

Cardiac Emergencies

*** CME Version ***

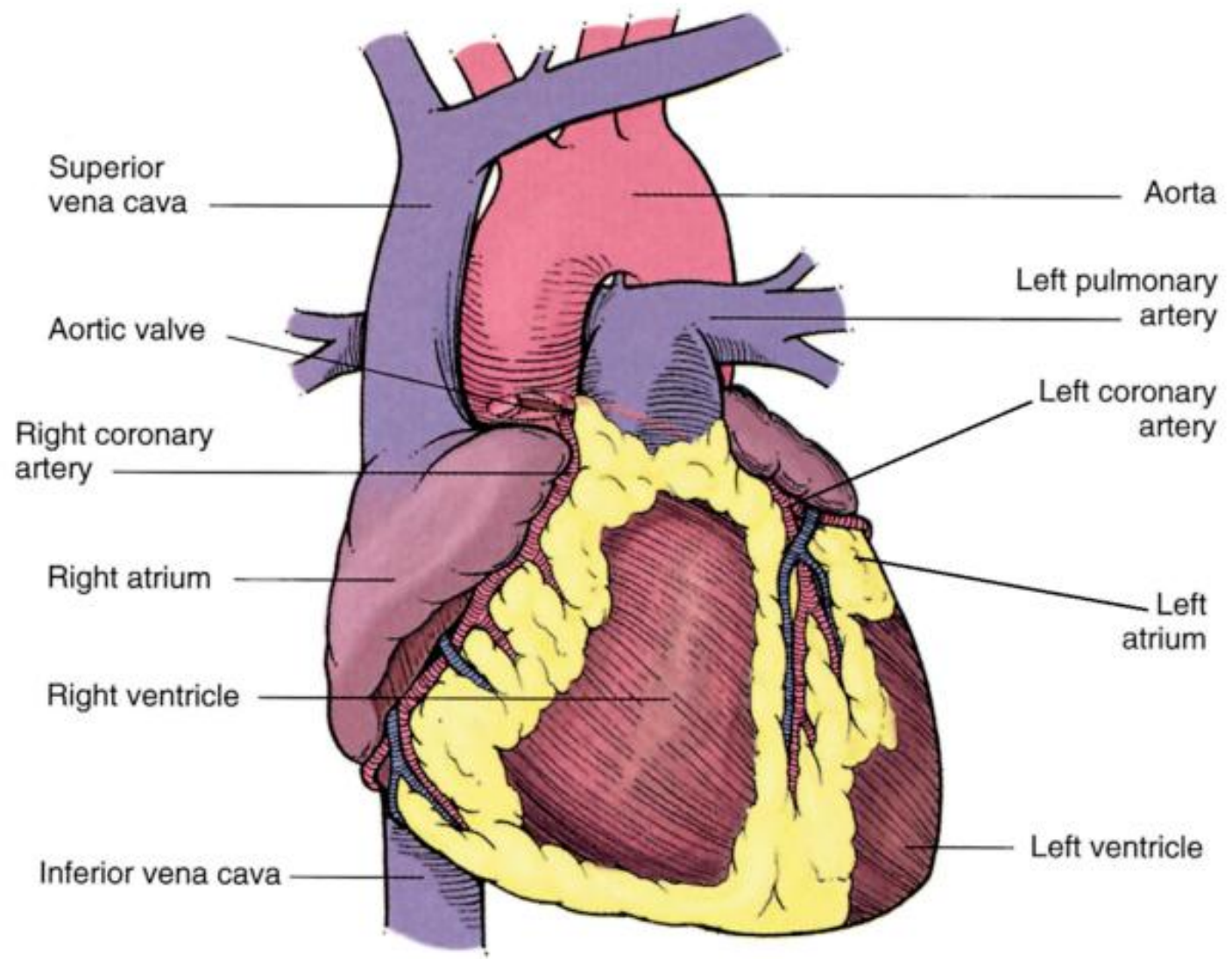
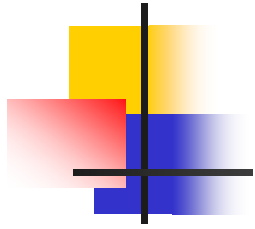
Aaron J. Katz, AEMT-P, CIC

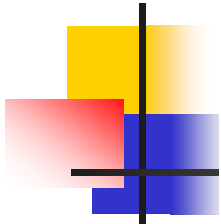
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Mechanical structure

- Atria
- Ventricles
- One way valves
- Pulmonary arteries
- Pulmonary veins
- Aorta
- **Coronary arteries**
 - Provide O₂ and nutrients to the heart muscle
- **Myocardium – the heart muscle**





Superior vena cava
(oxygen-poor blood from
head and upper body)

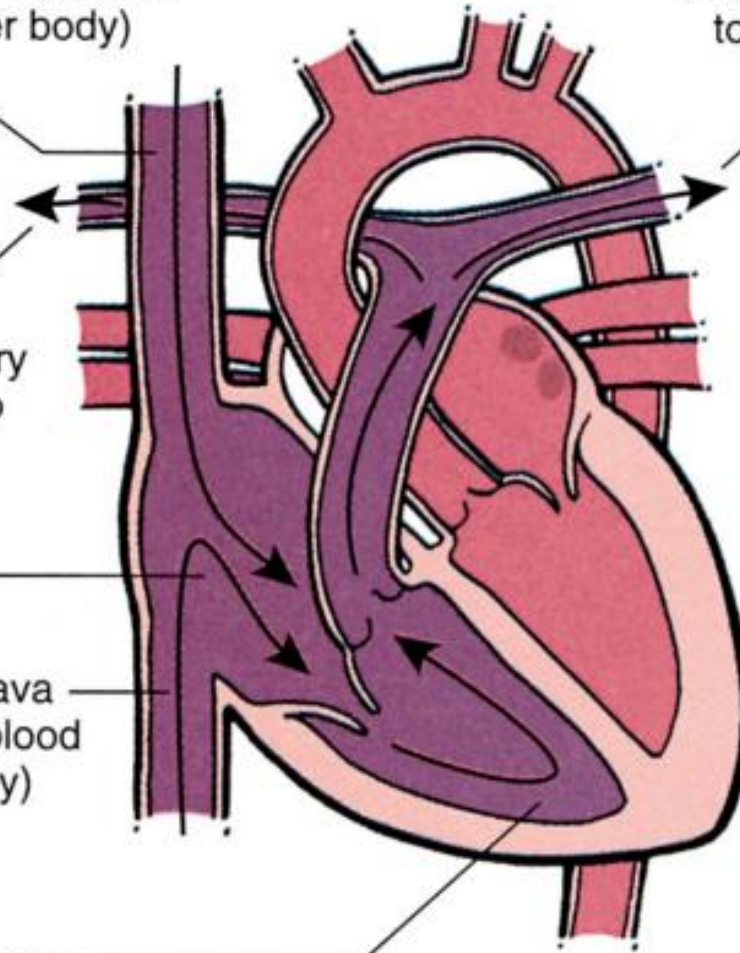
Left pulmonary
artery (blood
to left lung)

