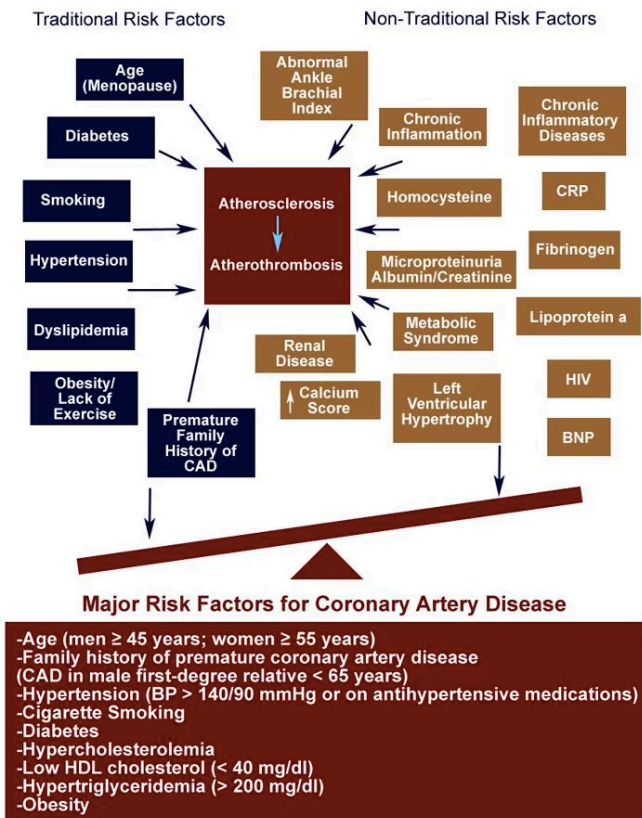


Acute Coronary Syndrome

INTRODUCTION



- **Calcium scores:** how much calcification a person has in arteries; this helps determine pt's predisposition to atherosclerosis
- **Chronic inflammation** can increase chances of damage to endothelium (esp in **coronary arteries**)
- **Dyslipidemia** is a strong risk factor for CAD
 - Could also mean low levels HDL
 - Very low-density lipoprotein (VLDL) is made in liver → LDL and HDL
 - LDL carries cholesterol to tissues and may cause plaque in arteries
 - HDL carries cholesterol to liver for elimination
- **Nitroglycerin** is given to relieve pain for angina
 - Can cause hypotension

Progression of CAD

1. Asymptomatic CAD
2. Stable angina
 - No cardiac cell death

- Occurs when about 70% of the artery is clogged; **we begin to have s/s and predictable angina**

3. Acute coronary syndrome (emergency interventions needed)
 - a. Unstable angina –occurs at rest
 - b. NSTEMI
 - c. STEMI

ANGINA PECTORIS

- **Def:** chest pain caused by inadequate O₂ supply to myocardium, leads to **ischemia**
- **CAD** is the most common cause but can be due to other issues like hypotension
- Triggered by any events that increase heart's O₂ demand such as **HTN, smoking**, etc.
 - HTN increases afterload → heart has to work harder to pump blood out
- Angina will cause activation of **SNS**
 - Forces the heart to work even harder when it's already weak
- Priority is to **enhance myocardial oxygenation**

Types of Angina

- **Stable**
 - Consistent pattern of onset, duration, and s/s
 - Usually worsened by **physical or emotional stress or exertion**
- **Variant angina (Prinzmetal's)**
 - Rare and can be associated with **Raynaud's disease** or history of migraines
 - Often occurs during rest
 - Caused by **coronary artery spasms** → **vasoconstriction of heart** → **ischemia of heart**
 - Treatment: **calcium channel blockers** for vasodilation
- **Unstable angina**
 - Unpredictable
 - Long lasting
 - **EMERGENCY!**

Exacerbating Factors of Angina

- Exertion
- Stress

- Temperature extremes
 - Vasoconstriction due to coldness → higher BP → increased workload for heart
- Tobacco use
- Heavy meals
 - Heart has to send more blood to GI system
- Stimulants (cocaine, caffeine, amphetamines)
- Circadian rhythms (more common is morning)
 - "stress hormones" are usually released in the morning into blood → makes heart beat faster

