Ischemic Heart Diseases

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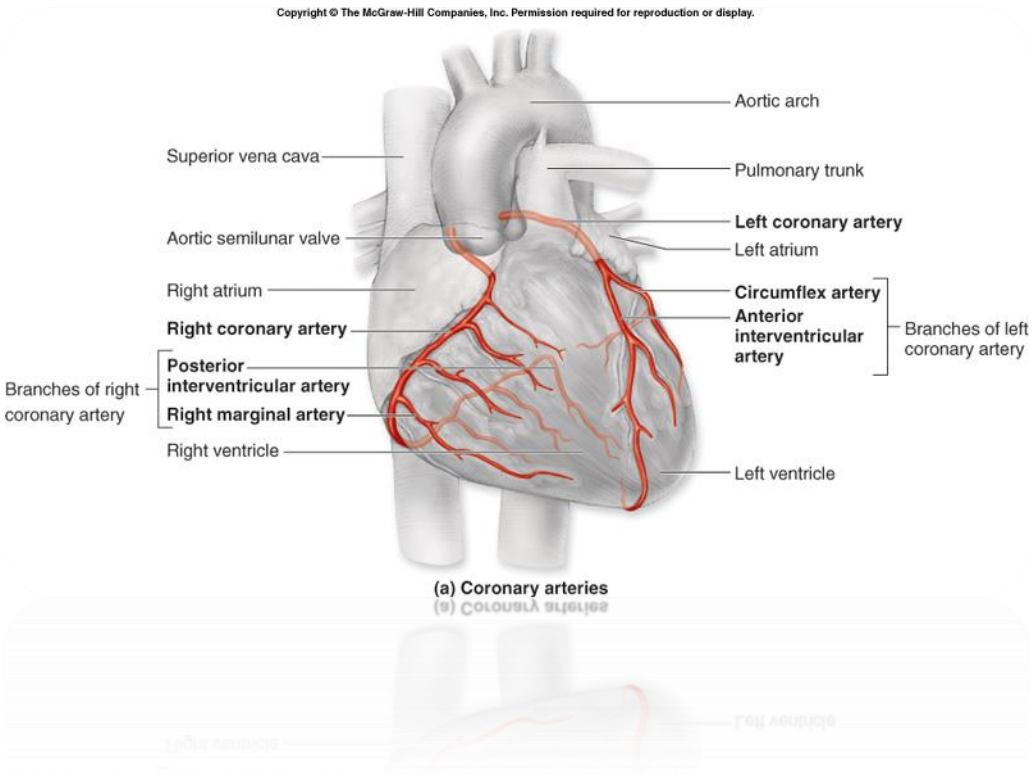
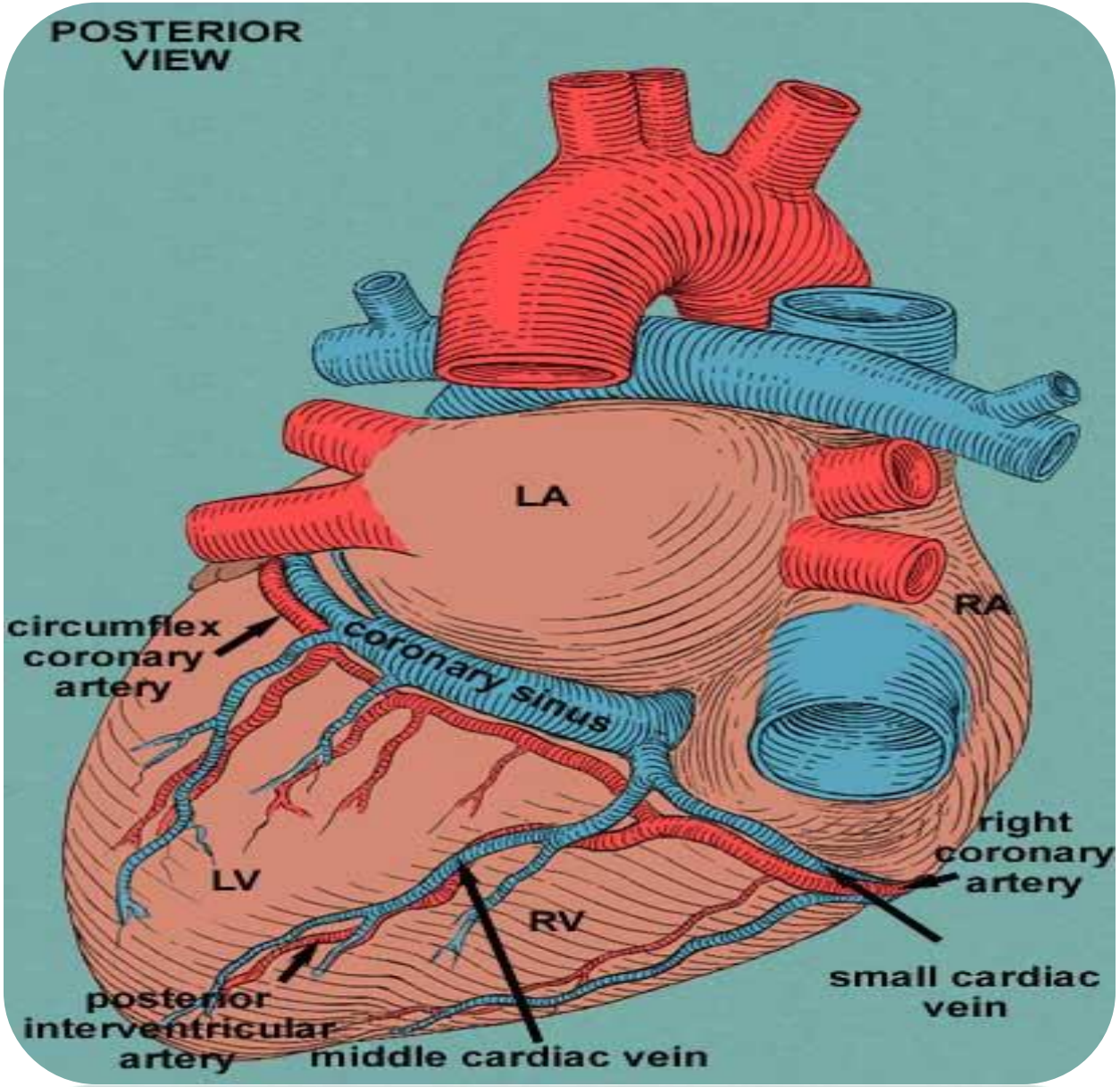
Anatomic considerations