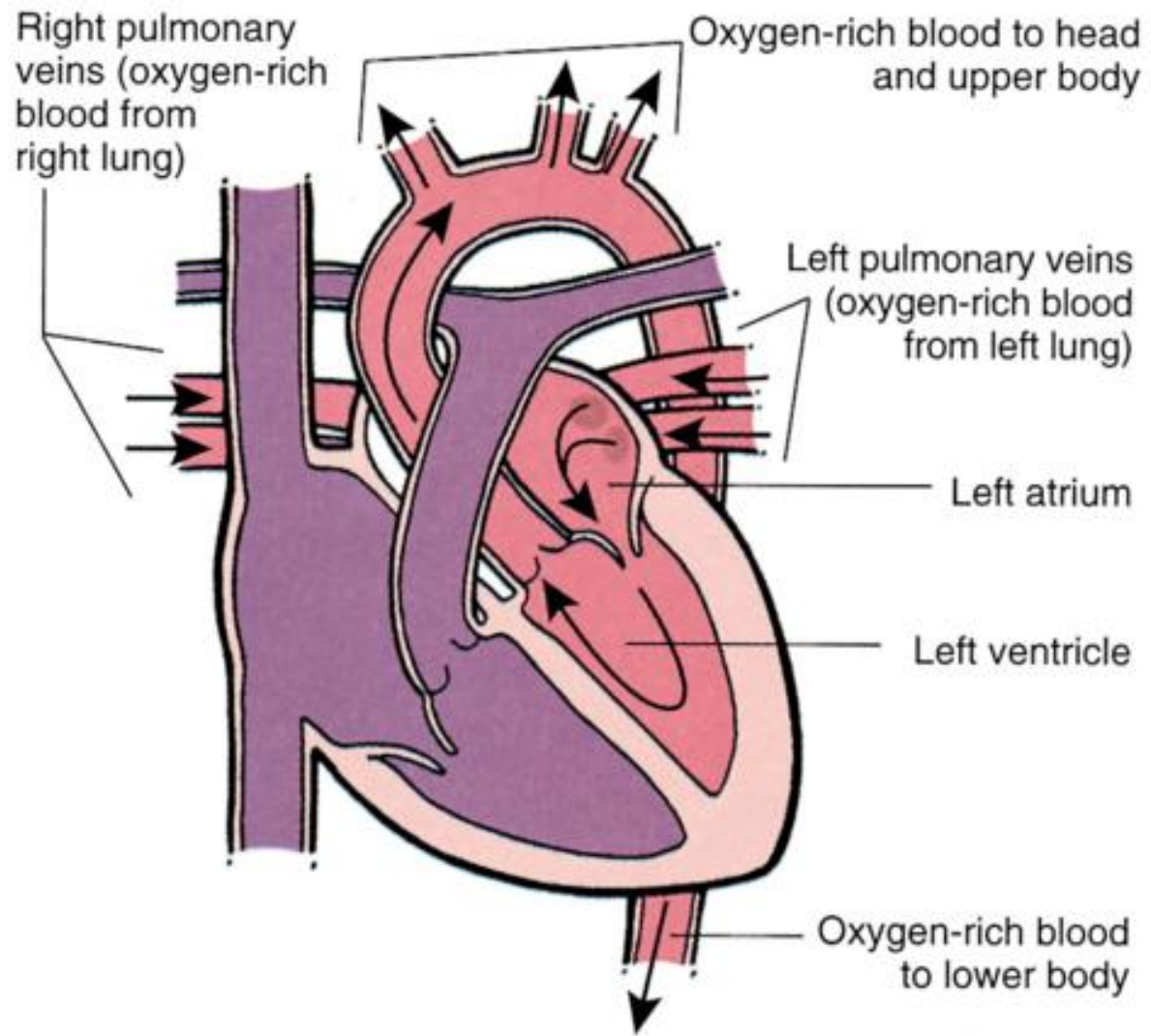
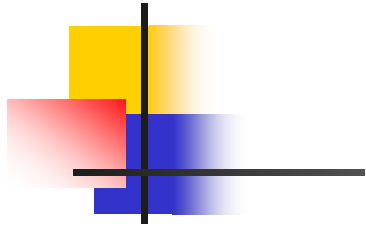
Right pulmonary
artery (blood to
right lung)

Right atrium

Inferior vena cava
(oxygen-poor blood
from lower body)