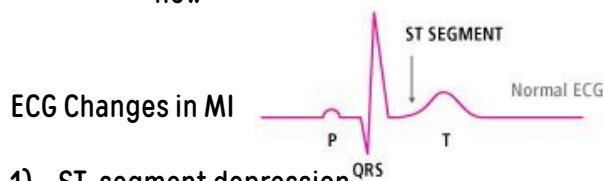
Clinical Manifestation

- **Chest pain**
 - Usually pain goes up to left jaw → left arm
 - This is more often in men than women
 - Can vary a lot for different pts
- Different pain characteristics for women
 - SOB
 - Epigastric pain
 - Tight chest and squeezing
 - Cold sweat
 - Dizziness
 - Nausea
 - Others
- Different pain characteristics for diabetic pts
 - Due to **neuropathy**, can be **asymptomatic**
- **SNS activation**
 - Pt feels **impending doom**
 - n/v, pallor, tachycardia, tachypnea, vasoconstriction
 - Restlessness, anxiety
- Pt may be either **hypotensive** or **hypertensive**
 - Hypotensive b/c if the heart is too weak → can't pump blood out → low BP
- Dysrhythmias due to AV heart block (if AV nodes or SA nodes are damaged)
- **Projectile vomiting** is common for **STEMI**
- **Heart failure and pulmonary edema**
 - Manifests as **coarse crackles in lungs** (do not get confused with fine crackles which is usually atelectasis)
 - Most common reason for this is CAD

- **Mechanism:** blood backup in lung b/c ventricle is too weak

DIAGNOSTICS

- 12 lead ECG (most important) –we need to get this **ASAP**
- Cardiac enzymes
- Stress test/exercise test
- Echocardiogram
- Cardiac catheterization –putting a catheter into heart to visualize the coronary artery using **contrast dye**
- Other blood tests
 - CRP: a molecule the liver makes in response to inflammation; ppl with **high CRP → higher risk for CAD**
 - Plasma ceramides: high levels found in pts with chronic inflammation; fairly new



- 1) ST-segment depression
 - Seen with **unstable angina** and **non-transmural MI (NSTEMI)**
 - Non-transmural MI: not a full myocardium thickness damage



- 2) ST-segment elevation
 - Seen in transmural MI
 - Full thickness of myocardium damaged
 - Diagnosis requires **2 contiguous leads**



- 3) T-wave inversion
 - Means ischemia or angina; NSTEMI



4) Pathologic Q waves

- Develops as MI evolves
- More permanent
- May be an indication that person had a previous MI
- Necrosis has already occurred



- We cannot rule out angina and NSTEMI just b/c troponin levels are normal since it takes some time for biomarker levels to go up
 - This is why they may do multiple blood draws

Cardiac Biomarkers

Cardiac enzyme	Normal levels	Starts to rise ...	Returns to normal...
CK-MB	0%	4 hours (peaks at 18hrs)	2 days
Troponin T	Less than 0.2ng/L	4-6 hrs (peaks at 10-24 hrs)	10 days
Troponin I	Less than 0.03ng/L	4-6hrs	4 days
Myoglobin	Less than 90mcg/L	3 hrs	24 hrs

- CK-MB is best if pt previously had an MI and we want to check if he/she had another one since CK-MB goes back to normal within 2 days **unlike troponin T**
- Troponin is most accurate for cardiac issues b/c they only exist in heart cells
- Myoglobin is not very specific to heart, but is the fastest one to show up

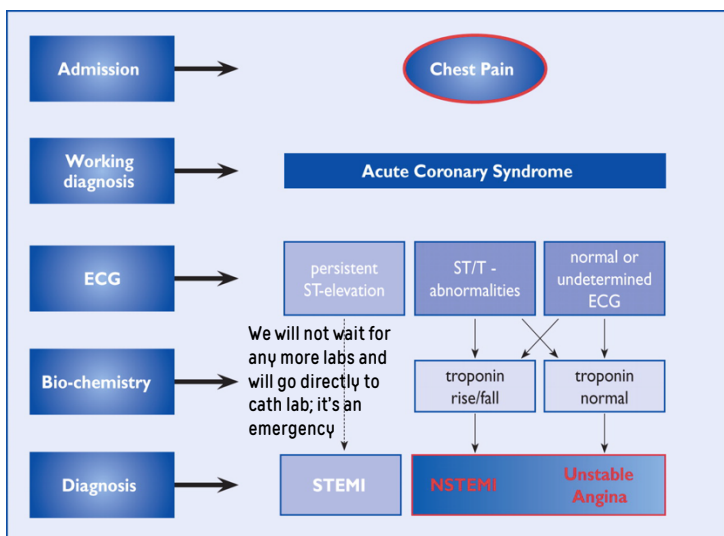
Checking Labs Before Cardiac Therapies

- **Make sure to check pt's labs before** for any precautions that may be needed
 - Ex: you may want to tell HCP that pt is at-risk for bleeding if platelet levels are too low
- We may not treat a little high BG levels due to risk of hypoglycemia if we administer hypoglycemia med
- Keep a close eye on creatinine since we may do a procedure needing contrast dye
- High BNP values may indicate HF due to ventricular stretching

