Coronary Artery Disease (CAD)

LEARNING OBJECTIVE 1

- Discuss the epidemiological factors of coronary artery disease (CAD) and define the risk factors.

CAD Is Leading Cause of Death in the US

- Causes one-fifth of all deaths in the US, making it the single largest killer
- Incidence of CAD increases with age

Coronary Artery Disease (CAD)

progressive disease resulting in coronary artery narrowing or total occlusion.

- **Atherosclerosis**
  - Most common cause of CAD
  - The abnormal accumulation of plaques on the vessel wall
    - Causes narrowing then eventually blockages in the coronary arteries that reduces myocardial blood flow = CAD
      - Asymptomatic until 75% occlusion of coronary artery lumen.

CAD: Risk Factors

- Modifiable
  - smoking
  - Hypertension
  - Hyperlipidema
  - Physical inactivity
  - Diabetes Mellitus
  - Obesity
  - Stress / Anxiety
  - Diet
- Non-Modifiable
  - Increasing Age
    - Males >45 years old
    - Females >55 years old
  - Gender
    - Affects both men and women; #1 killer is U.S.
  - Genetics
    - Strong genetic component
  - Ethnicity
    - Non-whites increased incidences versus whites

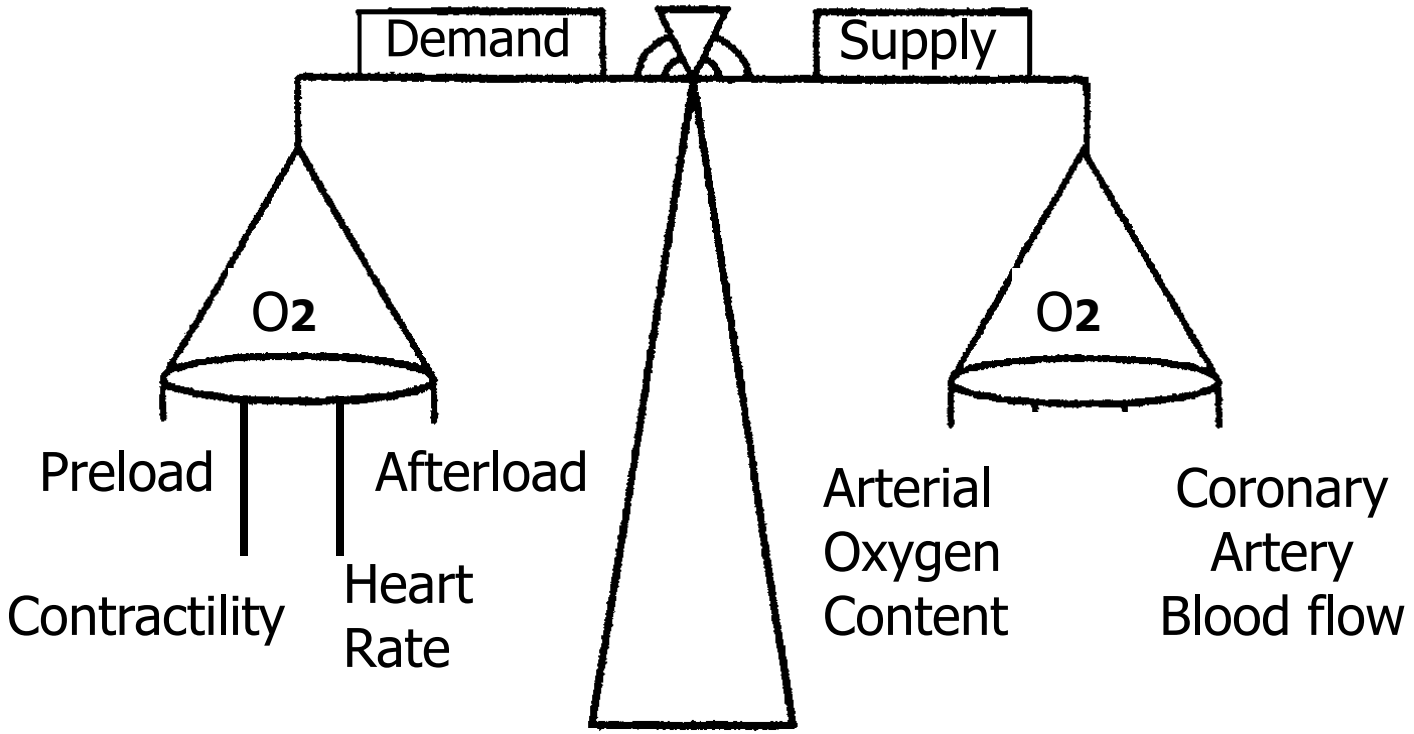
LEARNING OBJECTIVE 2

- Define pathophysiology of CAD/ischemic heart disease and explain the interventions used when evaluating a patient with angina pectoris.

Angina Pectoris

- As CAD progresses the atherosclerotic plagues become significant, reducing blood flow to portions of the myocardium = Ischemia.
  - ischemia clinically manifests most often as angina (chest pain).
  - Angina pectoris is =myocardial ischemia without cellular death.

Myocardial Oxygen Supply and Demand Balance



Precipitating Factors of Angina

- Any situation where oxygen demands are increased:
  - Physical exertion
  - Tachycardia
  - Dysrhythmias
  - Cold weather
  - Eating a heavy meal
  - Stress or emotional states

Angina Pectoris

- Signs and Symptoms
  - Chest Pain
    - Can occur anywhere in chest; commonly retrosternal.
      - Pain may radiate to the back, arms (left most common), shoulder, neck or jaw.
      - Described as pressure, tightness or burning sensation
    - Often precipitated by physical exertion or stress
    - Maybe associated with:
      - SOB, weakness, anxiety, diaphoresis, N/V, dizziness or numbness in upper extremities

Types of Angina

1)Stable Angina

- Predictable, consistent pain with physical exertion & relieved with rest; "my usual chest pain"