Right ventricle

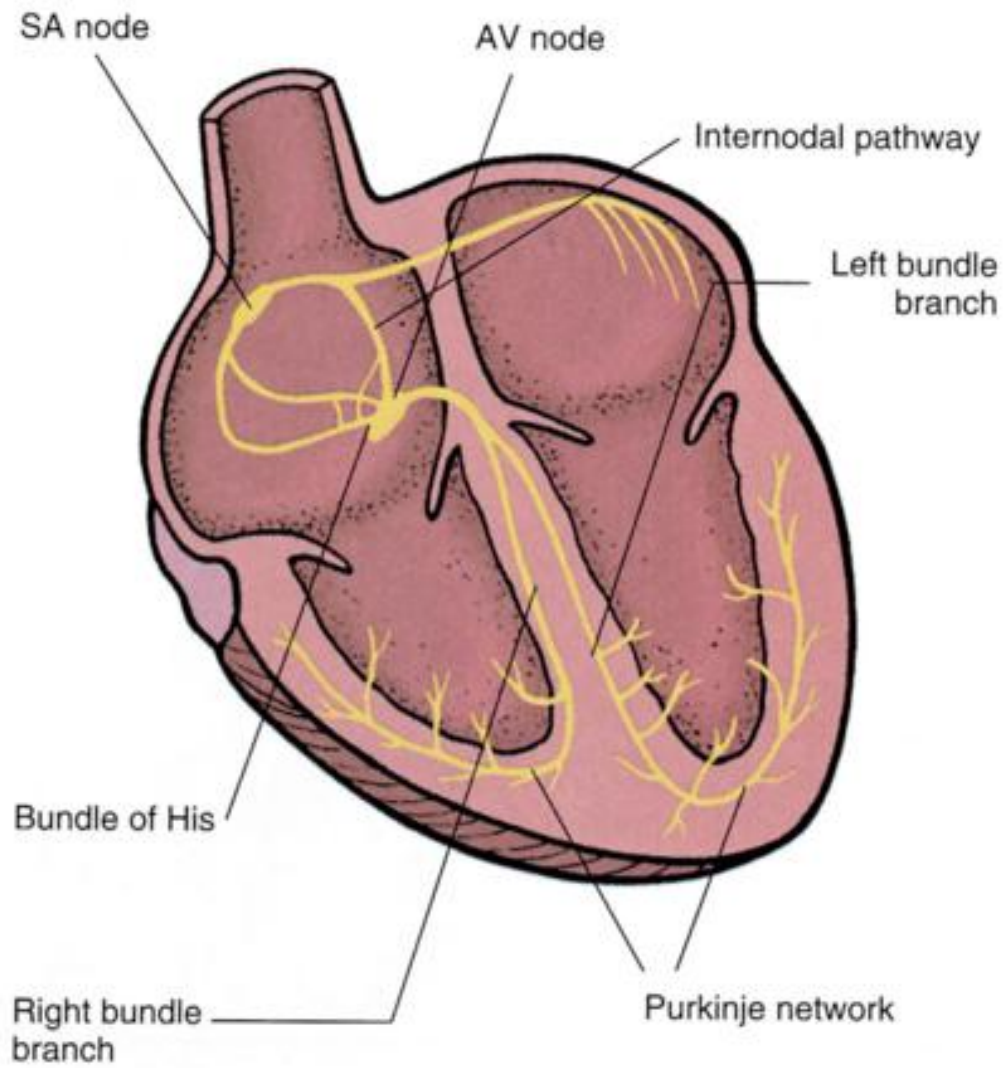
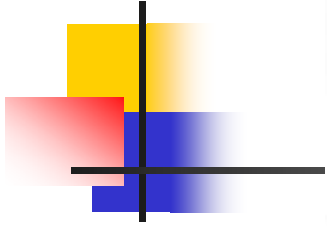






Electrical structure

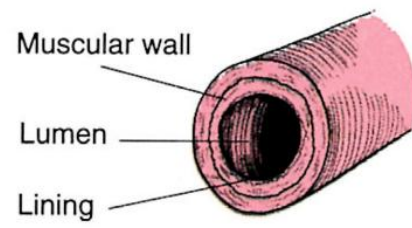
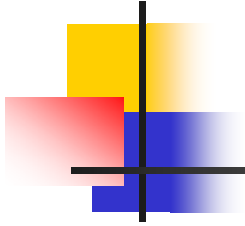
- SA Node
 - The “dominant pacemaker”
- Internodal pathways
- AV Node
- Bundle of HIS
- Bundle branches
- Purkinje Fibers/Network

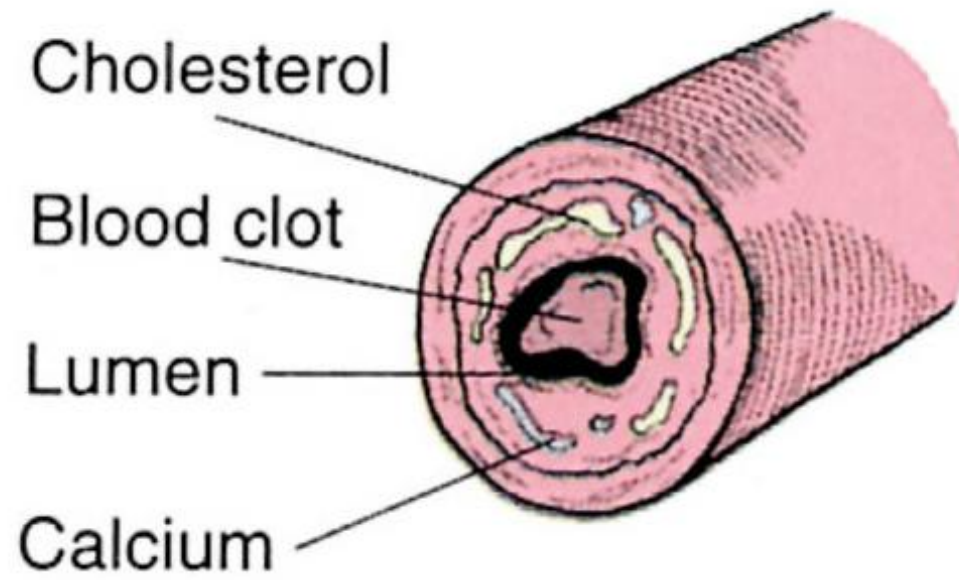
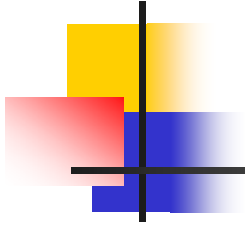




Cardiovascular abnormalities

- Atherosclerosis
 - Cholesterol/calcium deposit buildup
- Arteriosclerosis
 - Hardening of the arteries
- **Ischemia**
 - **Temporary** interruption of O₂ to tissues
- **Infarction**
 - **Death of tissue** after “a period of uncorrected ischemia”







