CORONARY ARTERY DISEASE ATHEROSCLEROSIS

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LEARNING OBJECTIVES

- To Describe the risk factors, and lab. Diagnosis of CAD
- To Define and Enlist the stages of atherosclerosis

CORONARY ARTERY DISEASE

- Coronary artery disease is the narrowing or blockage of the coronary arteries, usually caused by atherosclerosis.

ATHEROSCLEROSIS

- A process of progressive thickening and hardening of the walls of medium and large size arteries as a result of fat deposits on their inner lining.
- It underlies the pathogenesis of coronary, cerebral, and peripheral vascular disease, and causes more morbidity and mortality.

Table 11-2 Major Risk Factors for Atherosclerosis

Nonmodifiable (Constitutional)
Genetic abnormalities
Family history
Increasing age
Male gender
Modifiable
Hyperlipidemia
Hypertension
Cigarette smoking
Diabetes
Inflammation

NON MODIFIABLE

Age (men ≥45 yrs, women ≥ 55 yrs)

- between ages 40 and 60, the incidence of myocardial infarction in men increases fivefold
- Death rates from IHD rise with each decade even into advanced age

Male gender.

- Men are at grater risk than premenopausal women, because of the protective effects of endogenous estrogen

Genetics

- The familial predisposition to atherosclerosis and IHD is multifactorial
- In some instances it relates to familial clustering of other risk factors, such as hypertension or diabetes
- In others it involves well-defined genetic derangements in lipoprotein metabolism, such as familial hypercholesterolemia that result in excessively high blood lipid levels

MODIFIABLE RISK FACTORS

HYPERLIPIDEMIA

-high plasma cholesterol associated with atheroma

-LDL most significant

-HDL protective

HYPERTENSION

- High blood pressure produces mechanical stress on the vessel endothelium.
- It is a major risk factor for atherosclerosis in all age groups and may be as important or more important than hypercholesterolemia after the age of 45 years.

CIGARETTE SMOKING

- Powerful risk factor for IHD
- Risk falls after giving up
- Mode of action uncertain
  - -coagulation system
  - -reduced PGI2
  - -increased platelet aggregation

- **HYPERTENSION**
  - -Strong link between IHD and high systolic/diastolic blood pressure
  - -Mechanism uncertain
  - -Endothelial damage caused by raised pressure
- **DIABETES MELLITUS**
  - -Diabetes elevates blood lipid levels and otherwise increases the risk of atherosclerosis
  - -Incidence of myocardial infarction is twice as high in diabetic as in Nondiabetic individuals

- ***METABOLIC SYNDROME.***

Associated with central obesity, this clinical entity is characterized by insulin resistance, hypertension, dyslipidemia (elevated triglycerides and depressed HDL), hypercoagulability, and a pro-inflammatory state, which may be triggered by cytokines released from adipocytes

LIPOPROTEIN LEVELS.

- Apolipoprotein(a) is homologous to plasminogen and tPA and it
- competes with plasminogen for its binding site, leading to reduced fibrinolysis.
- Also, because Lp(a) stimulates secretion of PAI-1, it leads to thrombogenesis.
- It also may enhance coagulation by inhibiting the function of tissue factor pathway inhibitor

- ***Elevated levels of procoagulants***
- ***Clonal hematopoiesis***

Alterations in the function of innate immune cells derived from mutated hematopoietic stem cells

- ***Lack of exercise***
- ***Stressful life***

PATHOGENESIS ATHEROSCLEROSIS

- DUE TO ETIOLOGICAL FACTORS

- INJURY TO THE ENDOTHELIAL CELL THAT LINING THE ARTERY

- INFLAMMATION AND IMMUNE REACTIONS

- ACCUMULATION OF LIPIDS IN THE INTIMA OF ARTERIAL WALL

PATHOGENESIS ATHEROSCLEROSIS

- T LYMPHOCYTES AND MONOCYTES THAT BECOMES A MACROPHAGES INFILTRATE

↓

- INGEST THE LIPIDS

↓

PROLIFERATION OF SMOOTH MUSCLE CELLS WITH IN THE VESSEL

↓

FORMATION OF FIBROUS CAP OVER DEAD FATTY CORE (ATHEROMA)