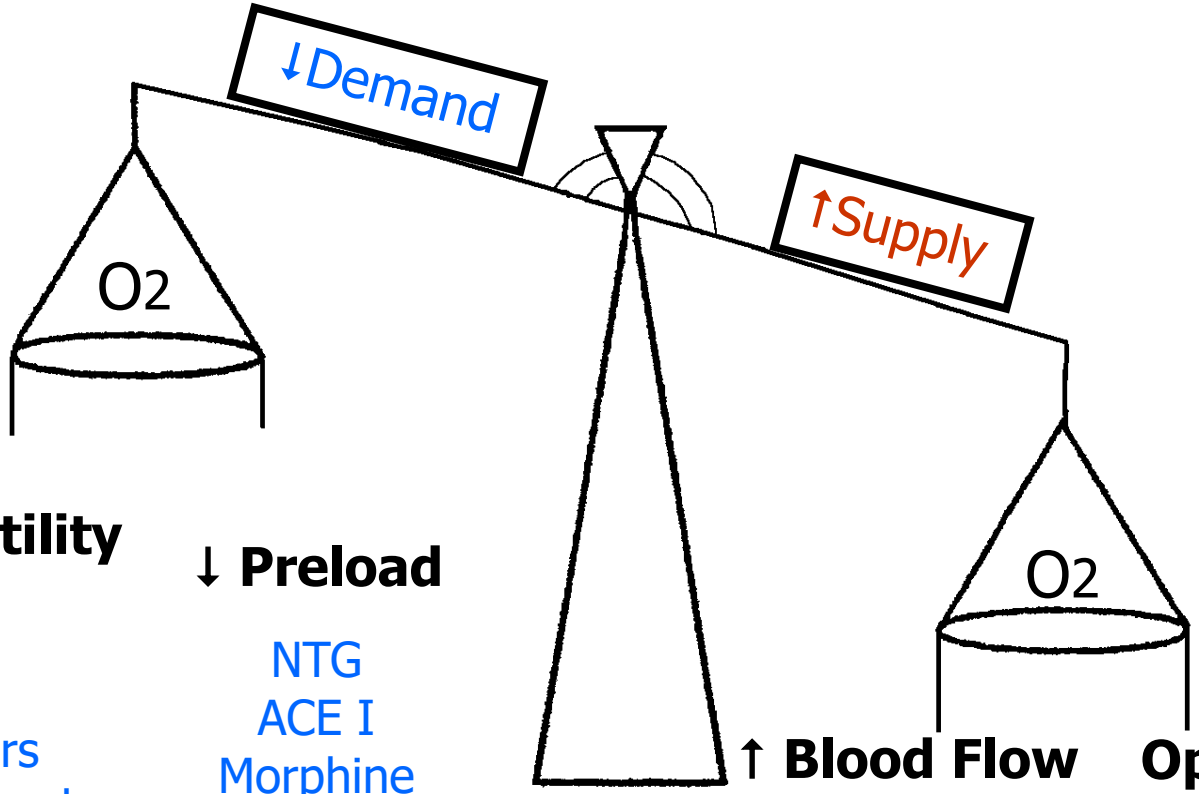
2)Unstable Angina

- Last longer
- increased frequency / intensity of symptoms
- pain at rest

3) Preinfarction Angina

- Lasting longer than 15 minutes /unrelieved by NTG x3 is a medical emergency!
  - Pt need hospitalization for management

Management of Unstable Angina



↓Contractility
↓HR

Beta Blockers
Ca Channel Blockers

↓ Afterload

ACE I

↓ Preload

NTG
ACE I
Morphine

↑ Blood Flow

NTG
Ca Channel Blockers
ASA
Anticoagulants
Morphine

Open Occluded Arteries

PCI

Management: Unstable Angina

- Goal is to Increase O2 supply & decrease O2 demand to prevent myocardium death.
- ECG
- Laboratory Tests

  Electrolytes

  Cardiac Enzyme Panel
  - Rule-out MI: every 8 hours x 3 / 6 hours x4

Management: Unstable Angina

- Relief of Chest Pain: "MONA"
  - **M**orphine (drug of choice)
  - **O**xygen
  - **N**itroglycerine
- Increase Coronary Artery Blood Flow
  - Antiplatelet medications
    - **A**SA
    - Glycoprotein (GP) IIb/IIIa Inhibitors
    - Heparin
  - Percutaneous Coronary Intervention (PCI)

Pharmacologic Therapies For Angina

- Nitrates
  - Dilate veins – decreases preload
  - Dilate arteries – decreases afterload
  - dilates coronary arteries
  - Administer- spray, sublingually, PO, IV, topically
  - Side effects – hypotension
  - Ex: Nitrostat SL or Tridil (nitroglycerin),
  - Need a nitrate free interval

Beta blockers

- Reduce myocardial oxygen consumption by decreasing heart rate, contractility
- Side effects – hypotension, bradycardia, bronchial spasm,