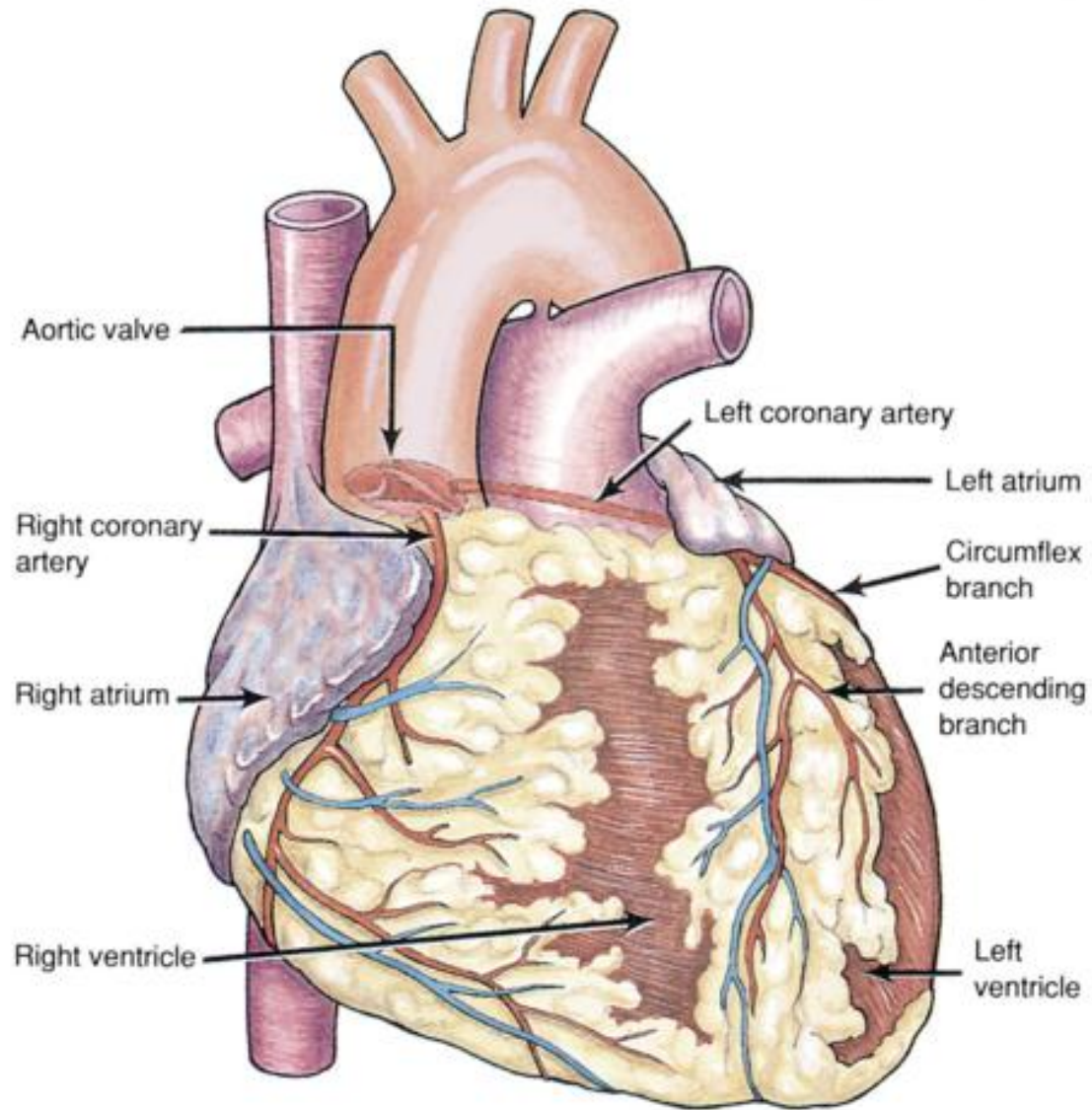
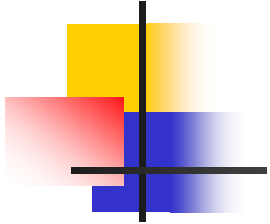
Risk factors

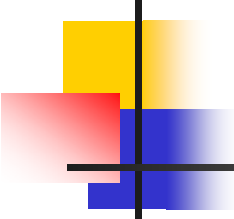
- Controllable
- Uncontrollable



Angina pectoris

- Chest pain
- Supply of O₂ does not meet hearts requirement
- **Partial blockage**
- Spasm?





Angina -- triggers

- Exercise
- Emotion
- Fear
- Cold
- Large meal
- elimination



Angina -- presentation

- Crushing/squeezing pain in midchest, under sternum ("substernal")
- Radiation to jaw, arms, midback
- Nausea
- Dyspnea
- Diaphoresis
- **Rarely lasts more than 15 minutes**



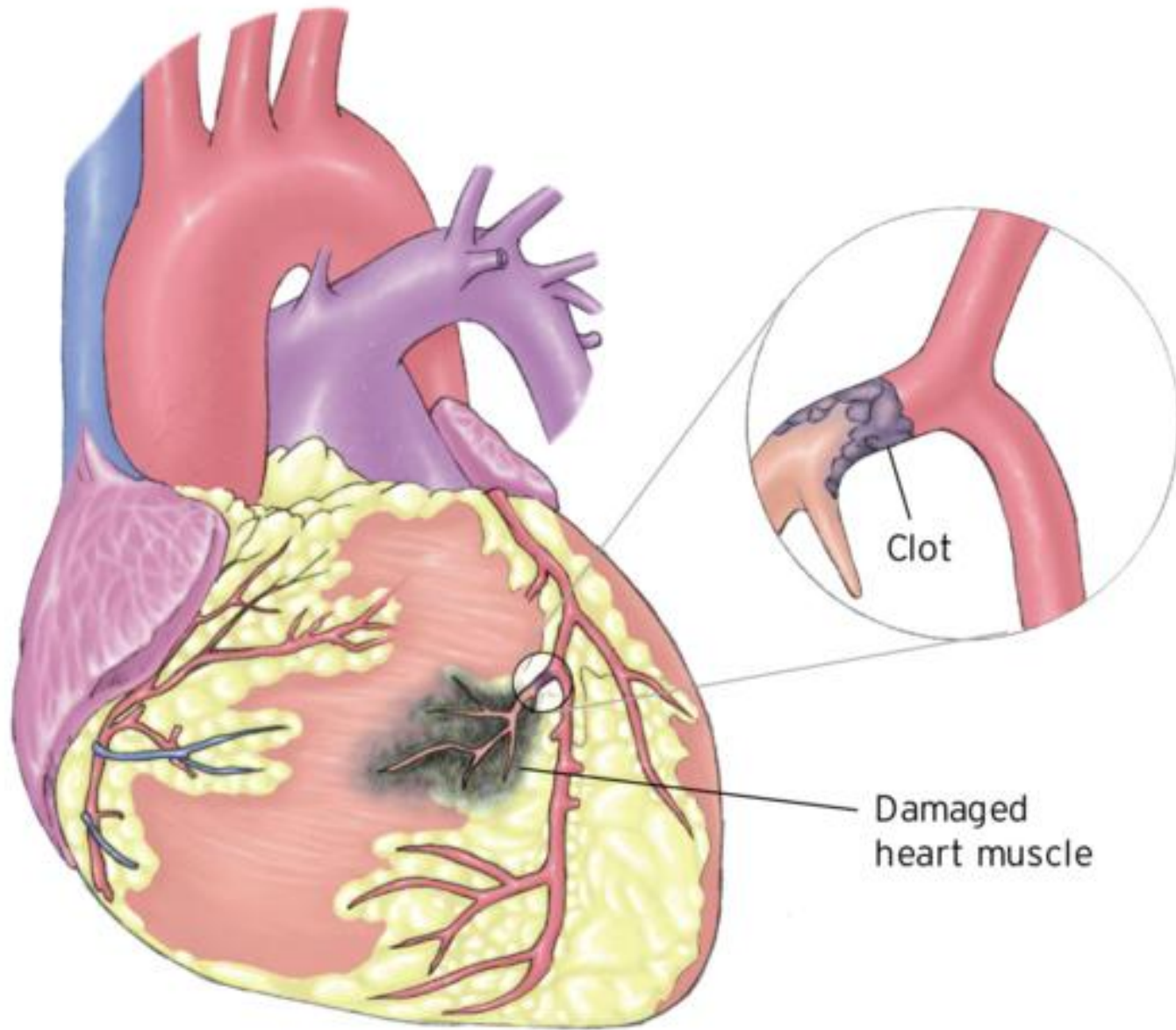
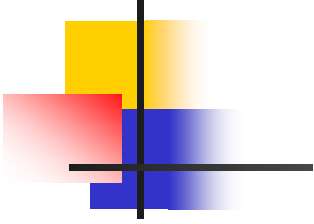
Angina-**promptly** relieved by