↓

PROTRUSION OF ATHEROMA IN TO THE LUMEN OF VESSEL

PATHOGENESIS ATHEROSCLEROSIS

- NARROWING AND OBSTRUCTION

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- IF CAP IS THIN THE LIPID CORE MAY GROW CAUSING IT TO RUPTURE

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- HEMORRHAGE INTO PLAQUE ALLOWING THROMBUS TO DEVOLOP

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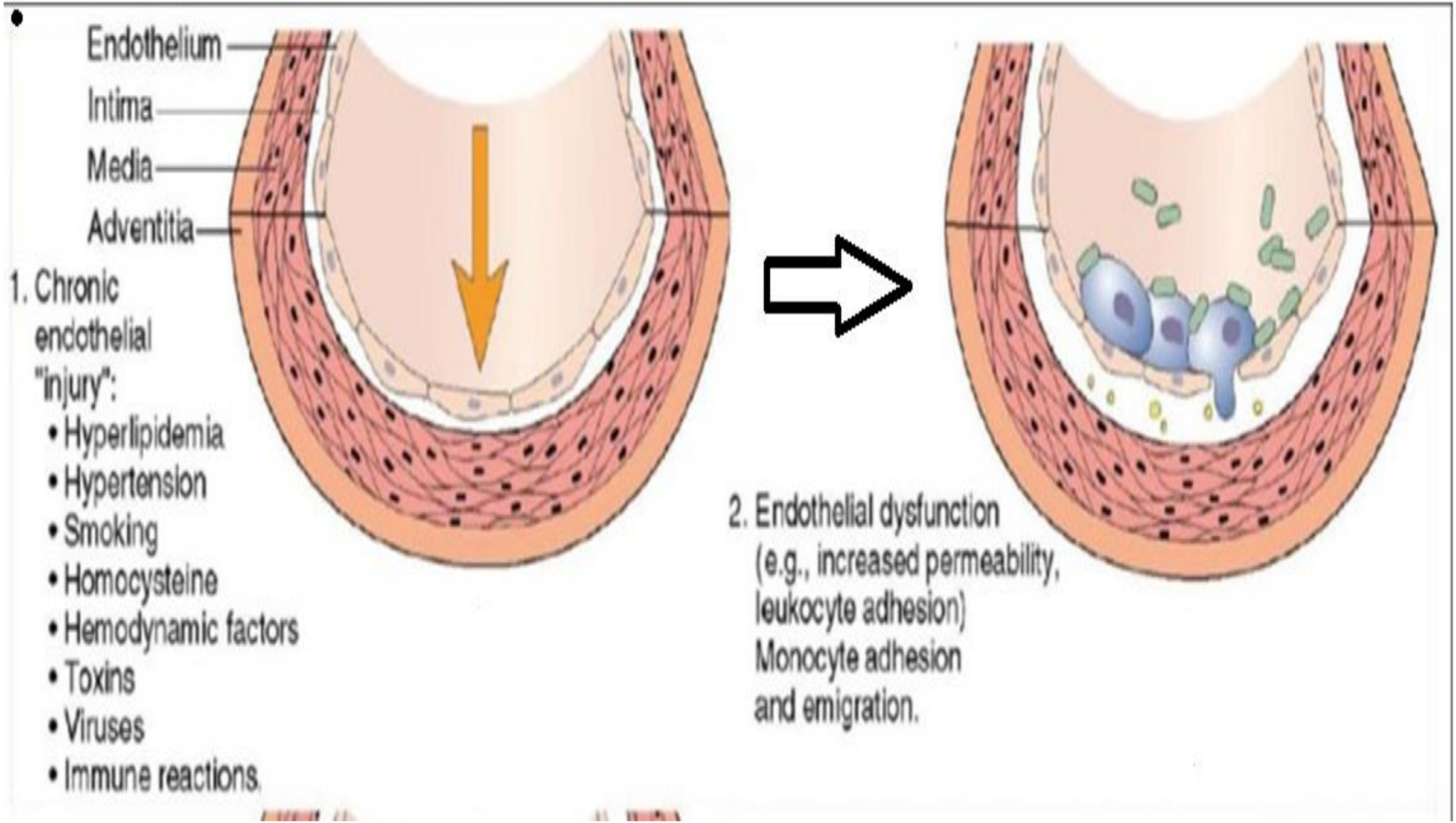
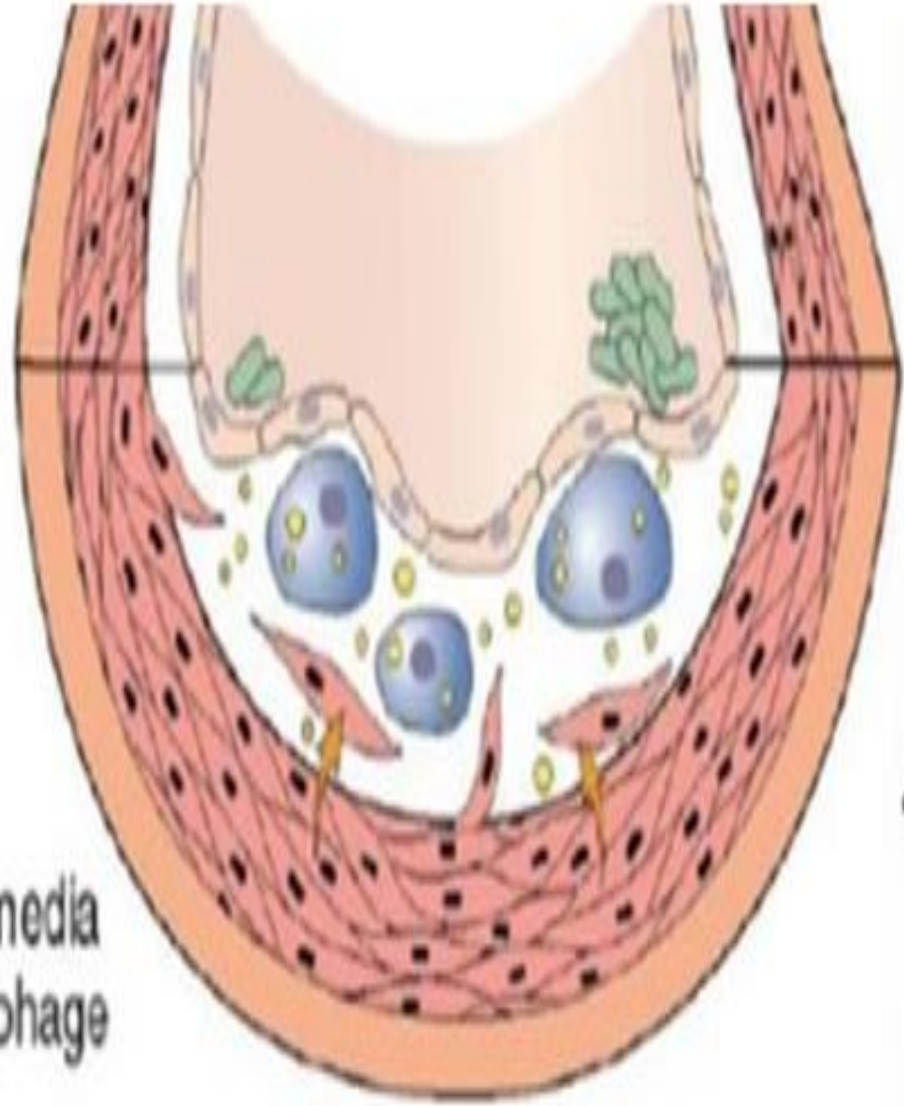
- OBSTRUCT THE BLOOD FLOW LEADING TO SUDDEN CARDIAC DEATH, MI ANGINA