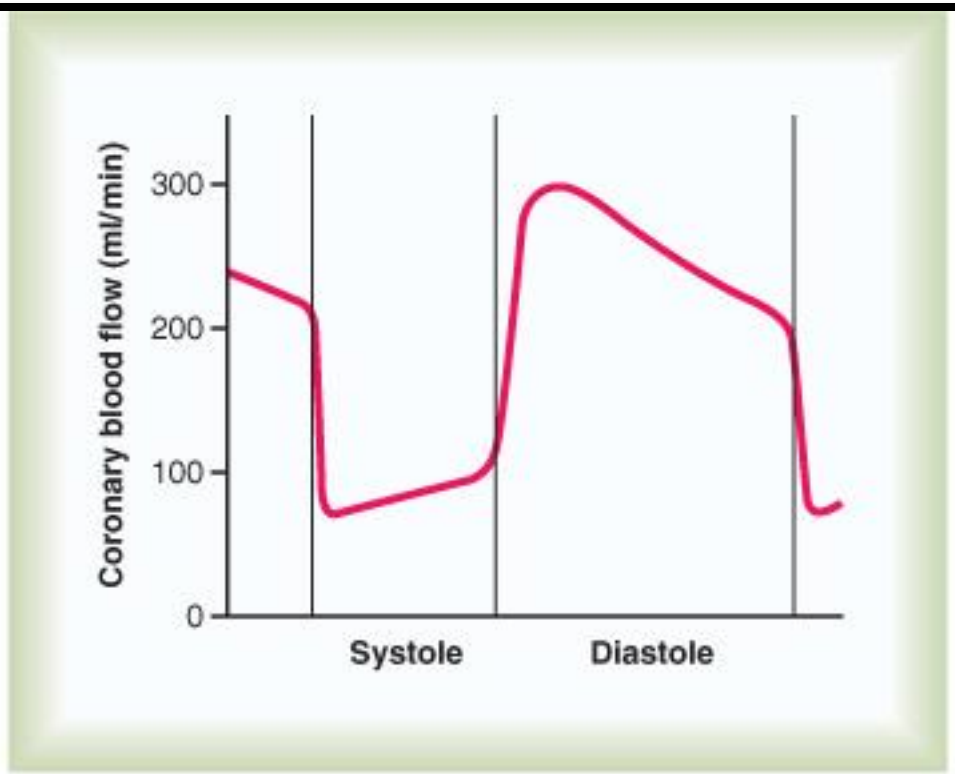



POSTERIOR
VIEW
LA
RA
circumflex
coronary
artery
coronary sinus
LV
RV
right
coronary
artery
small cardiac
vein
posterior
interventricular
artery
middle cardiac vein

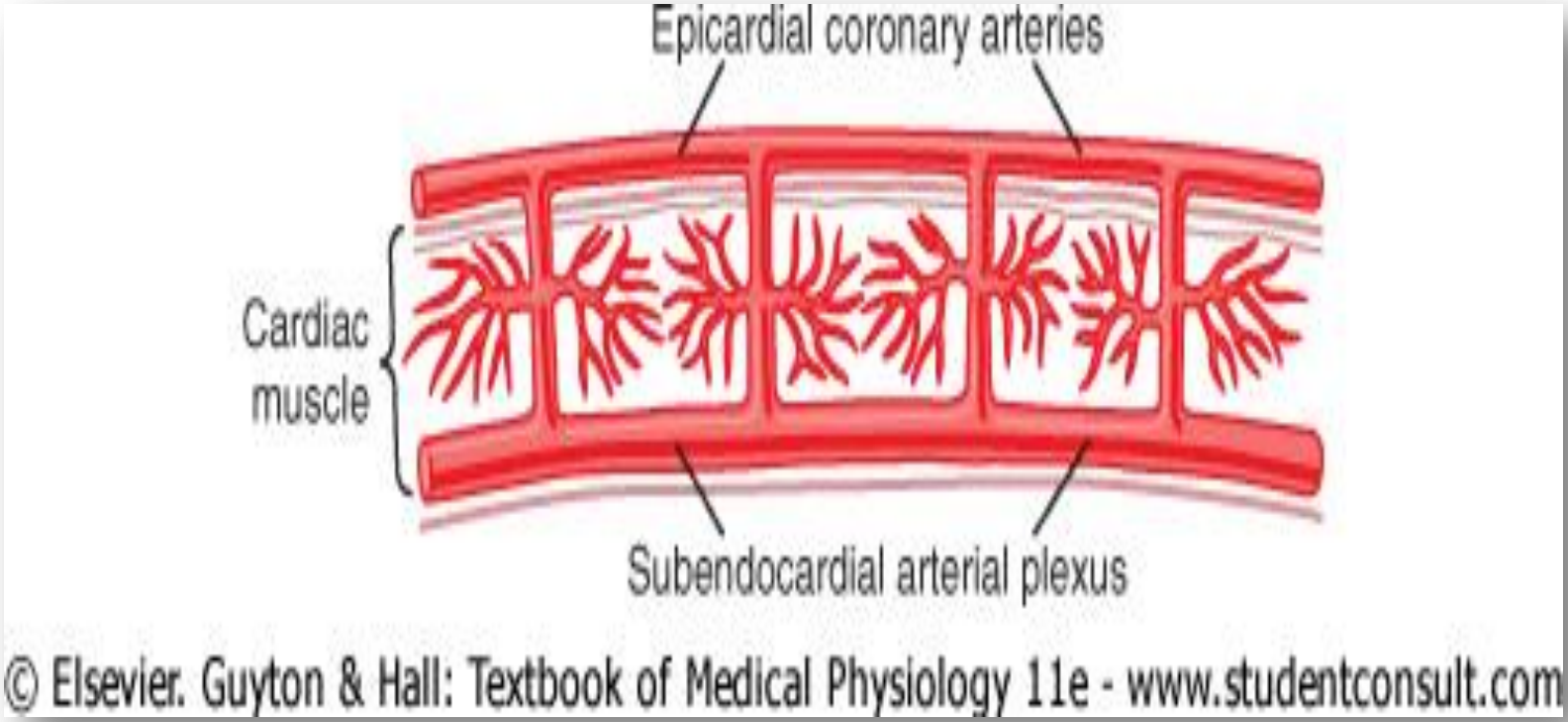
Normal coronary blood flow

- The resting coronary blood flow= 225 ml/min
- In strenuous exercise = increase three to four folds.