- Ex: Lopressor or Toprol (metoprolol),Inderal

Calcium channel blockers

- Dilate arteries – decreases vascular resistance
- Decrease heart rate and myocardial contractility
- decreases O2 consumption
- Side effects - hypotension, bradycardia,
- Ex: Adalat or Procardia (nifedipine), Cardene (nicardipine), Cardizem (diltiazem)

Antiplatelet medications

- Prevent platelet aggregation on atheroma or thrombus
  - ASA (Aspirin) – side effects: GI irritation, bleeding, increased bruising
  - Ticlid (ticlopidine)
  - Plavix (clopidogrel)

Anticoagulants

- **Heparin**
  - Given IV in acute situations or subcutaneous in non-acute situations
  - Monitor partial thromboplastin time (PTT)
  - Antidote – Protamine Sulfate
  - Observe bleeding precautions
  - Monitor for signs and symptoms of bleeding
  - Half-life of 1-2 hrs

Anticoagulants

- Coumadin (warfarin)
  - Used long term; given PO
  - Effects do not occur for 3-5 days
  - Monitor Prothrombin time (PT) or International Normalized Ratio (INR)
  - Antidote – Vitamin K
  - Contraindicated in pregnancy, clients with liver dysfunction or those at risk for bleeding

Oxygen therapy

- Oxygen therapy
  - Administered usually at 2 L/min per nasal cannula
  - Increases amount of O_2 delivered to myocardium

Acute Coronary Syndromes (ACS)

- Coronary artery diseases are two types
  1) chronic unstable angina
  2) acute coronary syndrome

The acute coronary syndrome is an Umbrella describes a wide range of CAD from unstable angina to acute myocardial infarction (MI).