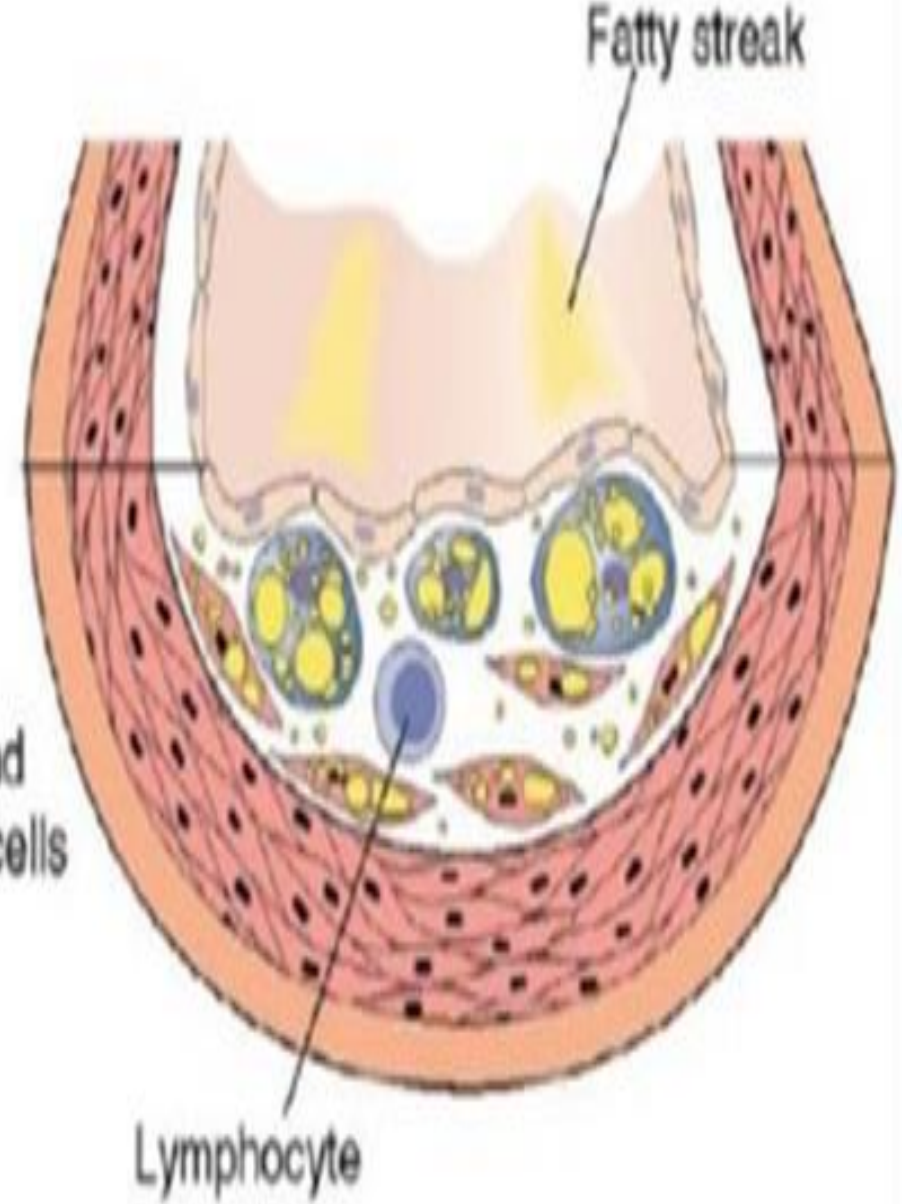
AND OTHER SYMPTOMS


Endothelium
Intima
Media
Adventitia
1. Chronic endothelial "injury":
• Hyperlipidemia
• Hypertension
• Smoking
• Homocysteine
• Hemodynamic factors
• Toxins
• Viruses
• Immune reactions
2. Endothelial dysfunction (e.g., increased permeability, leukocyte adhesion) Monocyte adhesion and emigration.