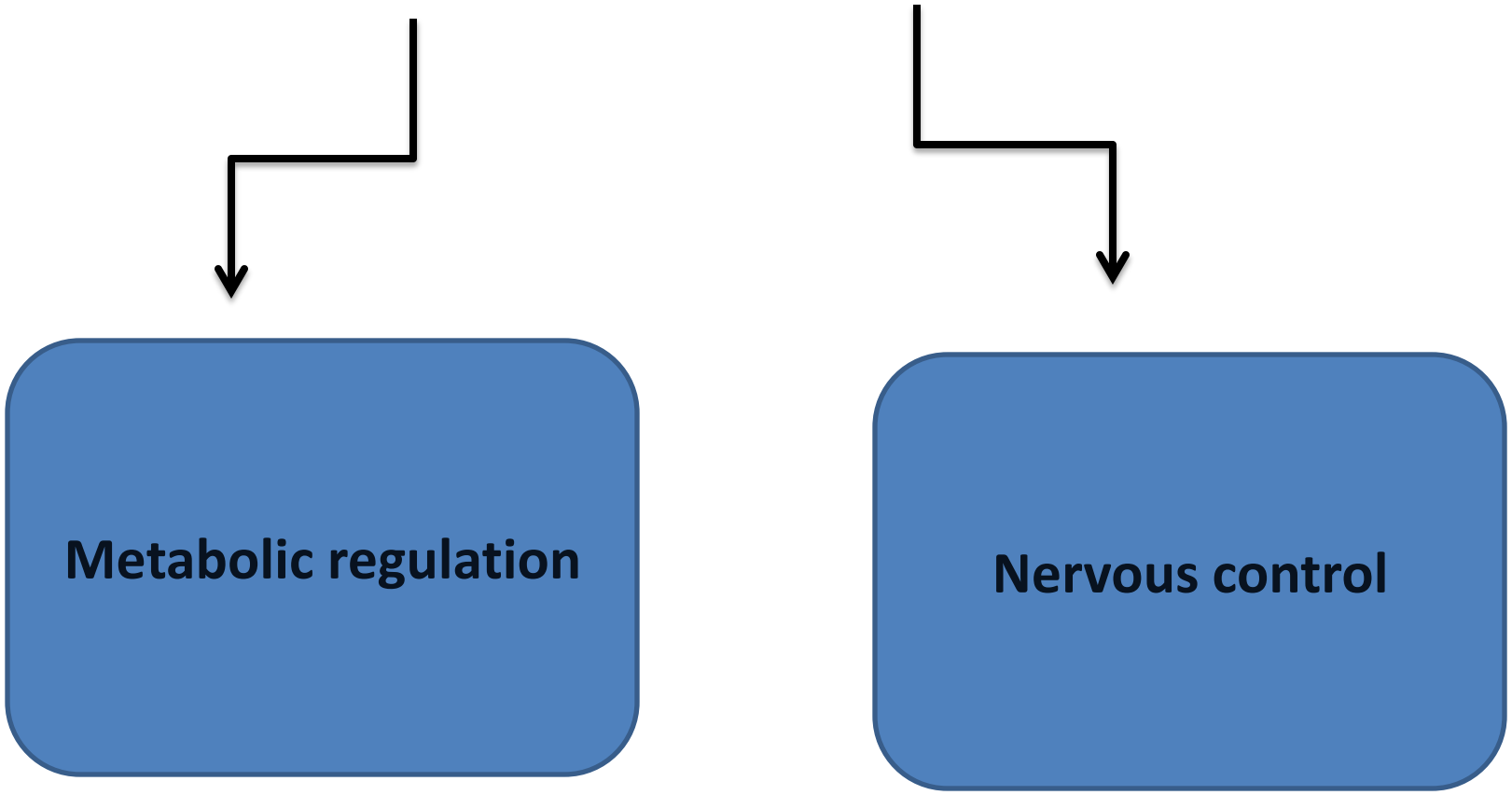
Phasic changes in coronary blood flow



Epicardial Vs. subendocardial blood flow



Control of coronary blood flow



Metabolic regulation

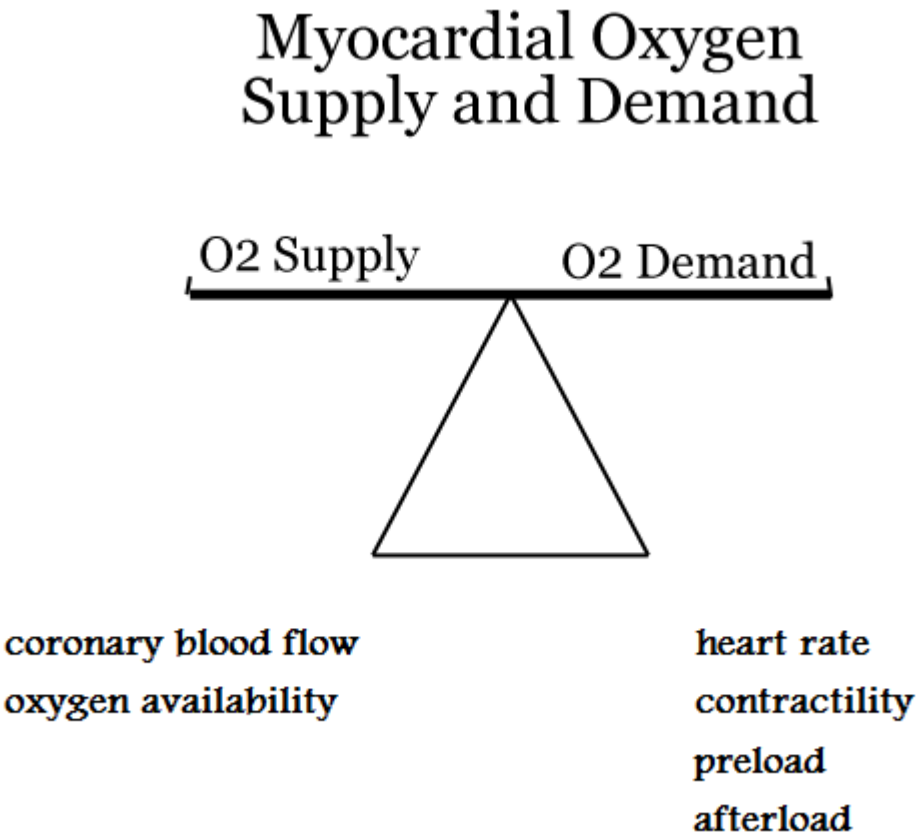
- Blood flow through coronary system is regulated almost entirely by local arterial vasodilatation in response to cardiac muscle need for nutrients.