- Rest
- **Oxygen**
- **Nitroglycerine**
 - Dilates blood vessels
 - Increases blood flow to heart muscle



Acute myocardial infarction

- "AMI", "MI", "Heart attack"
- May have same S/S as angina, but
- Longer in duration
- Often **not** relieved with rest, O₂, nitro
- **May be onset at rest with no "triggers"**
- → **Treat angina as AMI**



Clot

Damaged
heart muscle



Complications of AMI

- Sudden death
 - 40% never “make it” to the hospital
- **Arrhythmias**
 - **Most frequent cause of death in early hours following AMI**
- Congestive Heart Failure (“CHF”)
- Cardiogenic shock
 - At least 40% of the heart is infarcted



Sad facts

- Unfortunately, the left ventricle is the portion of the heart most often infarcted
- The left ventricle is the highest powered portion of the heart
- Pumping power of the heart may be severely reduced



Classical S/S of AMI

- All, some or none of the following:
- Sudden onset of weakness, nausea, sweating
- Crushing chest pain – does not change with breathing
- Pain *radiating* to jaw, arms, neck
- Sudden arrhythmias causing syncope
- Acute Pulmonary Edema
- Cardiac Arrest



Classical S/S of AMI -- 2

- Vital signs -- commonly:
 - Pulse: increased, irregular
 - BP: Usually normal; dropping in cardiogenic shock
 - RR: Usually normal, elevated in APE
- Feeling of doom
- Looks frightened
- **Denial**
- **→ Diabetics and the elderly ←**



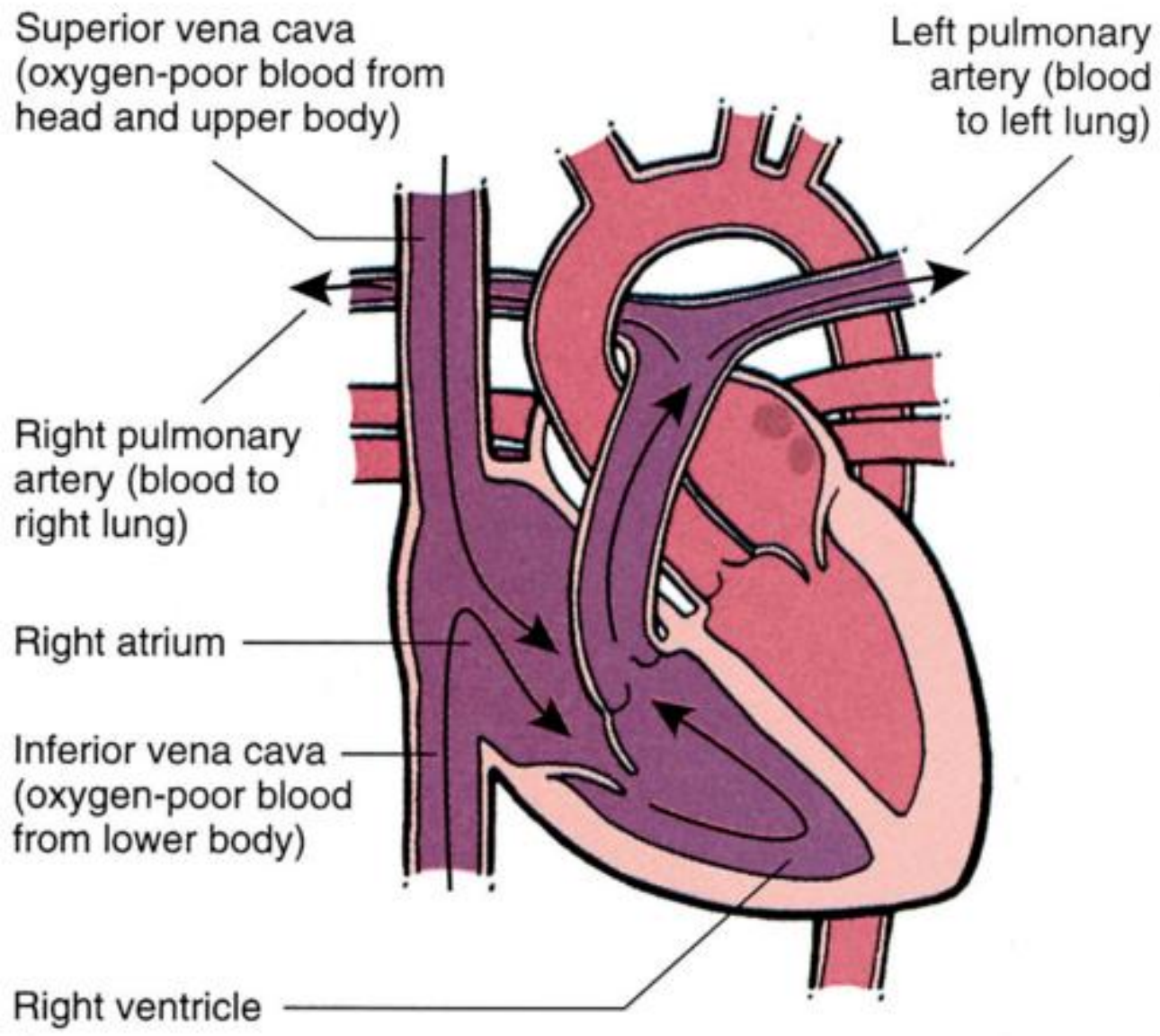
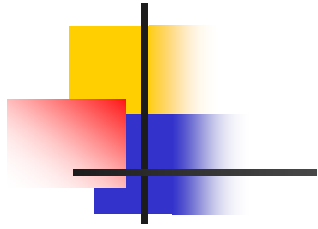
Congestive Heart Failure