EMERGENCY MANAGEMENT

- Most important is to **ensure airway by administering O2**
- **12-lead ECG** –do this before giving any meds I order to figure out that the cardiac issue is
- **2 IV access**
- Pain assessment (PQRSTU)
- Baseline labs
- CXR
- Prep for possible PCI or fibrinolytic therapy
- Manage pain –pain may actually cause heart to work harder
- Meds
- Others

Diagnosing Chest Pain



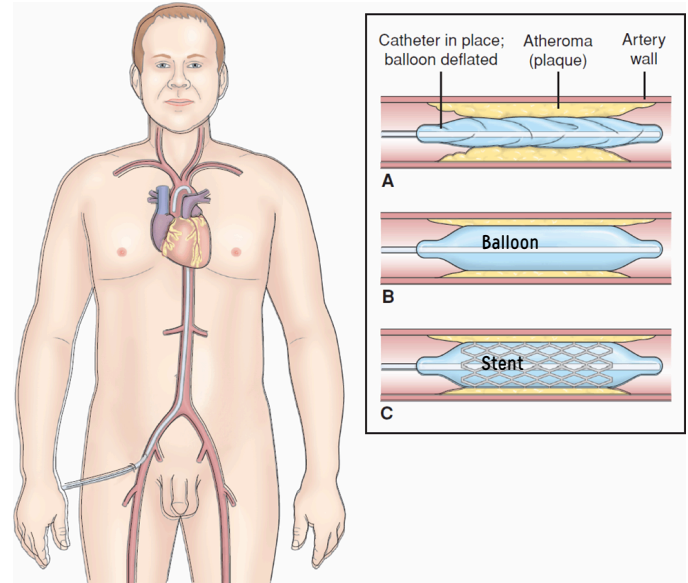
Medication (OHBATMAN)

1. Oxygen
 2. Heparin (decrease clot growth or new clots)
 3. Beta blockers
 4. Aspirin
 5. Thrombolytics
 6. Morphine
 7. Ace-inhibitors
 8. Nitroglycerin
- You may consider stool softeners b/c pain meds can cause constipation and "bearing down" can stress heart

STEMI Treatment

- Main meds: **aspirin, beta-blockers, heparin**
 - Meds can change ECG pattern, so make sure to get ECG first!
 - Always ask pt for consuming **Viagra** b/c it drops BP (vasodilation) and if you mix it with nitroglycerin → **severe hypotension risk**
- Supportive med: O2, nitrates, morphine
- You need to do **immediate reperfusion** b/c time is important; can do:
 - PCI with stent – should be done in less than **90 mins**
 - Fibrinolytics – should be done in less than **30 mins** of s/s; not done much
 - CABG (surgery)

- Stent placement: stent may be drug eluting and requires **anticoagulation and antiplatelet treatment**



Anticoagulants in MI

Antiplatelet meds	Anticoagulant meds
- Aspirin	- Heparin
- Clopidogrel	- LMWHs
- Glycoprotein IIb/IIIa inhibitors – super aspirins	- Coumadin (vit K antagonist)
	- Direct thrombin inhibitors

- Make sure to **assess skin** and check for ecchymosis, scars with bleeding, hematoma, hematuria, etc. for bleeding precautions
 - Do **neuro assessment for brain bleed**

REPERFUSION THERAPY

- Goal: **restore BF to affected areas**
- 3 main ones:
 1. PCI
 2. Thrombolytic therapy
 3. CABG

Percutaneous Coronary Intervention (PCI)

- Can be done in **femoral or radial artery**
- Performed in **cath lab**
- 2 types:
 - Balloon angioplasty: increases vessel diameter

1) Pre-PCI management

- Keep pt **NPO 8-12 hrs** before
- **Assess for allergies**
- **Ensure IV access**
- **Baseline labs**
- **Others**

