action improves survival


QRS
Complex
R
Commotio cordis
risk window
T
P
Q
S
PR Interval
QT Interval

Cardiac Tamponade

- Fluid buildup in the pericardial sac
- Compresses the heart
  - Lowers cardiac output

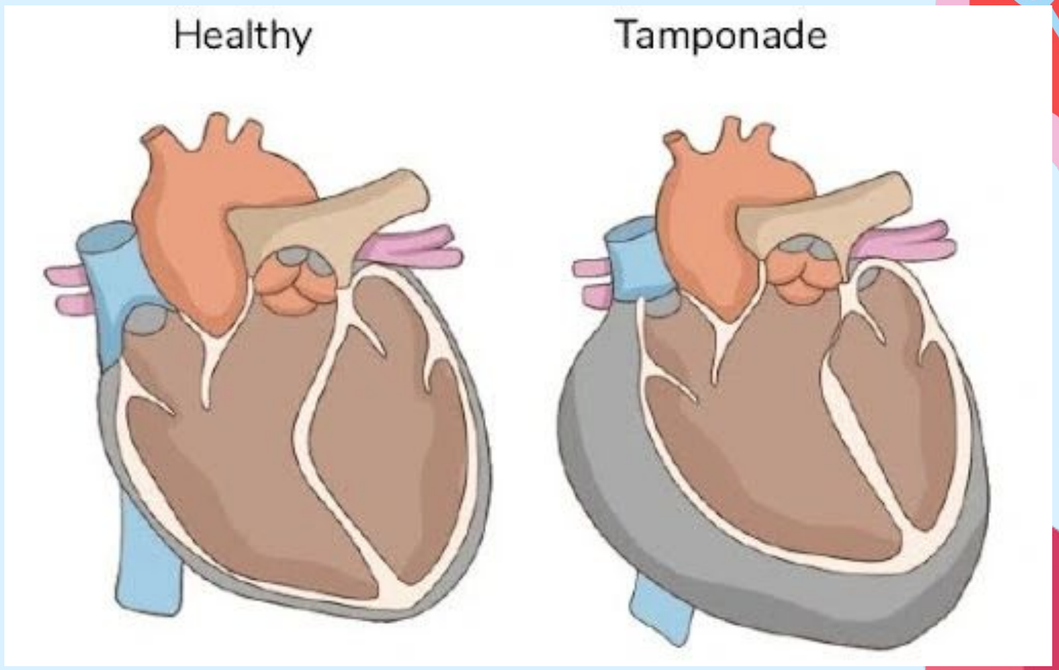
Causes:

- Trauma (blunt or penetrating)
- Heart surgery complications
- Pericarditis or cancer

Signs & Symptoms (S/S):

- Beck's triad:
  - Hypotension (low BP)
  - Distended neck veins (JVD)
  - Muffled heart sounds
- Shortness of breath
- Chest pain
- Rapid heartbeat

  Anxiety or restlessness



Management:

- Emergency pericardiocentesis to remove fluid

Aortic Dissection

- Tear in the aortic wall ↠ blood leaks between layers
- Can lead to life-threatening internal bleeding

Causes:

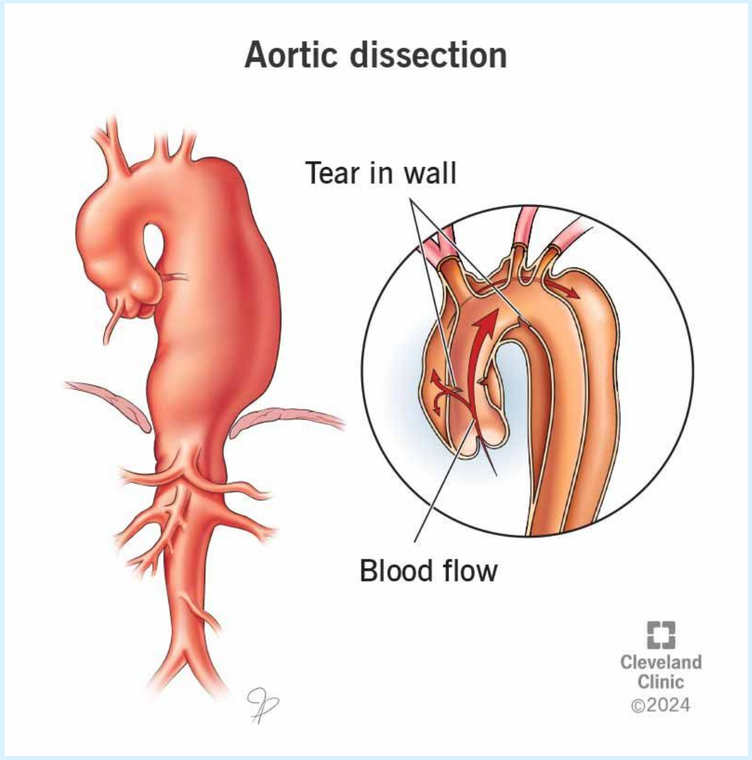
- High blood pressure (chronic)
- Connective tissue disorders (e.g., Marfan syndrome)
- Trauma