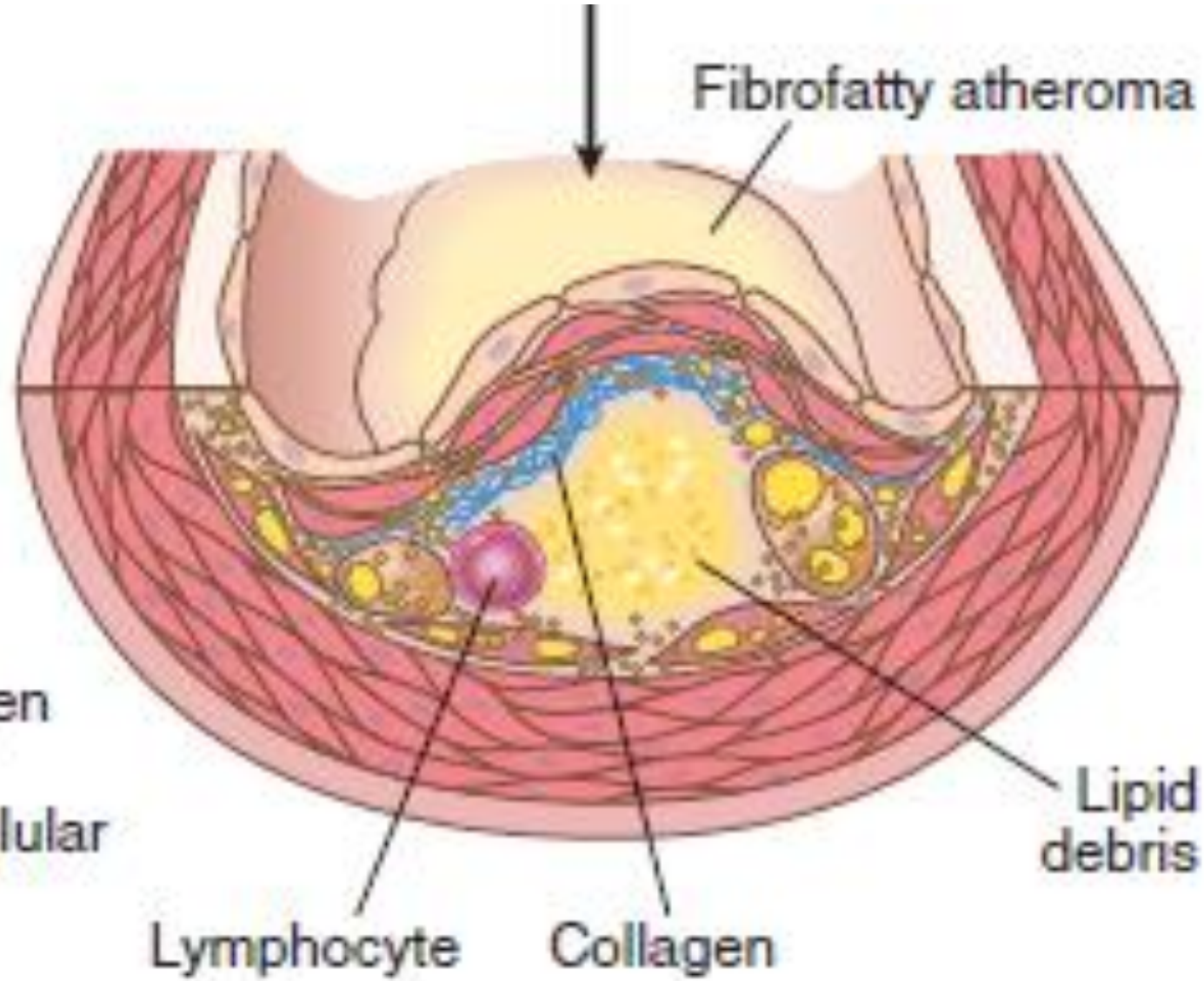


3. Smooth muscle emigration from media to intima. Macrophage activation.

4. Macrophages and smooth muscle cells engulf lipid

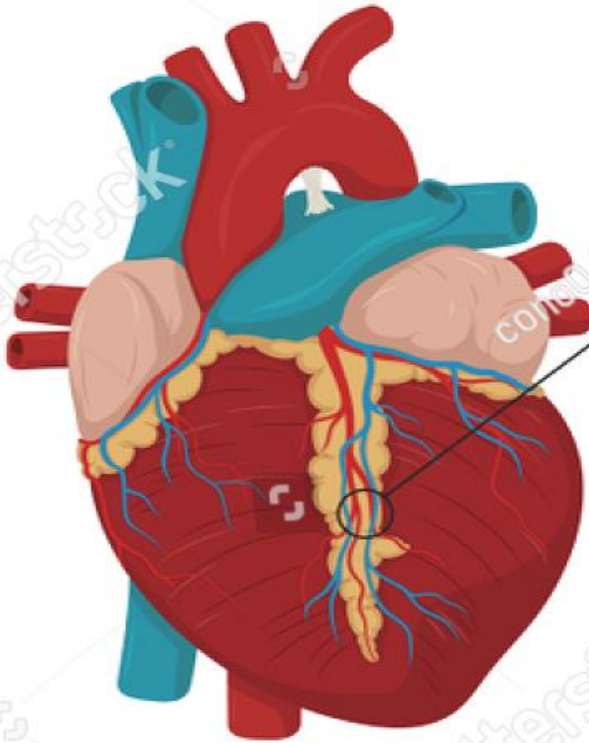


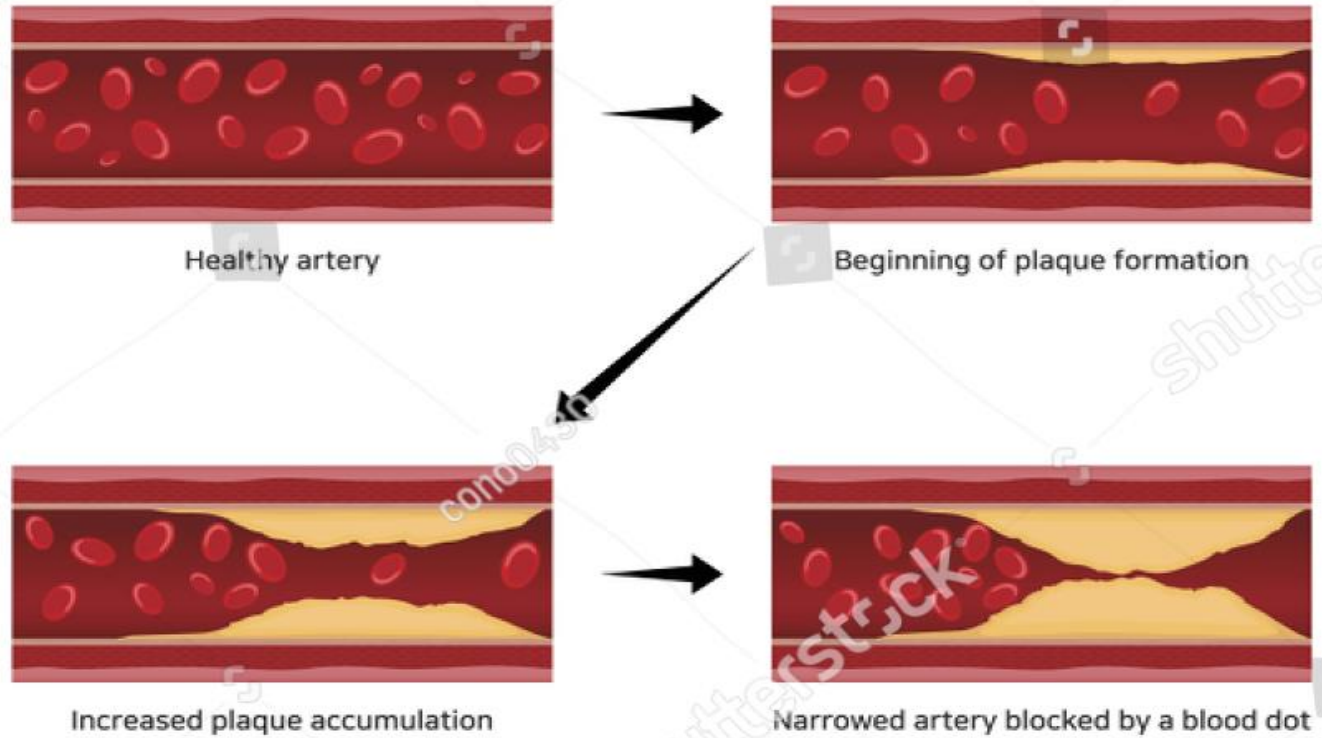
5. Smooth muscle proliferation, collagen and other ECM deposition, extracellular lipid



Atherosclerosis Stages

Plaque formation and growth.





DIAGNOSIS

DIAGNOSIS

- History collection
- Physical examination
- Cardiac enzymes
- Electrocardiograms
- Echocardiograms
- Stress Tests
- Nuclear Imaging
- Angiography

ECHOCARDIOGRAMS

- An echocardiogram is a non invasive test that uses ultrasound images of the heart.

STRESS TESTS

- They are used to show how the heart reacts to physical exertion. Exercise stress tests are usually performed on a treadmill or exercise bicycle

