THE UNIVERSITY OF JORDAN

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ARTERIOSCLEROSIS

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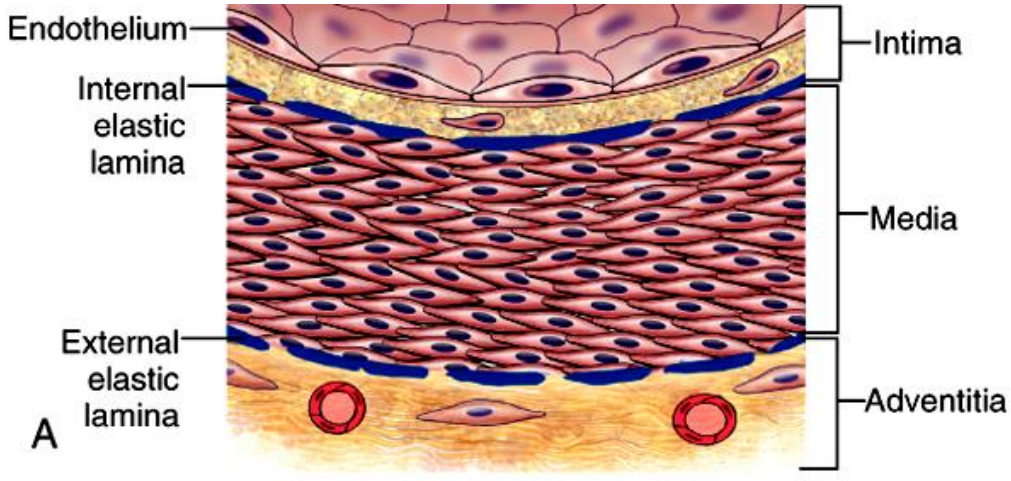
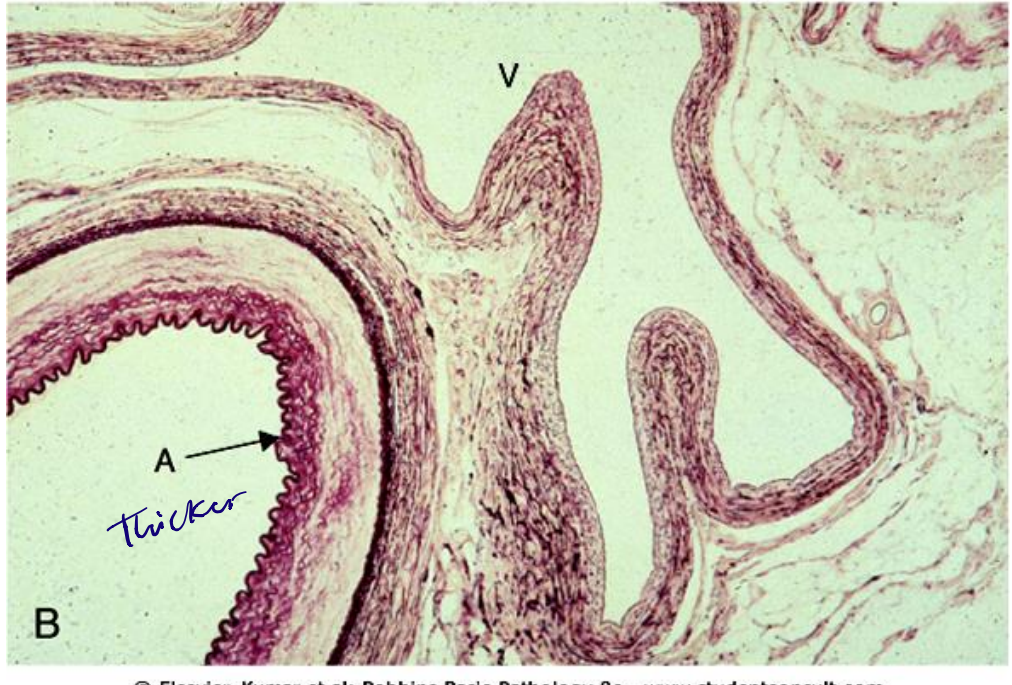
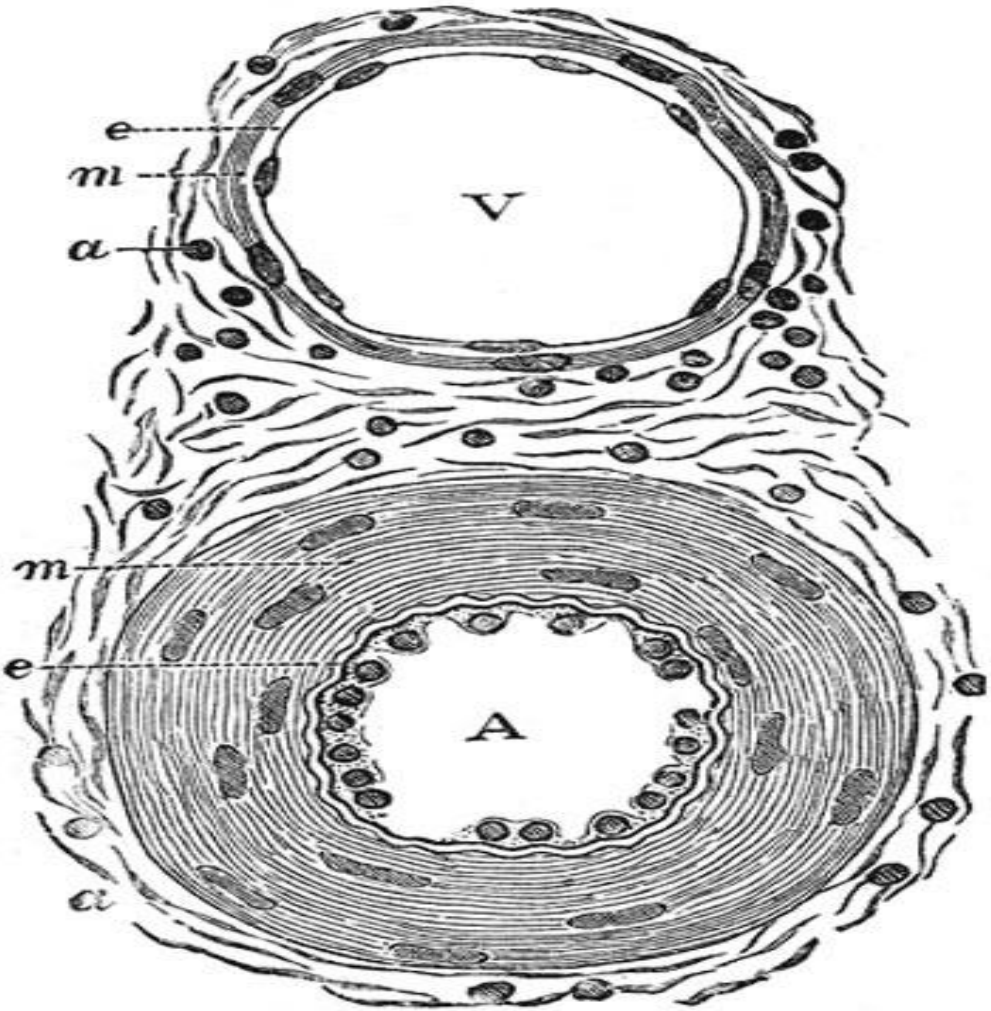
Normal
blood vessels
A= artery
V= vein