Signs & Symptoms (S/S):

- Sudden, severe “tearing” chest or back pain
- Unequal blood pressures in arms
- Weak or absent pulse
- Shortness of breath
- Fainting or loss of consciousness
- Shock (pale, clammy skin, rapid heartbeat)

Management:

- Emergency surgery or endovascular repair
- Blood pressure control



Congestive Heart Failure

- Heart cannot pump blood effectively ↠ fluid buildup in lungs & body

Causes:

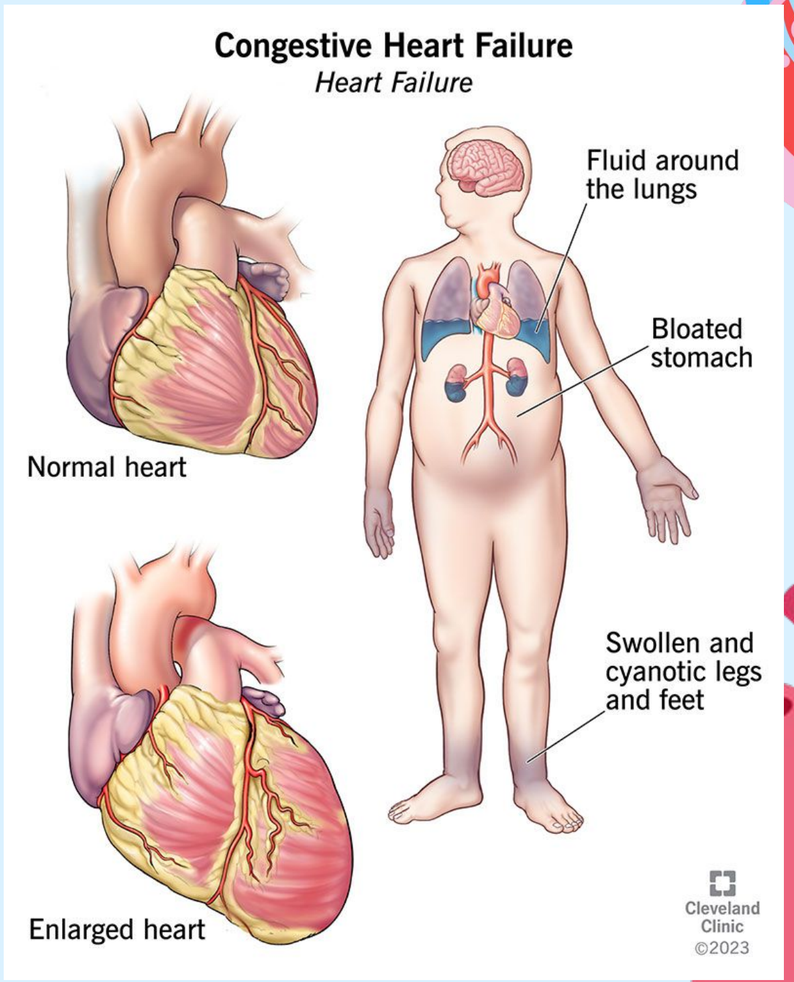
- Coronary artery disease
- Hypertension
- Heart valve problems
- Previous heart attack