Myocardial Infarction (MI)

- MI is defined as irreversible death of myocardial tissue, resulting from decrease or total lack of coronary blood supply and O2 to the myocardium.

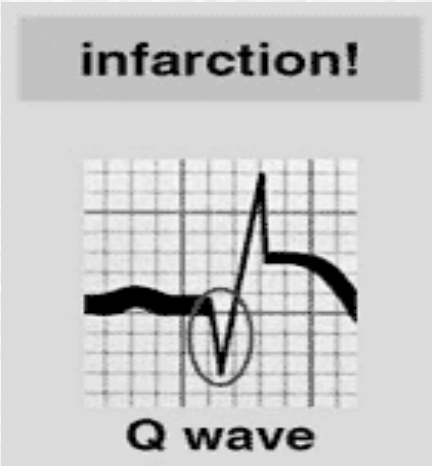
  - Causes:
    - Coronary artery thrombosis (most common)
    - Coronary artery spasm
    - Trauma
    - Severe and abrupt hypotension

Myocardial Infarction (MI) Cont.,

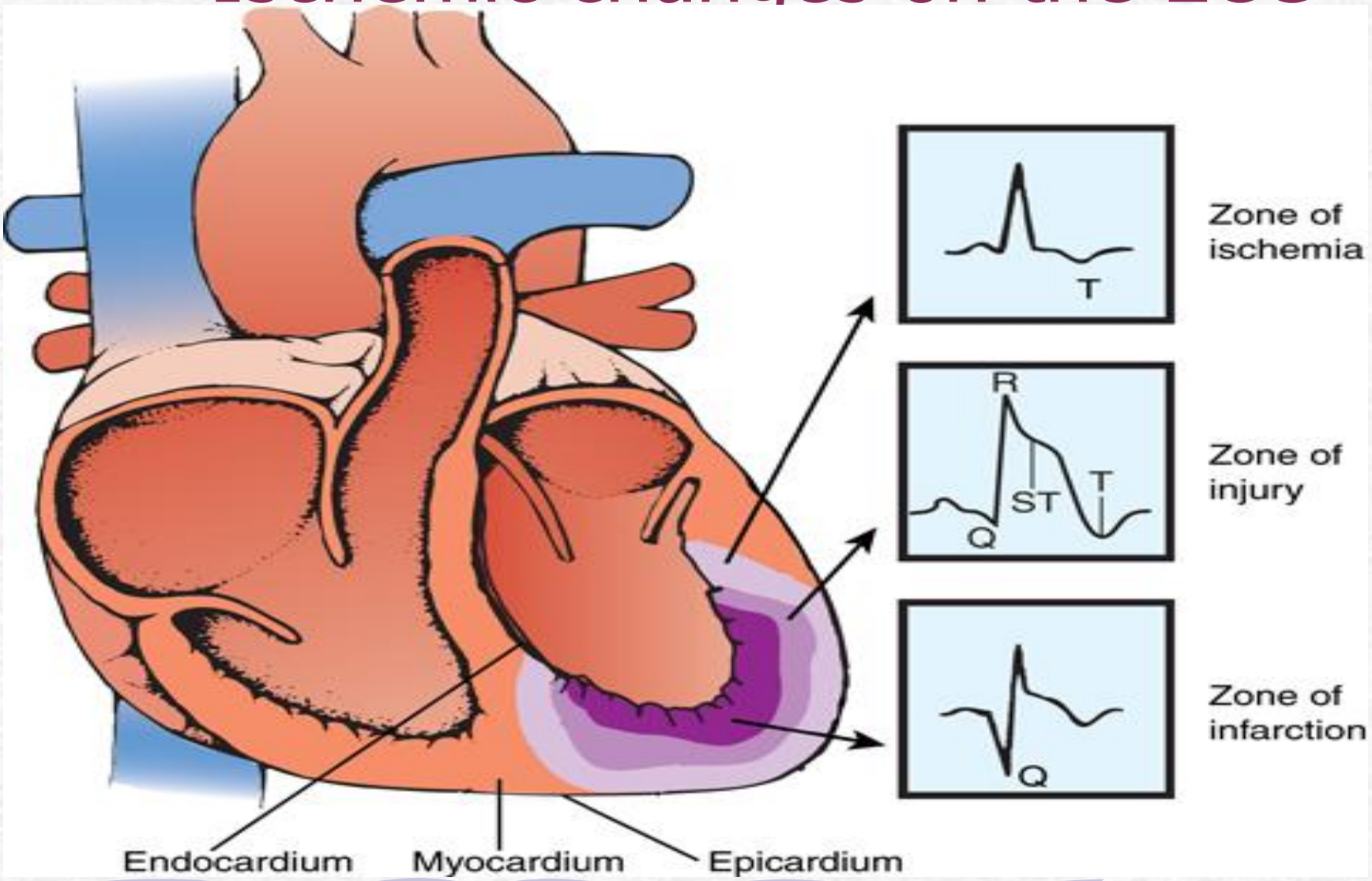
- Signs and Symptoms:
  - Chest Pain
    - Severe and unrelenting substernal chest pain; often radiating to the back, left arm or jaw.
    - Lasting for 30 minutes or more
    - Only relieved by opioids
    - Occurs without a know precipitating event; usually occurring in the morning
  - Associated Symptoms
    - SOB, weakness, anxiety, diaphoresis, N/V, dizziness or numbness in upper extremities.