Increase in rate of coronary blood flow

Ischemia:

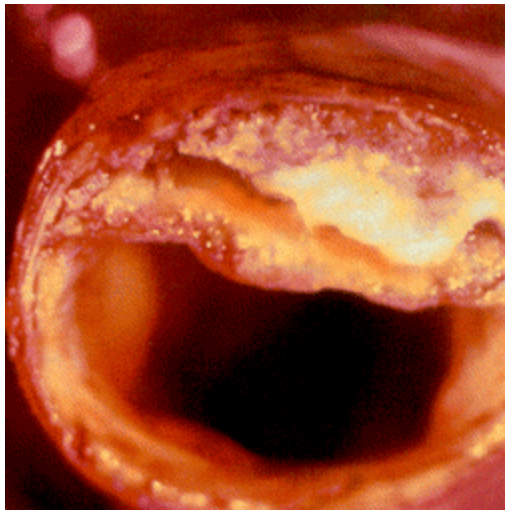
- Lack of oxygen due to inadequate perfusion of the myocardium, which causes imbalance between oxygen supply and demand.

Etiology of ischemic heart disease



Coronary atherosclerosis

- **The most common cause of myocardial ischemia.**
- **Epicardial coronary arteries are the major site.**



- **Major risk factors:**
  - **Increase in LDL.**
  - **Decrease in HDL.**
  - **Cigarette smoking.**
  - **Hypertension.**
  - **DM.**
  - **Obesity**

Normal function of vascular endothelium

- Local control of vascular tone.
- Maintenance of an anticoagulant surface.
- Defense against inflammatory cells.

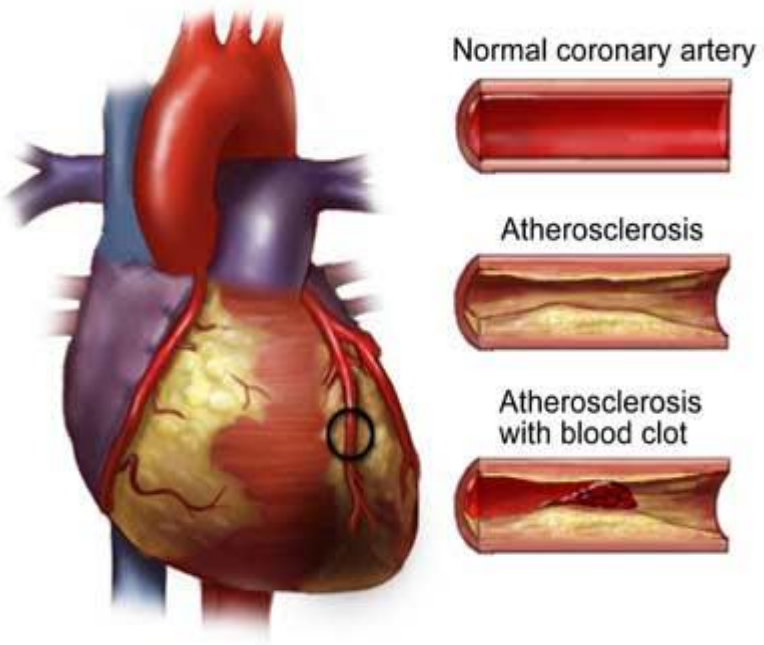
Loss of these defenses

- Inappropriate constriction.
- Luminal clot formation.
- Abnormal interactions with blood monocytes & platelets.

Acute coronary occlusion

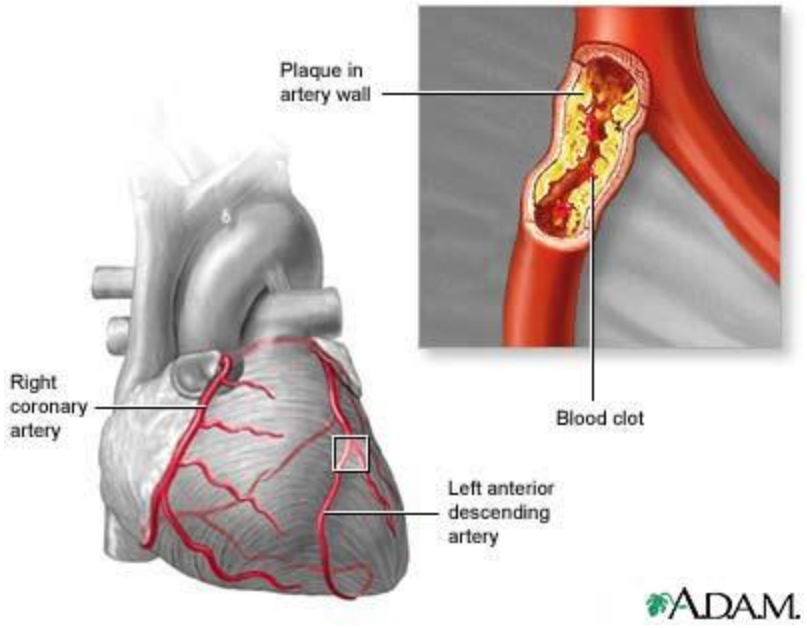
- Thrombosis.
- Embolism.

- Local spasm:
  - Direct irritation of the smooth muscle.
  - Nervous reflexes.