Signs & Symptoms (S/S):

- Shortness of breath (especially lying down)
- Fatigue / weakness
- Swelling in legs, ankles, feet (edema)
- Rapid weight gain (fluid retention)
- Crackles in lungs (pulmonary edema)
- Rapid heartbeat

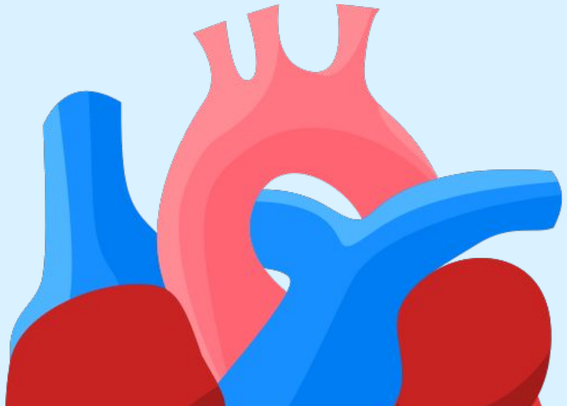
Management:

- Medications (diuretics, ACE inhibitors, beta-blockers)
- Lifestyle changes (low-salt diet, fluid restriction)
- Treat underlying cause



02

Assessment & Treatment



Assessment

Responsive pt:

determine C/C, vital signs/ABC, SAMPLE

Unresponsive pt:

Rapid medical assessment, vitals, SAMPLE if obtainable from bystanders/family

Primary Assessment

- BSI Scene Safety
- ENAMES
  - MOI/NOI, # of pt, ALS
- General Impression
- AVPU/LOC
- ABC