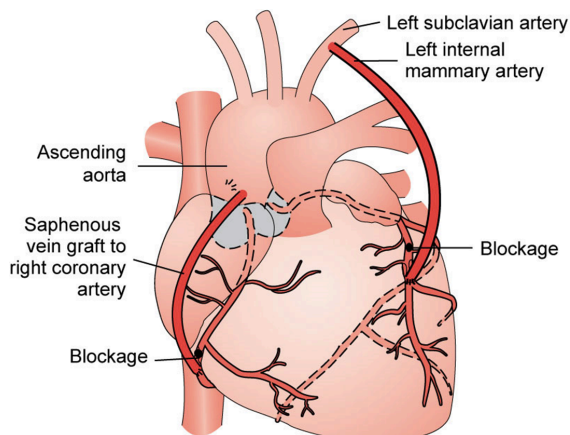
2) Post-PCI management

- **Monitor site** for bleeding or hematoma
- **Assess pulse, color, temp, capillary refill, and sensation** frequently
- **Monitor v/s trends**
- **Monitor pain**
 - Chest pain is a high sign for **re-occlusion**
- **Monitor ECG changes** constantly
 - Sometimes a little bit of dysrhythmias okay since it can be due to re-perfusion
 - Look out for **A-fib, v-fib, or v-tach**
- **Lab tests (esp creatinine)**
 - Creatinine and urine output is important since this procedure may use **contrast dye**
- **Reinforce bedrest for 2-6 hrs** due to risk of bleeding
- Instruct pt to **keep legs straight**, bed should **not be elevated more than 30 degrees** (for femoral PCI) to maintain **hemostasis**

Fibrinolytic Therapy

- **Def:** "clot busting" meds given
- Very high risk for bleeding
 - Make sure to scan pt for **contraindications like:**
 - **NSTEMIs** (b/c those clots are different from STEMI clots)
 - **Recent hemorrhagic stroke**
 - **Active bleeding like ulcer or colitis**
 - **Intracranial neoplasm (brain tumor)**
 - **Pregnancy**
 - **Recent trauma or surgery**
- Time is critical
 - Should be given **within 3-6 hrs** of s/s
 - **Ideal is 30min to 1hr**
 - **After 6 hrs, bleeding risk is higher** due to necrosis tissue being more prone to bleeding
- **IV administration**
- This is **not a final treatment** (due to high chance of re-occlusion); needs follow up **PCI or CABG**

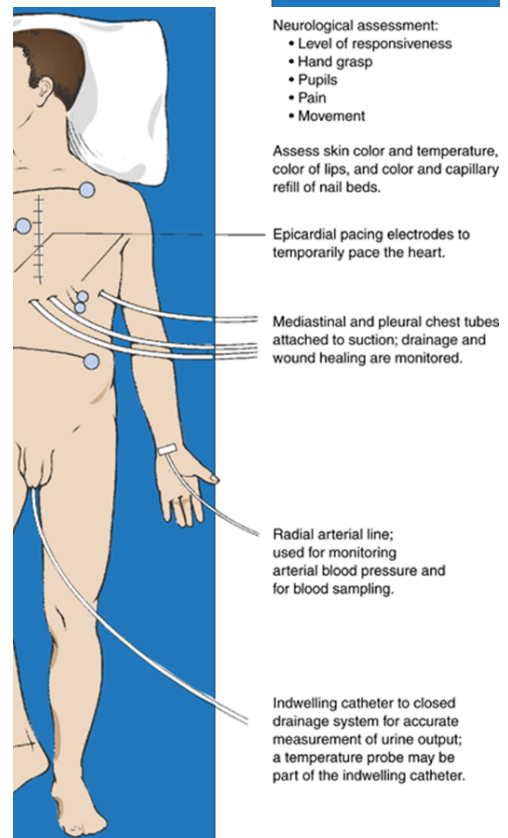
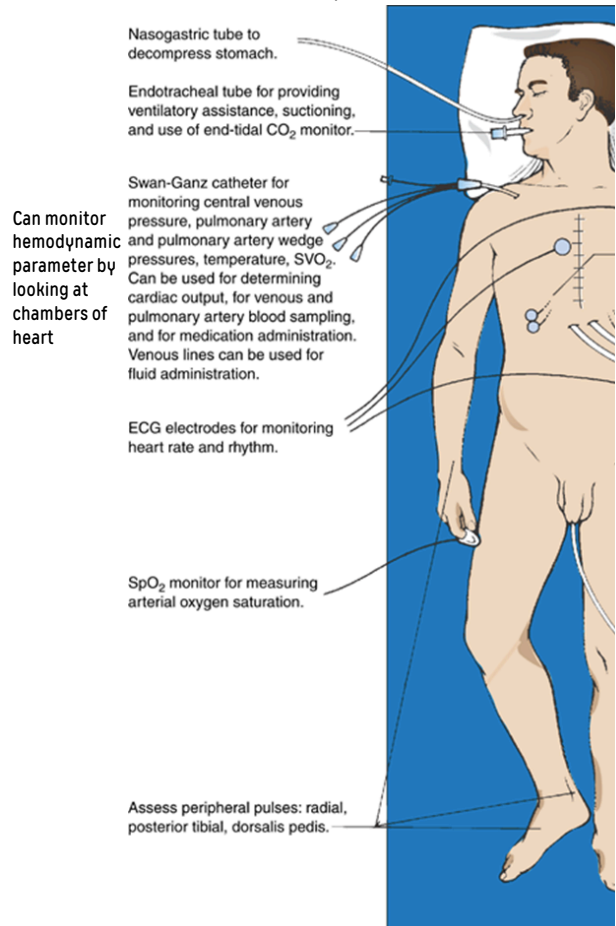
Coronary Artery Bypass Graft (CABG)