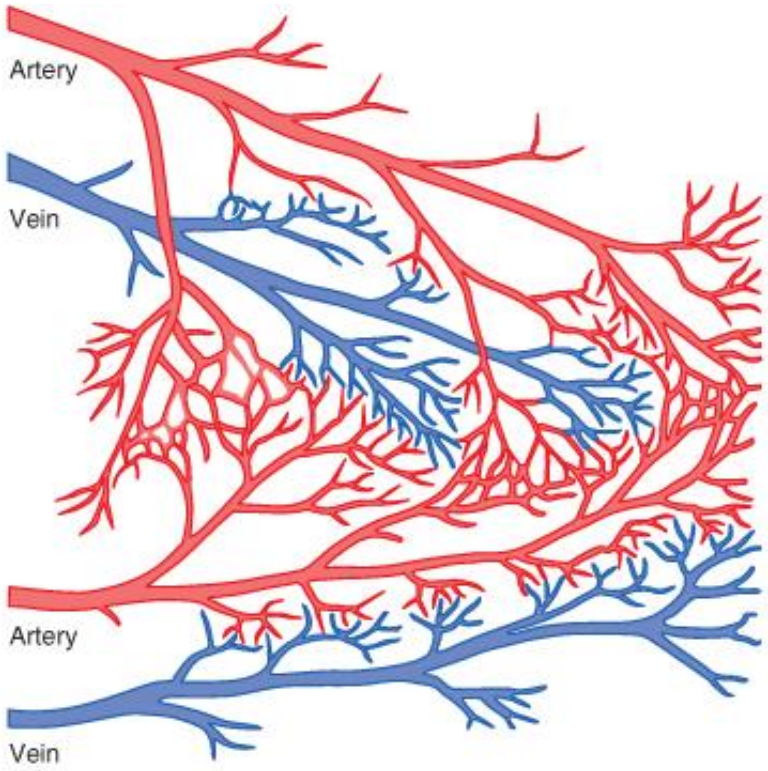
Location of the obstruction

- Influence the quantity of myocardial ischemia.
- Determines the severity of the clinical manifestations.



Collateral circulation

- With sudden occlusion.
- With gradual developing atherosclerosis.



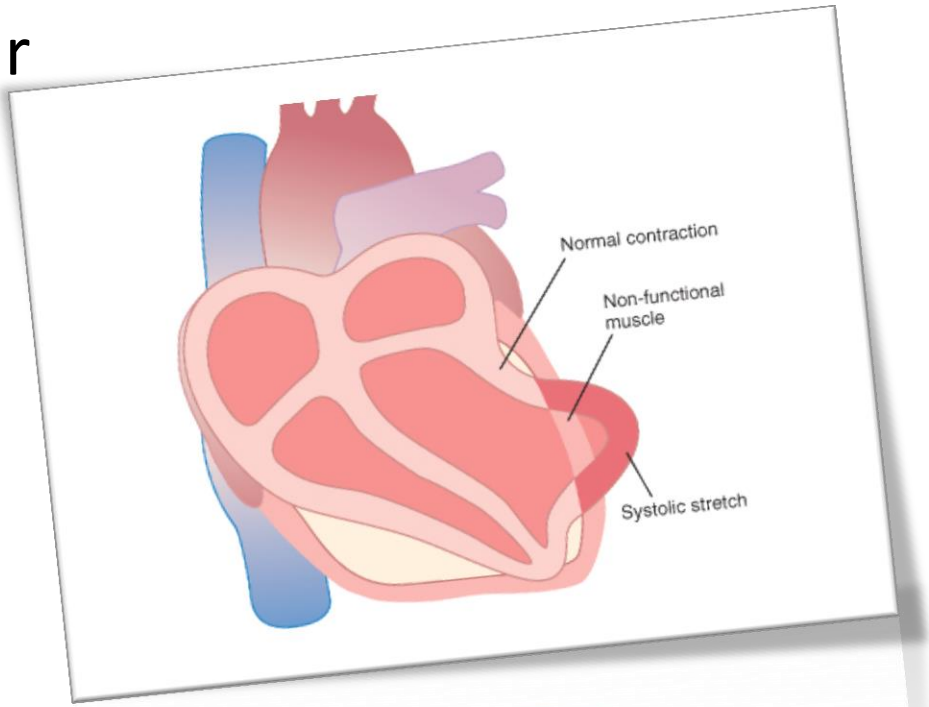
Effects of ischemia

- Disturbances of myocardial functions:
  - Mechanical function.
  - Biochemical function.
  - Cell membrane function.
  - Electrical function.

Effect of ischemia

1)Mechanical function:

- Failure of normal muscle contraction & relaxation.
- Ischemia of large portions of ventricle : left ventricular failure.
- Regional disturbances:
  - Systolic stretch.



Effect of ischemia

2) Biochemical function:

- Fatty acid can’t be oxidized.
- Glucose is broken down to lactate.
- Reduced intracellular PH and ATP stores.

Effect of ischemia

3) Cell membrane function:

- Leakage of potassium and uptake of sodium by myocytes.

4) Electrical function:

- ECG changes:
  - Repolarization abnormalities.
  - Transient ST segment depression.

- Electrical instability:
  - Ventricular tachycardia and fibrillation.