NUCLEAR CARDIAC IMAGING

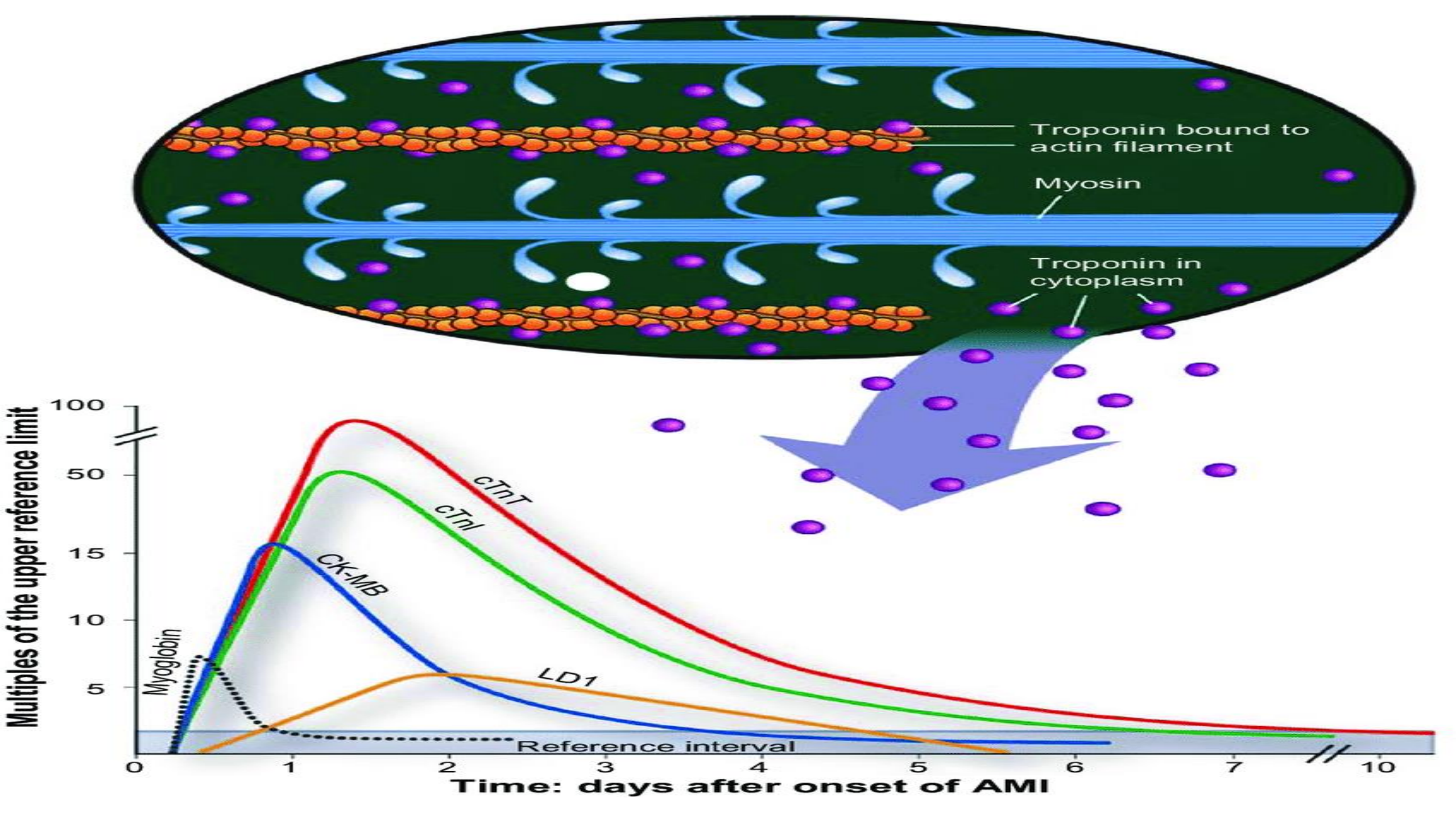
- Involves the use of small amounts of short lived radioactive material, which is injected into the bloodstream.
- A special camera (live-motion x-ray) detects the radioactivity of these materials, and the images displayed show how heart pumps blood.
- This is useful in identifying any areas of abnormal motion or for assessing the blood supply to the heart muscle

ANGIOGRAPHY

- Is the most accurate means by which to examine the coronary arteries
- It requires a surgical procedure called cardiac catheterization.
- During the procedure, catheters (small thin plastic tubes) are placed in the artery of the leg or arm, and directed using an x-ray machine to the opening of each of the coronary arteries

- **Magnetic Resonance Angiography**
- MRA is a newer non invasive imaging technique that can provide three-dimensional images of the major arteries to the heart.
- COMPUTED TOMOGRAPHY • Computed tomography (CT) scans may be used to evaluate coronary artery disease.

- Blood Enzyme Tests
- Troponin
- Creatine Kinase


Troponin bound to actin filament
Myosin
Troponin in cytoplasm
Multiples of the upper reference limit
100
50
15
10
5
cTnT
cTnI
CK-MB
Myoglobin
LD1
Reference interval
0
1
2
3
4
5
6
7
10
Time: days after onset of AMI

LIPID PROFILE,

- Total cholesterol
- Low-density lipoprotein cholesterol
- High-density lipoprotein cholesterol
- Triglycerides


Thank you!