- Pathophysiology
- Right sided CHF
- Left sided CHF



Right sided CHF

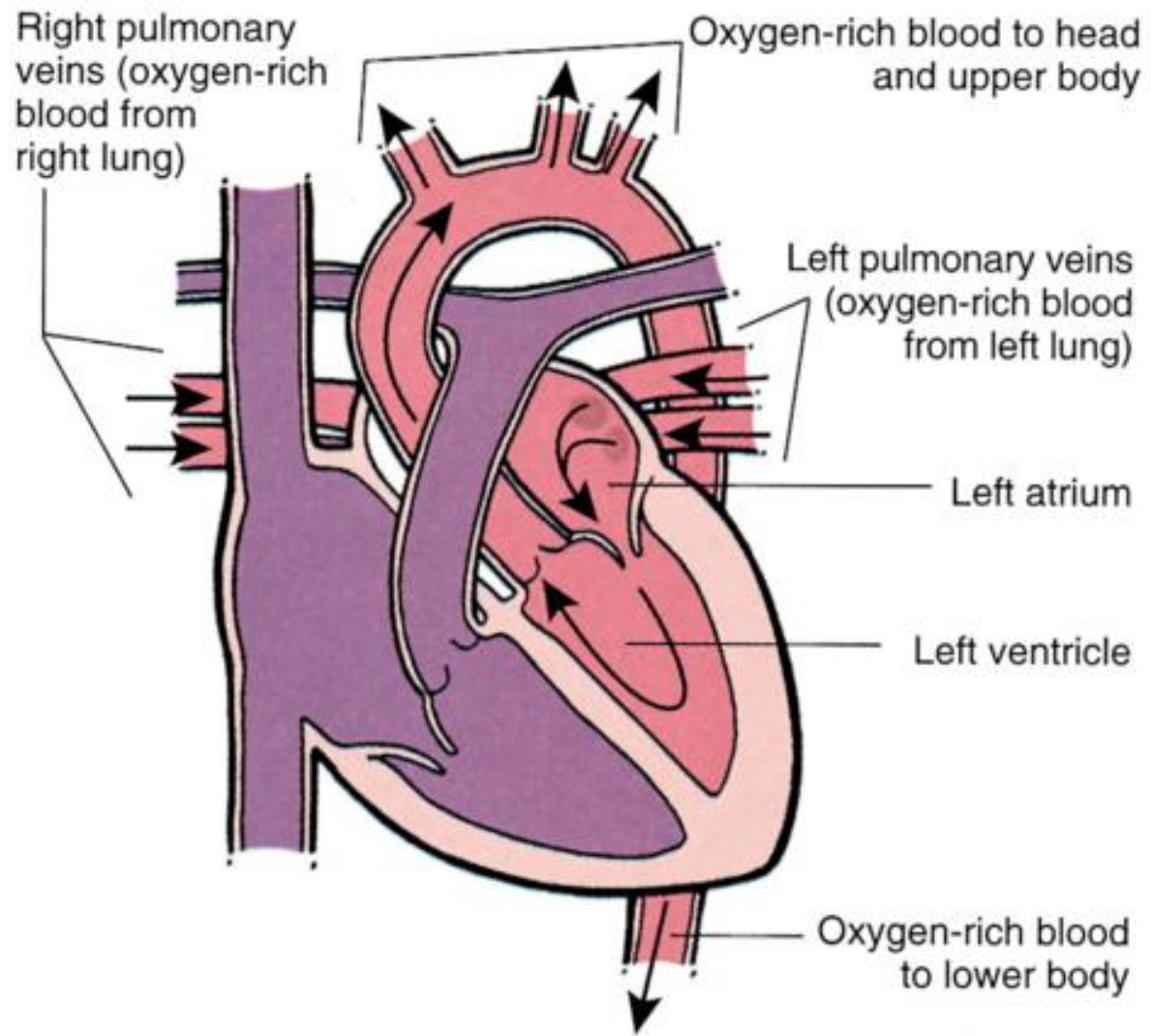
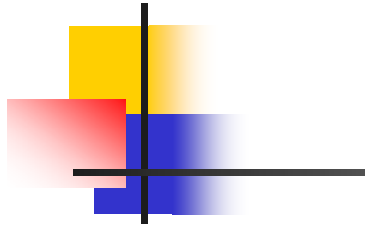
- Dependent edema
 - **Pedal edema**, sacral edema
- Enlarged liver
- **JVD**
- Due to back-pressure from damaged **right** ventricle
- **Chronic condition**
 - **People often live with it for years**
- Controlled by:
 - Medication (Lasix, Digitalis)
 - Salt free diet





Left sided CHF

- "APE"
- Fluid in the lungs due to back pressure from damaged **left** ventricle
- **Patient feels like they are drowning**
- Acute condition
- Frequent recurrences
- Often results in death
- Controlled by:
 - Medication (Lasix, **Bumex**, Digitalis)
 - Salt free diet
- Often a result of long-standing HTN





APE Calls

- Most of them are due to either:
- Poor diet control
 - They eat too much sodium filled foods
- Poor compliance with medications
 - Lasix is a diuretic
 - Annoying side effects
 - **A new MI**



Mathematics of CHF



CHF Math - The Normal Heart

Assume that the Normal Heart: Ejects about 100% of the content of the ventricle with each contraction of the heart. (NOT a correct assumption!)

Assume that 100ml. Of blood enters the ventricle after each contraction

	<u>Ejected</u>	<u>Remains</u>
Beat 1	100	0
Beat 2	100	0
Beat 3	100	0
Beat 4	100	0

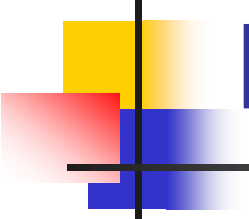


CHF Math – The Failing Heart

Failing Heart: Assume that it ejects about 50% of the content of the ventricle with each contraction of the heart.

Volume Ejected Remains

Beat 1	100	50	50
Beat 2	150	75	75
Beat 3	175	87.5	87.5
Beat 4	187.5	93.75	93.75



Where does the remaining blood go???