Artery (A) versus vein (V)



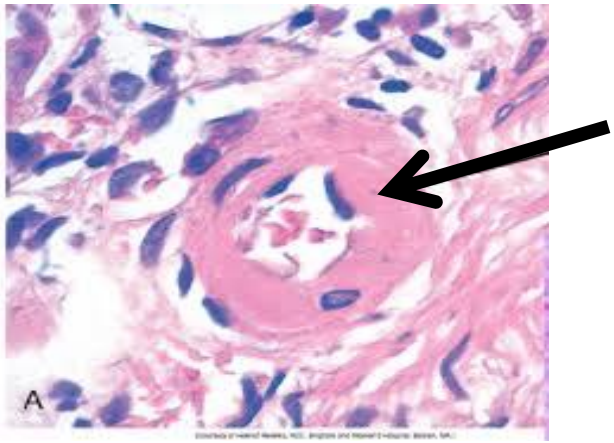
ARTERIOSCLEROSIS

- ***Arteriosclerosis*** **="hardening of the arteries"**
- **arterial wall thickening and loss of elasticity.**
- **Three patterns are recognized, with different clinical and pathologic consequences:**

we will talk about
1, 2 → very briefly
3 → concentrate.

1-Arteriolosclerosis

- affects small arteries and arterioles
- associated with hypertension and/or diabetes mellitus



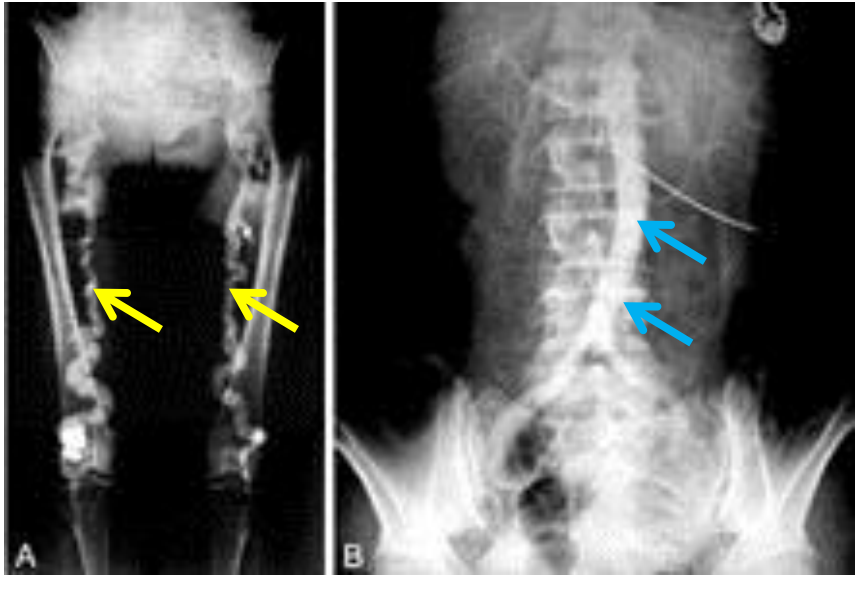
→ Media (Muscular) of Artery.

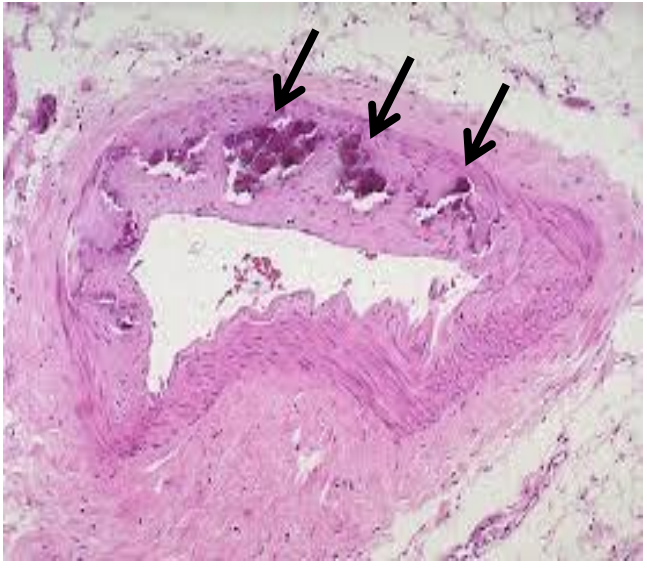
2- Mönckeberg medial calcific sclerosis

- calcific deposits in muscular arteries
- typically in persons > age 50
- radiographically visible (x-rays, etc…) → white (calcium) deposits.
- palpable vessels if Artery is subQ.
- do not encroach on vessel lumen and are usually not clinically significant No Narrowing.