Myocardial Infarction Cont.,

- Pathophysiology
  - Irreversible cell death within 20-40 minutes of cessation of blood flow.
  - EKG changes associated with an MI:
    - Ischemia: T wave inversion
    - Injury: ST segment elevation
    - Infarction: Pathological Q waves



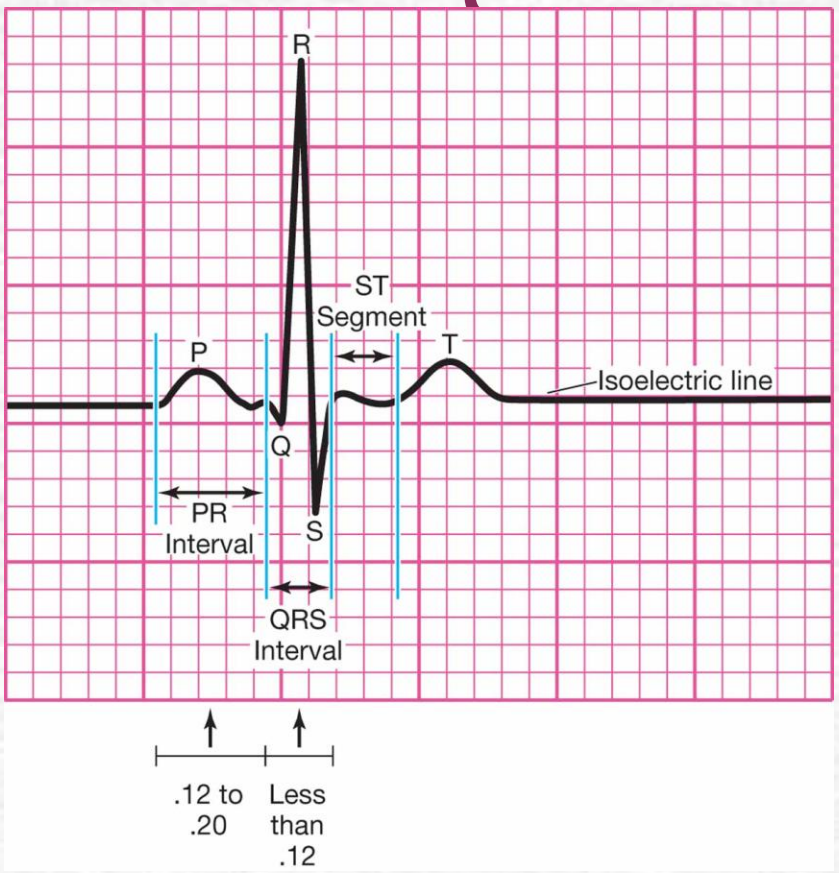
Ischemic changes on the ECG



ST Segment Elevation

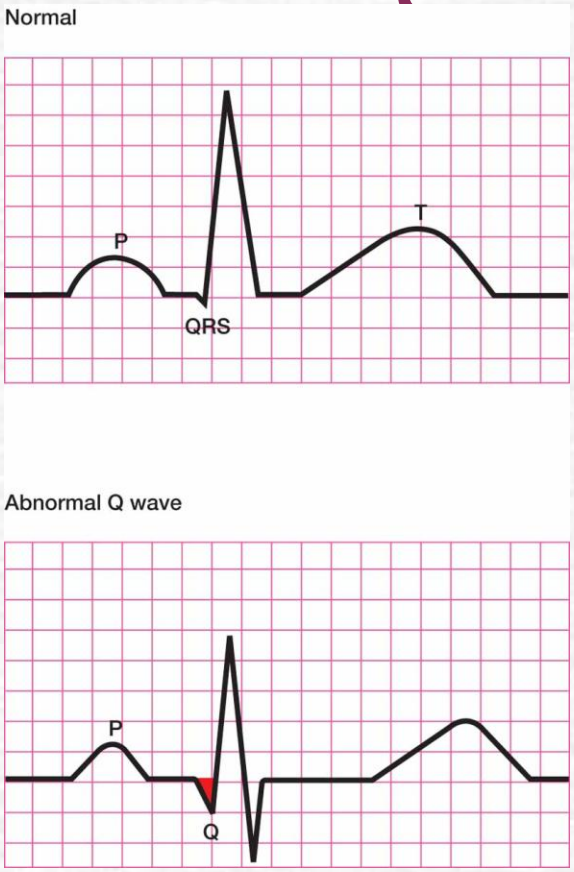
ST segment elevation morphology differences.

Normal Q Wave



Normal ECG waveforms.

Abnormal Q Wave



Normal and abnormal Q wave.

Types of Myocardial Infarctions

according to muscle layer affected:

- Q wave MI
  - Transmural: full thickness muscle wall necrosis
  - Often associated with a more prolonged MI
- Non-Q wave MI
  - Partial-thickness muscle wall necrosis
  - Often associated with smaller, less complete occlusions.
    - i.e. Subendocardial- necrosis of the inner 1/3 to 1/2 of the muscle wall.

Types of Myocardial Infarctions

According to anatomical location

- Left Ventricle (**Anterior Wall)**

  Left Anterior Descending (LAD) occlusion

  Associated with left ventricular failure.