- In **Right Ventricular Failure**, remaining blood backs up through S/I Vena Cava to the neck (JVD), liver (Ascites) or Legs (Pedal Edema)
- In **Left Ventricular Failure**, remaining blood backs up through Pulmonary Vein to the capillaries surrounding the alveoli and ultimately in to the alveoli → A.P.E



Cardiogenic Shock

- Heart muscle is so damaged that it can no longer pump enough to meet bodily demands
- **Very** high mortality rates
 - **Even with the best treatment**
- S/S of shock immediately after or within hours or days of AMI



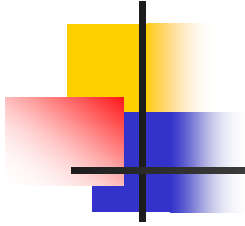
Treating the patient with “CP”

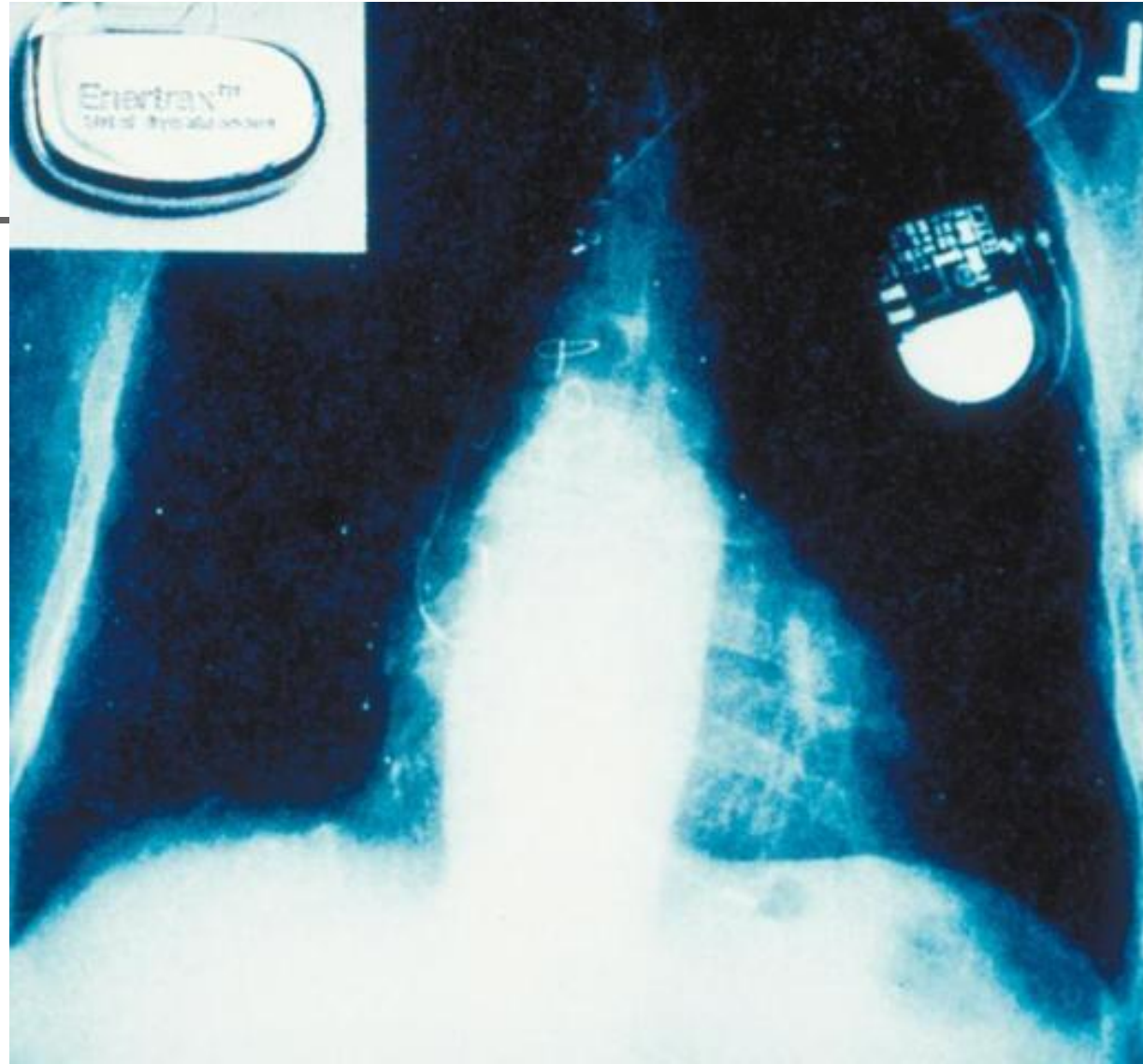
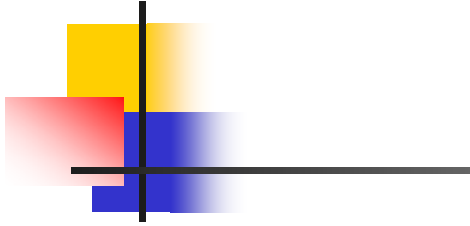
- **Calm reassuring approach**
- Cardiac arrest – CPR/AED
- High-con Oxygen
 - **NRB or BVM PRN**
- **ALS**
 - **For any cardiac/respiratory problem**
- Position of comfort
 - Usually sitting upright (dyspnic patient)
 - **NEVER** let an APE pt lie down!