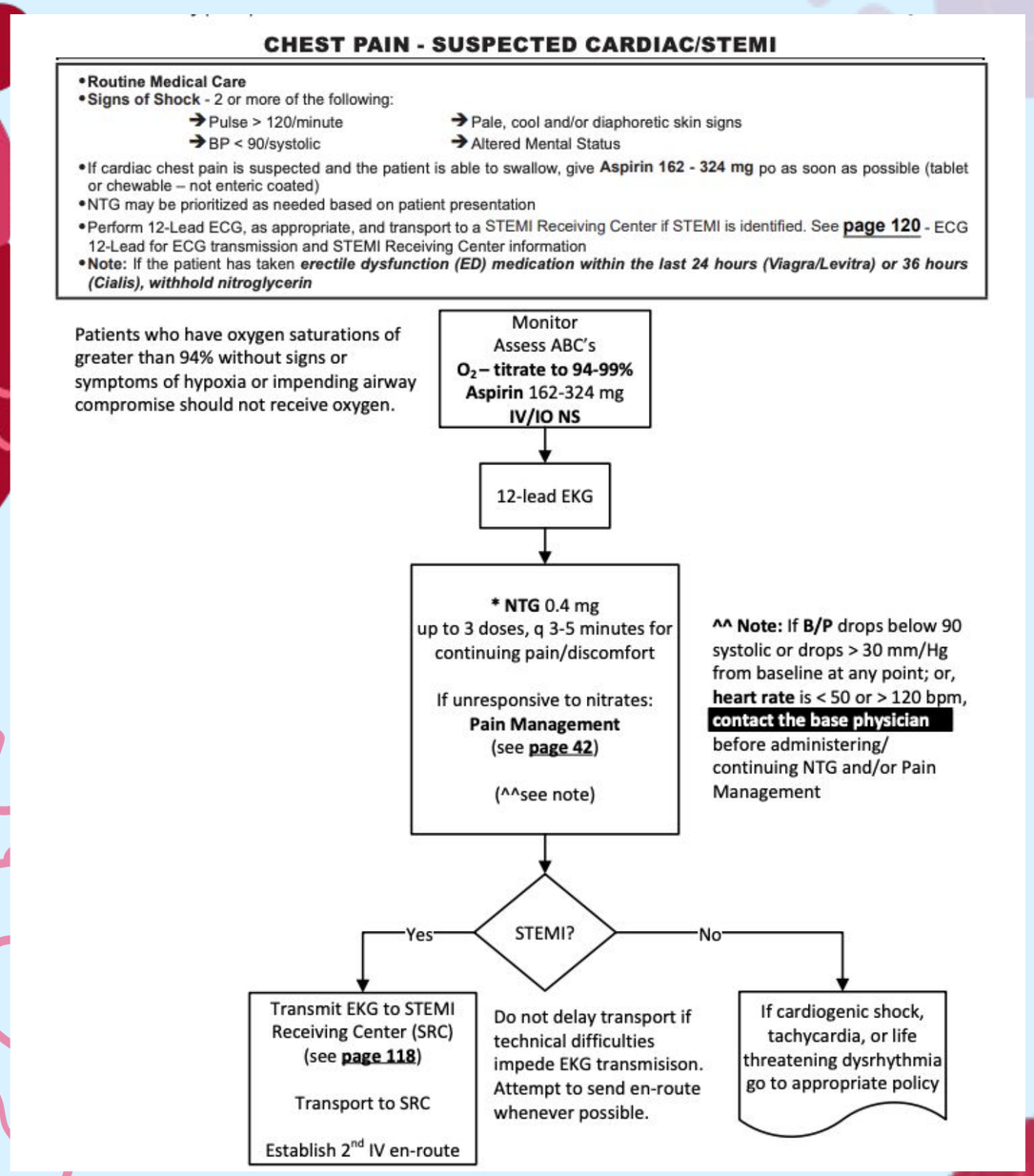
Secondary Assessment

- SAMPLE
- OPQRST
- PASTE
- IPA
  - lung sounds!!

Treatment (ALCO)

- O2
  - get up to 94% SPO2
- Aspirin
  - 81-324 mg
- Nitroglycerin
  - 0.4 mg up to 0.12mg
  - Erectile Dysfunction (24 hrs): viagra, levitra, cialis
- CPR + Defibrillation

ALCO Protocol



CHEST PAIN - SUSPECTED CARDIAC/STEMI

- **Routine Medical Care**
- **Signs of Shock** - 2 or more of the following:
  - → Pulse > 120/minute
  - → BP < 90/systolic
  - → Pale, cool and/or diaphoretic skin signs
  - → Altered Mental Status
- If cardiac chest pain is suspected and the patient is able to swallow, give **Aspirin 162 - 324 mg** po as soon as possible (tablet or chewable – not enteric coated)
- NTG may be prioritized as needed based on patient presentation
- Perform 12-Lead ECG, as appropriate, and transport to a STEMI Receiving Center if STEMI is identified. See **page 120** - ECG 12-Lead for ECG transmission and STEMI Receiving Center information
- **Note:** If the patient has taken ***erectile dysfunction (ED) medication within the last 24 hours (Viagra/Levitra) or 36 hours (Cialis), withhold nitroglycerin***

Patients who have oxygen saturations of greater than 94% without signs or symptoms of hypoxia or impending airway compromise should not receive oxygen.

Monitor
Assess ABC's
O_2 – titrate to 94-99%
Aspirin 162-324 mg
IV/IO NS

12-lead EKG

*** NTG** 0.4 mg
up to 3 doses, q 3-5 minutes for continuing pain/discomfort

If unresponsive to nitrates:
Pain Management
(see **page 42**)

(^^see note)

^^ Note: If **B/P** drops below 90 systolic or drops > 30 mm/Hg from baseline at any point; or, **heart rate** is < 50 or > 120 bpm, **contact the base physician** before administering/ continuing NTG and/or Pain Management

STEMI?

Yes

Transmit EKG to STEMI Receiving Center (SRC)
(see **page 118**)