Ischemic heart disease

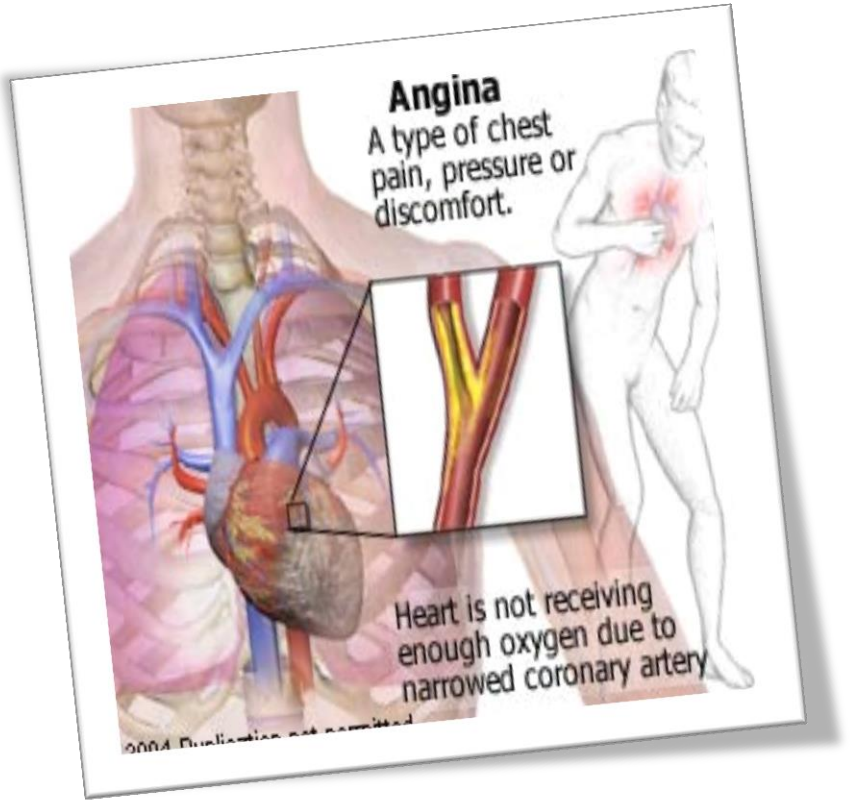
Stable angina
(chronic artery disease)

Acute coronary syndrome:
- Unstable angina.
- Acute MI.

Stable angina…

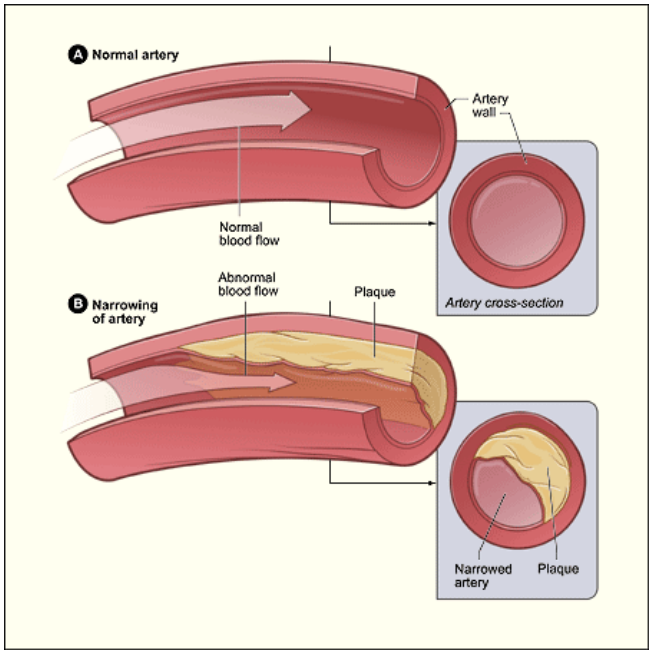
- An effort-related chest discomfort.

- ***Characteristics:***
  - Heaviness.
  - Pressure.
  - Squeezing.
  - Smothering.
  - Choking pain.



Stable angina…

- ***Causes:***
  - CAD.
  - Other heart diseases:
    - Aortic valve disease.
    - Hypertrophic cardiomyopathy.



Stable angina…

- ***History:***
  - A man > 50 years.
  - A woman > 60 years.
  - Pain with physical & emotional exertion.
  - Last to 5-10 min.

Stable angina…

- Radiating pain to the left shoulder, both arms, back, interscapular region, root of the neck, jaw and teeth.

Stable angina…

- ***physical examination:***
  - Atherosclerotic disease at other sites.
  - Important risk factors:
    - Hyperlipidemia
    - DM.
  - Left ventricular dysfunction.
  - Conditions that may exacerbate angina:
    - Anemia.
    - Thyroid disease.

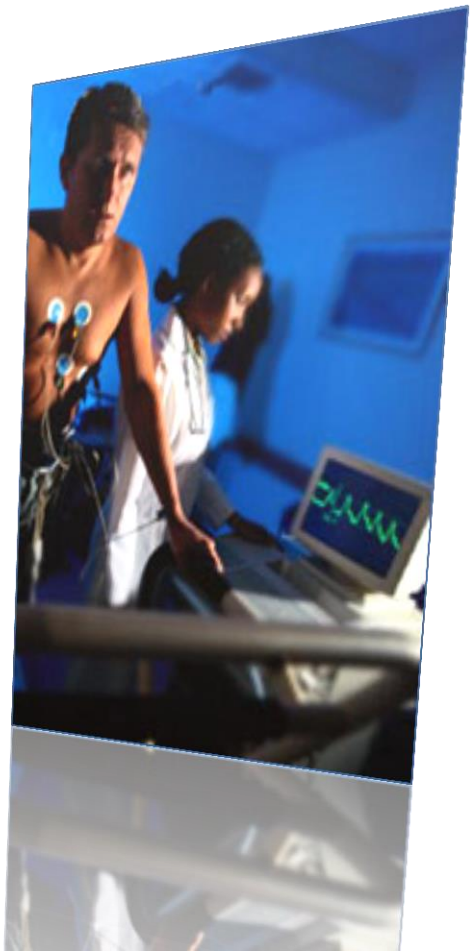
Stable angina…

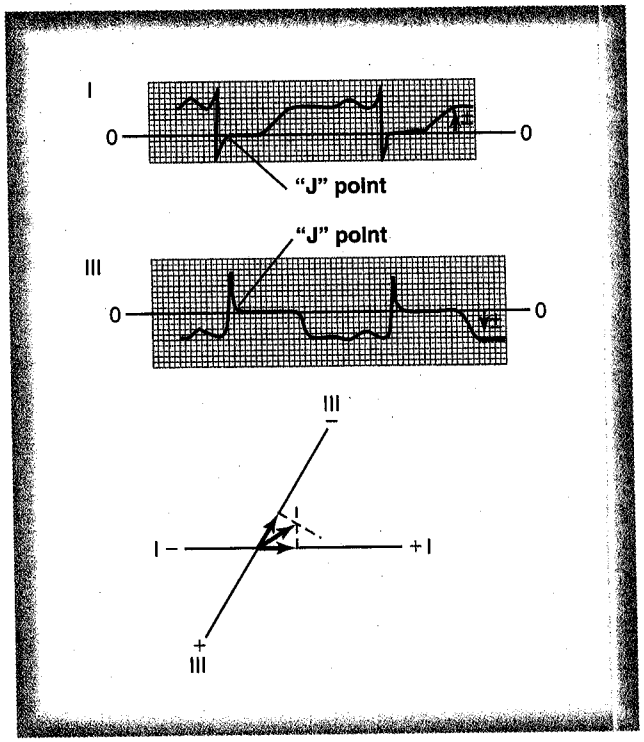
- ***Laboratory examination:***
  - Urine analysis (DM and renal disease).
  - Full blood count.
  - Measurements of:
    - lipids,.
    - Glucose.
    - Createnine.
    - Hematocrite.
    - Thyroid function test.