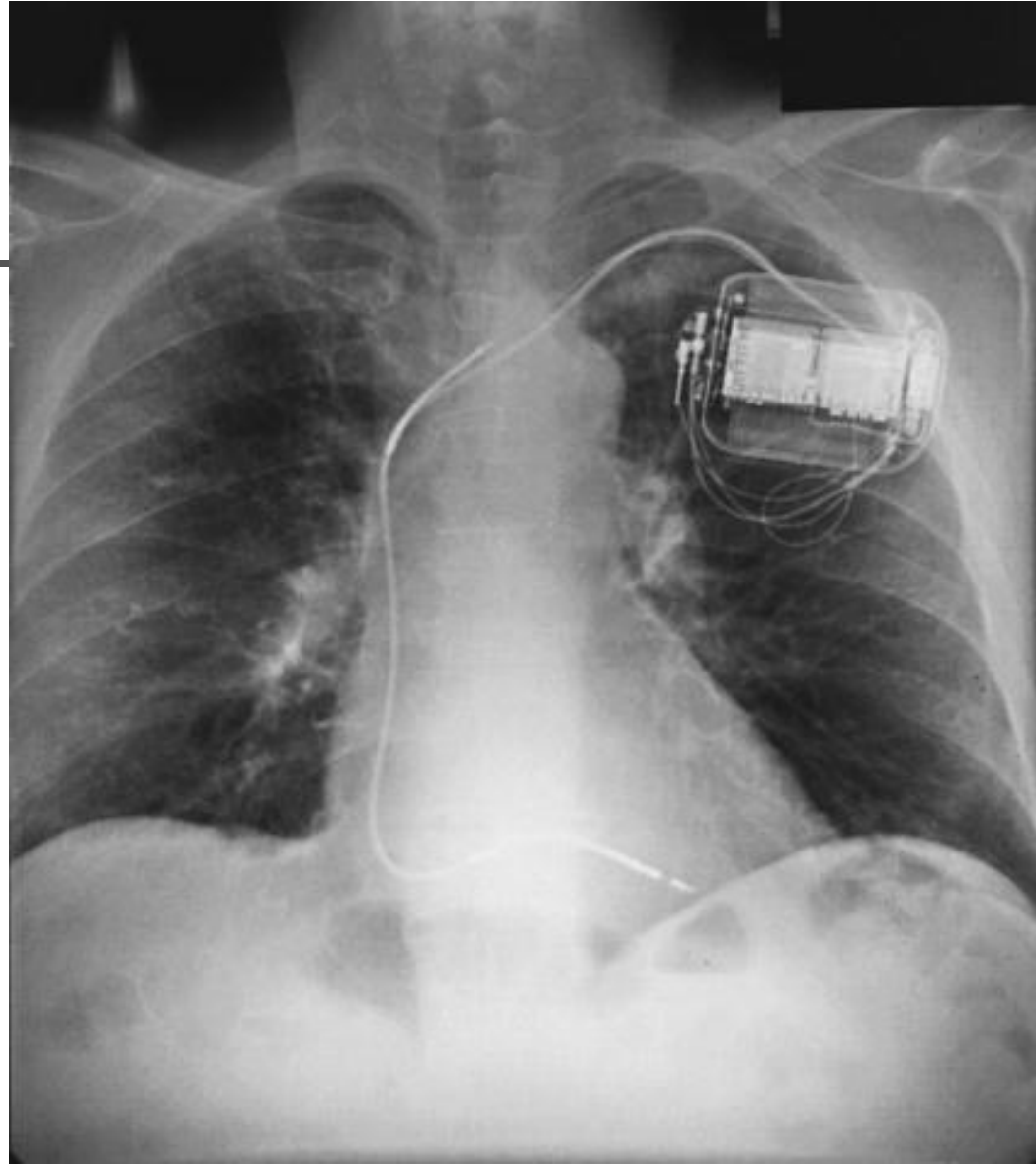
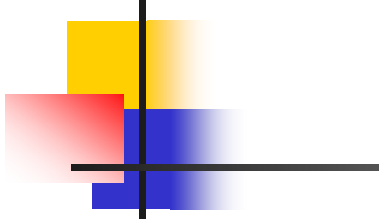


Treating the patient with “CP”

- Focused history
 - OPQRST – and in addition
 - Previous MI history
 - Previous “heart problems”
 - Family history / risk factors
- Monitor vital signs
- Need to get personal
 - **MUST** determine if patient has taken erectile dysfunction drugs within the last **72 hours**
- Other interventions
 - **Assist pt with prescribed nitro – SL**
 - If systolic BP > 120
- **Priority transport – CP patients decompensate very quickly and unexpectedly!**









ALS Treatment - after BLS

- Suspected MI
- Cardiogenic Shock
- SVT
- AFIB/Aflutter
- VTACH w/Pulse – Wide complex
- Brady Dysrhythmias/3 degree block
- Acute Pulmonary Edema



Suspected MI - ALS

- EKG
- 12-lead unless unstable dysrhythmia
- IV
- V/S Q2-3 m
- Nitro SL Q5m max of 3 (SO)
 - Only if Systolic BP > 100 and no ED drugs in past 72h.
Consult MC for variance.
- ASA 162mg PO
- MC Options:
 - MS 0.1mg/kg → Max 5mg/dose, total 15mg
 - Repeat Nitro SL

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Cardiogenic Shock - ALS

- **MC Options Only!**

- 250ml NS Fluid Challenge X 2
- Dopamine 5mcg/kg/min drip → max of 20 mcg/kg/min drip

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SVT - ALS

- Unstable SVT:
 - Cardiovert 100J, 200J, 300J, 360J
- Stable SVT:
 - Adenosine 6mg/12mg/12mg RAPID IVB each followed rapid NS flush
- MC Options:
 - Diltiazam (Cardizem) 0.25mg/kg slowly
 - Cardiovert 100J --> 360J
 - Amioderone 150mg in 100ml D5W over 10m

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AFIB/Aflutter - ALS

- Unstable AFIB/Aflutter:
 - Cardiovert 100J, 200J, 300J, 360J
- MC Options → For failed cardioversion or stable AFIB/Aflutter with HR > 150:
 - Diltiazam (Cardizem) 0.25mg/kg slowly
 - Amioderone 150mg in 100ml D5W over 10m

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VTACH w/Pulse

- Unstable VTACH w/Pulse:
 - Cardiovert 100J, 200J, 300J, 360J
 - Amioderone 150mg in 100ml D5W over 10m
- MC Options → For failed Amioderone conversion or low Cardiac Output S/S.
 - Cardiovert 100J, 200J, 300J, 360J
 - Mag Sulfate 2g/10ml NS over 2m
 - Calcium Chloride 1g slowly for hyperkalemia or suspected CC Blocker OD. Follow with NS flush.
 - Sodium Bicarbonate 44-88mEq Q10m

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Brady Dysrhythmias/3 degree block - ALS

- Ventricular Rate < 60 and S/S decompensated shock:
 - Atropine 0.5mg
- Transcutaneous pacing
- MC Options:
 - Repeat Atropine 0.5mg Q3-5m max 3mg
 - Dopamine 2mcg/kg/min → max of 10mcg/kg/min
 - Epi drip 2mcg/min → Max of 10mcg/min (***Soon to be out of protocol***)
 - Calcium Chloride 1g slowly for hyperkalemia or suspected CC Blocker OD. Follow with NS flush.
 - Sodium Bicarbonate 44-88mEq Q10m

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Acute Pulmonary Edema - ALS

- EKG/IV NS/V-S (Q2-3m)
- Nitro SL Q5m max of 3 (SO)
 - Only if Systolic BP > 100 and no ED drugs in past 72h.
Consult MC for variance.
- Lasix 20-80mg (***soon to become MC***)
- CPAP therapy – note conditions
- MC Options
 - MS 0.1mg/kg → Max 5mg/dose, total 15mg
 - Lorazepam 1-2mg IV/IN/Versed 1-2mg IV/IN – ***preferred over Morphine***
 - Nitro SL Q5m

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