- **Def:** creation of alternate route for blood to supply heart
- This may **last longer** than other procedures
- Access to thoracic cavity via **sternotomy**
- Place on **cardiopulmonary bypass (CPB)** – mechanically circulating and oxygenating blood for body while bypassing the heart and lungs
 - Allows surgeon to complete surgery in **bloodless field; sometimes not done**

- Heart is stopped with cooled K⁺ solution

- Pt will be transferred to **CCU or ICU for extended recovery**
- Pt will have multiple tubes inserted

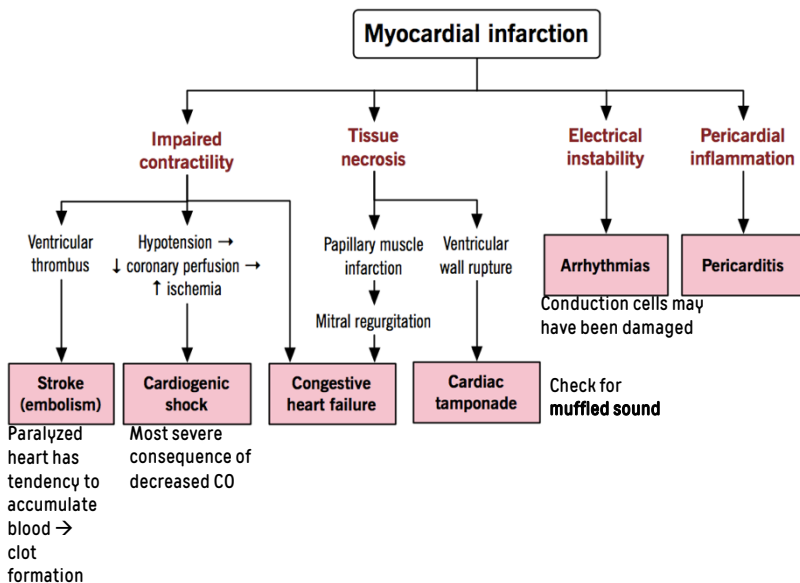


CONSEQUENCES OF MI

- Contractility of affected area disrupted
 - Affected area can no longer pump or transmit electrical impulses
- Outcome depends on the **degree** and **location** of damage
 - Majority of infarctions involve **left ventricle**
- Highest mortality MI is **ventricular fibrillation**

- Side effects
 - **Headache, hypotension, reflex tachycardia, flushing** (not serious)

Complications



Rehabilitation

- 1) Hospital for **post MI activity levels**
 - 2) Early recovery
 - 2-12 weeks outpatient programs; may be longer for **STEMI**
 - Monitored continuously with increased activity
 - 3) Late recovery
 - Long term maintenance
 - Permanent lifestyle changes may be needed
 - Medication supervision
- Education pt on **nitroglycerin**
 - Pill must be dissolved under tongue
 - Protect from **light, extreme temp, moisture, and air**
 - **Prophylactic use** (antibiotic) for activities causing increased heart work
 - Dose: 1 tablet **every 5 mins**, up to **3 doses**; call 911 if s/s doesn't resolve after 1 tablet