Transport to SRC

Establish 2nd IV en-route

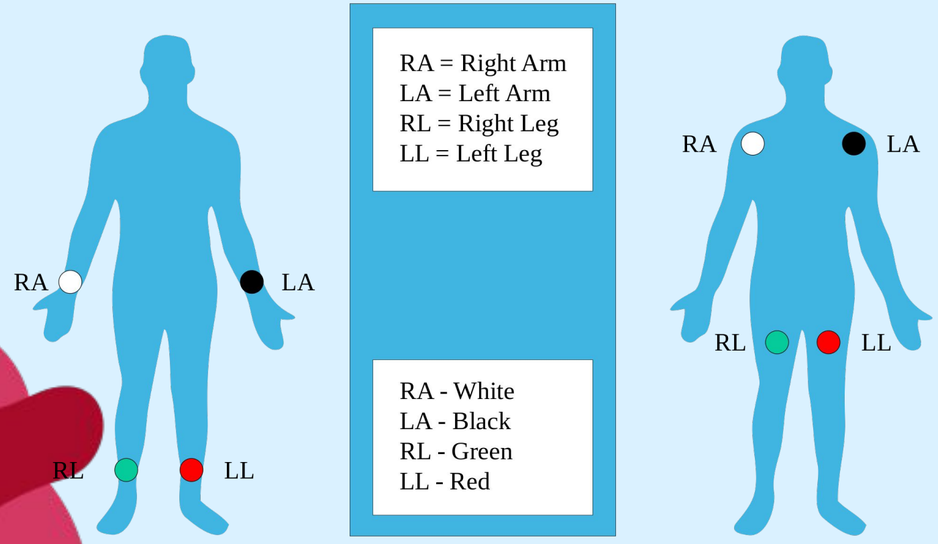
Do not delay transport if technical difficulties impede EKG transmisison. Attempt to send en-route whenever possible.

No

If cardiogenic shock, tachycardia, or life threatening dysrhythmia go to appropriate policy

Electrocardiogram(EKG)

How do we do EKGs?

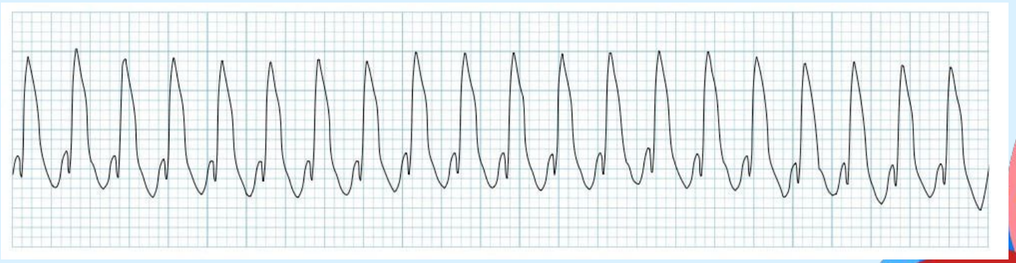


sky over grass...smoke over fire!!

Abnormal EKGs!!

V-Fib

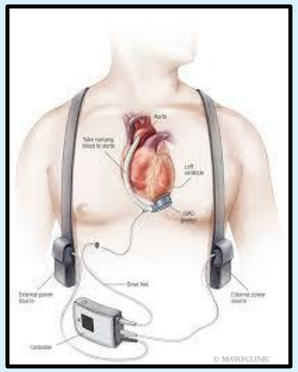
V-Tach



VADs, ICDs, & Pacemakers

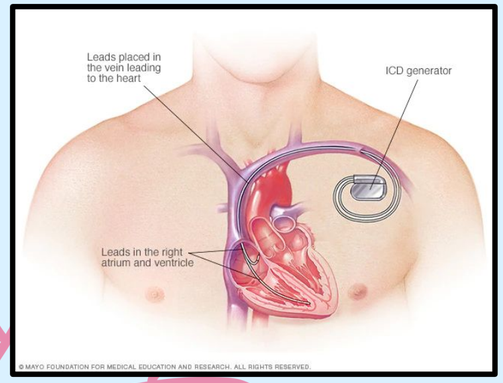
VADs

mechanical heart pumps for severe heart failure. Most common are LVADs. Long term in some cases, and sometimes for bridging recovery time/transplants.