Stable angina…

- ***Other investigations:***

  - ***Resting ECG:*** most important baseline investigation.
  - ***Stress testing***.

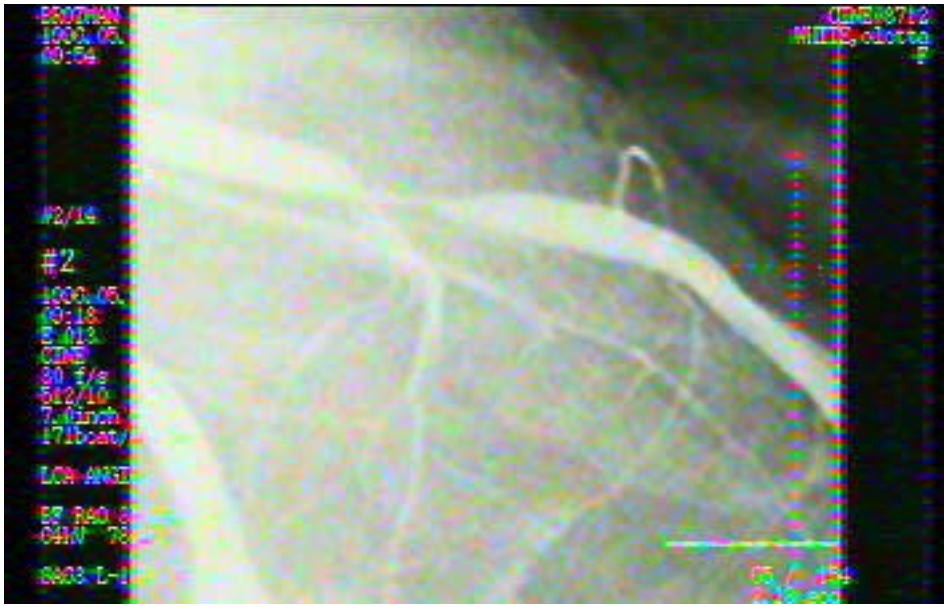




J point as the zero reference potential of the electrocardiograms for leads I and II. Also, the method for plotting the axis of the injury potential is shown by the lowermost panel.

Stable angina…

- ***Other investigations:***
  - Coronary arteriography.



Stable angina…

- ***Management:***
  - A careful assessment.
  - Identification and control of aggravating conditions.
  - Identifications of high risk pts.
  - Application of treatment to improve life expectancy.

Stable angina…

- ***Drug therapy:***
  - nitrates.
  - β-adrenergic blockers.
  - Calcium antagonist.
  - Antiplatelet drugs.

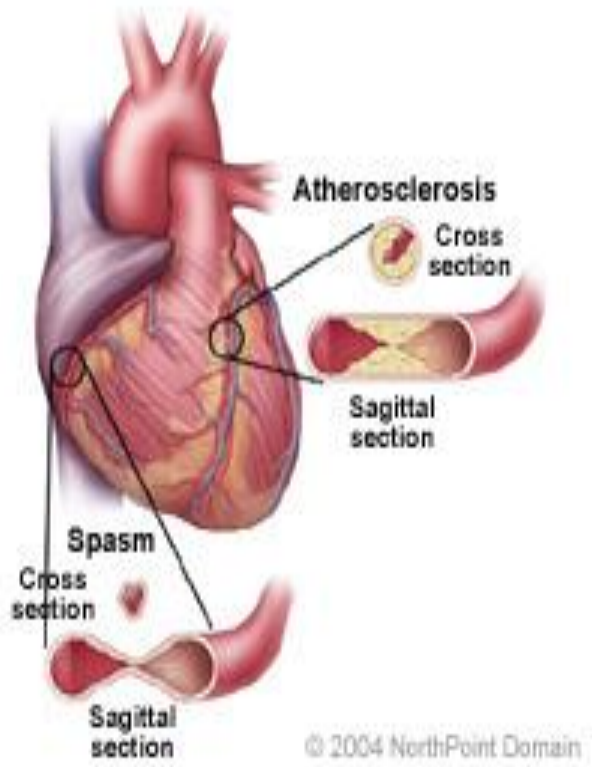
Unstable angina…

- Angina pectoris that is rapidly worsening.

- ***Characteristics:***
  - Occurs at rest, usually lasting >10 min.
  - Sever and of new onset.
  - Crescendo pattern.

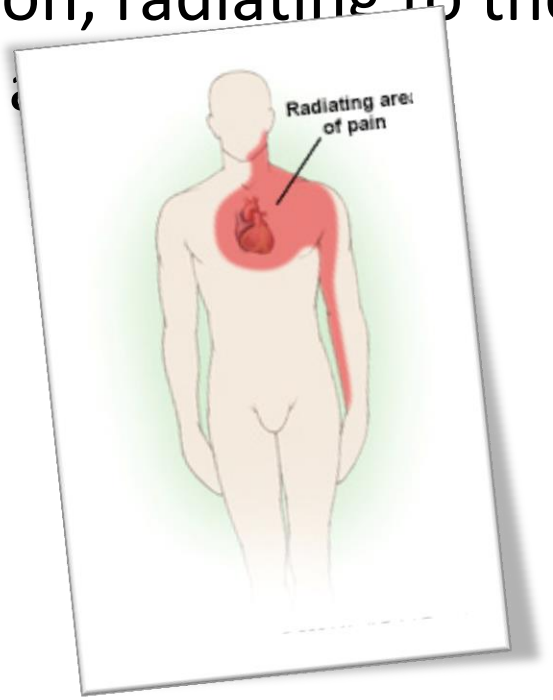
Unstable angina…

- ***Causes:***
  - Shares common pathophysiological mechanisms with acute MI.
  - Plaque rapture or erosion.
  - Dynamic obstruction (coronary spasm).
  - Rapidly advancing coronary atherosclerosis.