  - **Inferior Wall**

    Right Coronary Artery (RCA) occlusion

    Associated with dysrhythmias & conduction disturbances

  - **Posterior Wall**

    RCA or Circumflex Artery

- Right Ventricle
  - Portion of the RCA; Rare

Different Types of Acute MI and associated ECG changes

I Lateral	aVR None	V_1 Septal	V_4 Anterior
II Inferior	aVL Lateral	V_2 Septal	V_5 Lateral
III Inferior	aVF Inferior	V_3 Anterior	V_6 Lateral

Complications: Post-Acute MI

- Dysrhythmias (Most Common)
  - Sinus Bradycardia
    - Occurs in about 40% of clients after an acute MI
  - Sinus Tachycardia
    - Must be corrected !!
  - Atrial
    - PAC's or Atrial fibrillation common
  - Ventricular
    - PVC's and ventricular tachycardia (VT)
  - AV Heart Blocks
    - Most common with inferior wall MI

- Ventricular Aneurysm
  - Non-contractile, thin ventricular wall = ↓ SV
    - Leads to acute heart failure, emboli and VT
- Ventricular Septal Defect
  - Rupture of septum; shunting of blood
    - S/Sx: Severe CP, syncope, ↓BP & murmur
    - Medical emergency; high mortality; surgery to correct
- Pericarditis
  - An inflammation of the pericardial sac