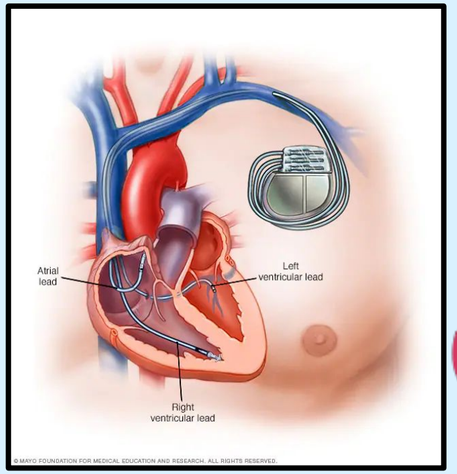
ICD

detects abnormal heartbeat and returns it to normal heartbeat by either sending **electrical signals**/ **defibrillating** (pacemaker x AED)



Pacemakers

sends electrical pulses to assist heart in beating at regular **rhythms**/rate

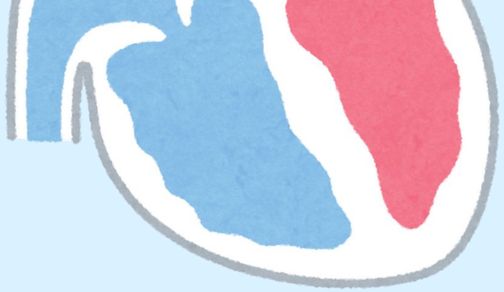


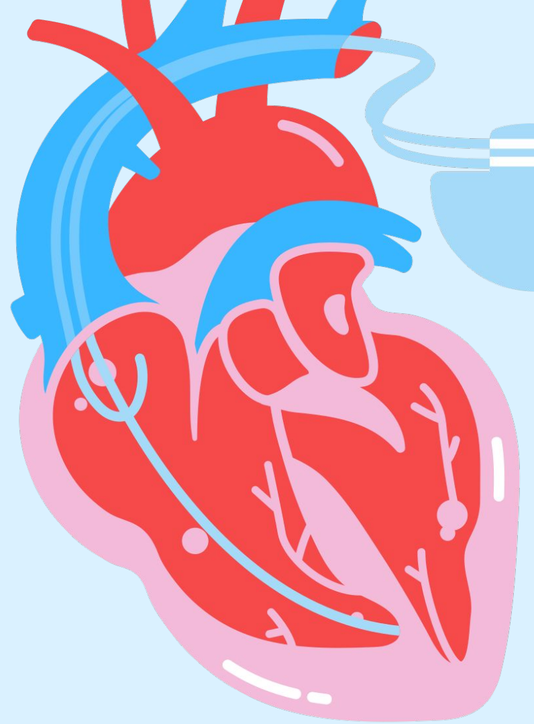
STEMI CENTERS

TRAUMA CENTER	PEDIATRIC CAPABLE	LOCATION	PHONE #
STANFORD UNIVERSITY MEDICAL CENTER	X	PALO ALTO	(650) 723-7337
SAN FRANCISCO GENERAL HOSPITAL		SAN FRANCISCO	(415) 206-8111
REGIONAL MEDICAL CENTER		SAN JOSE	(408) 729-2841
SANTA CLARA VALLEY MEDICAL CENTER	X	SAN JOSE	(408) 885-6912
JOHN MUIR MEDICAL CENTER		WALNUT CREEK	(925) 947-4444
SAN JOAQUIN GENERAL		FRENCH CAMP	(209) 982-1975

STEMI Centers	ED Phone Number
Kaiser Walnut Creek (Out of County)	(925) 939-1788
Kaiser Fremont	(510) 248-5011
Kaiser Oakland	(510) 752-8869
Alameda County Medical Center - Highland	(510) 535-6000
San Ramon Medical Center (Out of County)	(925) 275-8338
St. Rose Hospital	(510) 264-4251
Summit Medical Center	(510) 869-8797
Valley Care Medical Center	(925) 416-6518
Washington Hospital	(510) 608-1367

VAD CENTER	24-HOUR HOTLINE
Stanford Hospital and Clinics Lucille Packard Children's Hospital at Stanford*	650-723-6661 (ask operator to page the VAD Coordinator-pager code #12502)
California Pacific Medical Center	415-600-1051
UC San Francisco	415-443-5823 (pager number)
Kaiser Santa Clara	408-851-3750
*Stanford Hospital and Clinics & Lucille Packard Children's Hospital at Stanford share the same VAD Coordinators	





Thank You