Unstable angina…

- ***History:***
  - History of chronic stable angina.
  - May present as new phenomena.
  - Chest pain (substernal region, radiating to the neck, left shoulder and left a



Unstable angina…

- ***Physical examination:***
  - Diaphoresis.
  - Pale cool skin.
  - Sinus tachycardia.
  - 3^{rd} or 4^{th} heart sound.
- ***Biochemical markers:***
  - Troponin I & T.
  - CK.

Unstable angina…

- ***ECG changes:***
  - 12 lead ECG is mandatory.
  - ST elevation or depression.

Unstable angina…

- ***Management:***
  - Urgent admission to hospital.
  - Bed rest.
  - Antiplatelet.
  - β-blockers (atenolol).
  - IV or buccal nitrates.
  - Revascularization.

Stable angina

- Fixed stenosis.
- Demand-led ischemia.
- Predictable.

  - Exercise tolerance test.

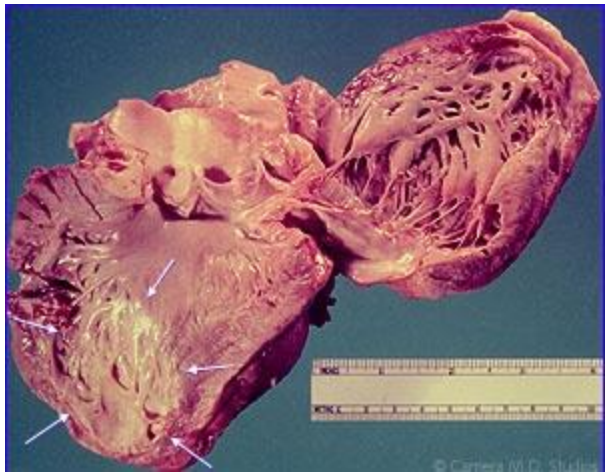
Unstable angina

- Dynamic stenosis.
- Supply-led ischemia.
- Unpredictable.

  - Clinical features.
  - ECG changes.
  - Biochemical markers.

Myocardial infarction

- Occurs when there are zero flow or so little flow that it can’t sustain cardiac muscle function.
- Occlusive thrombus in a coronary artery.



Myocardial infarction

- ***Clinical features:***
  - Pain (sever, last longer).
  - Breathlessness.
  - Vomiting.
  - Collapse.
  - Syncope.

Myocardial infarction

- ***Investigations:***
  - ECG:
    - Partial thickness infarction→ST/T wave changes.
    - Transmural infarction→ST elevation and Q waves.
- ***Biochemical markers.***
- ***Chest radiography.***
- ***Cardiac US.***

Myocardial infarction

- ***Management:***
  - Immediate access to hospital.
  - High-flow oxygen.
  - ECG monitoring.
  - I.V analgesia and antiemetic.
  - Detect and manage acute complications:
    - Arrhythmia.
    - Ischemia.
    - Heart failure.

Myocardial infarction

- ***Complications of infarction:***
  - Arrhythmia.
  - Ischemia.
  - Acute circulatory failure.
  - Pericarditis.
  - Embolism.

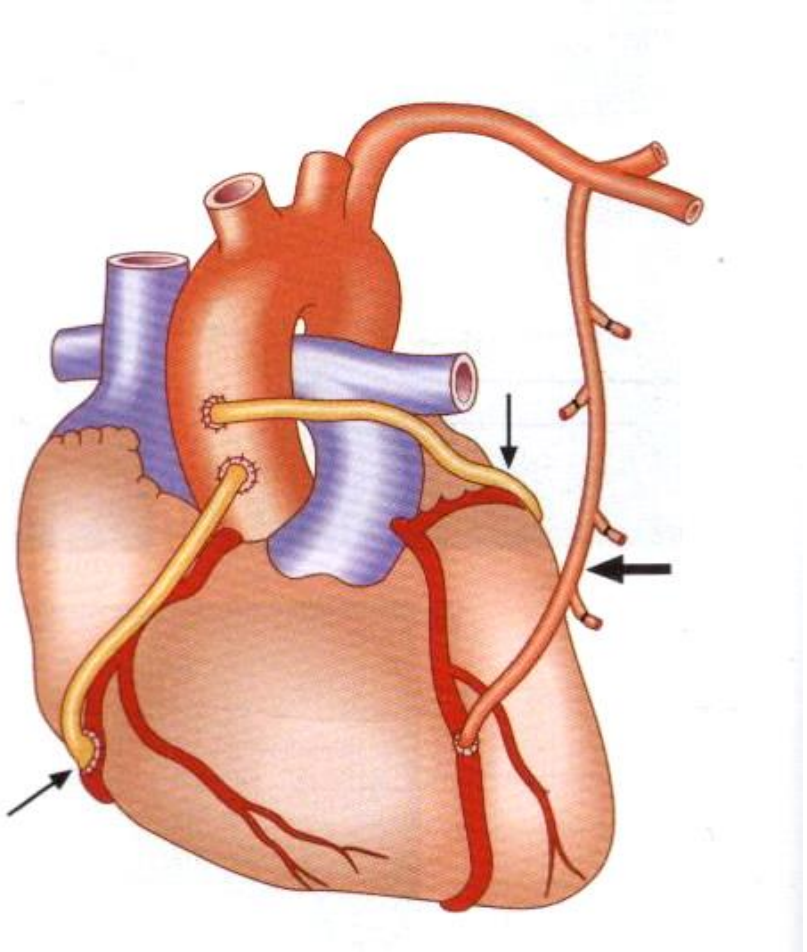
Myocardial infarction

- ***Causes of death in MI:***
  - Decreased CO.
  - Damming of blood in the pulmonary or systemic veins.
  - Fibrillation.
  - Rupture of the heart.

Surgical treatment of coronary disease

- Aortic-coronary bypass surgery.
- Coronary angioplasty.

Aortic coronary bypass surgery



Coronary angioplasty