2-Mönckeberg medial calcific sclerosis

H&E





* Not significant on its own, should be known to not misinterpret it as something else.

3-Atherosclerosis

تصلب الشرايين

- **Greek word="gruel" ,"hardening,"**
- Fat deposition inside intima.
- **most frequent and clinically important pattern of arteriosclerosis**
- **characterized by intimal lesions =*atheromas* (a.k.a. *atherosclerotic plaques*)**
- **atheromatous plaque = raised lesion with a core of lipid (cholesterol and cholesterol esters) covered by a firm, white fibrous cap**

Precursor

Pathogenesis

LDL → Inflammation.

- **not fully understood**
- **? inflammatory process in endothelial cells of vessel wall associated with retained low-density lipoprotein (LDL) particles→ ? a cause, an effect, or both, of underlying inflammatory process**

LDL, HDL → remember 'H' as in healthy

LDL → Low Density

HDL → High Density.

Classified in regard with their Affinity to deposit inside walls of Blood vessels.

LDL → High Affinity. (Bad)

HDL → Low Affinity. (Good)

- **initiation of inflammatory process→ LDL particles and their content are susceptible to oxidation by free radicals→ endothelial activation**

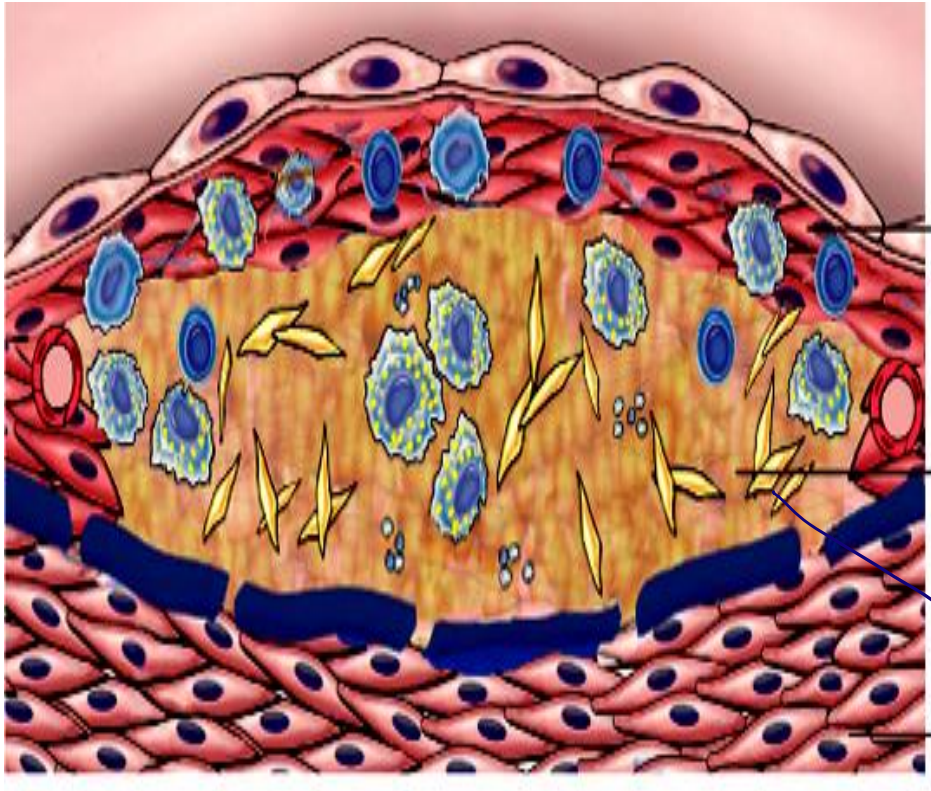
*inflammation → cascade of events in the wall of the intima causing narrowing in the Lumen of Blood Vessel.

↓

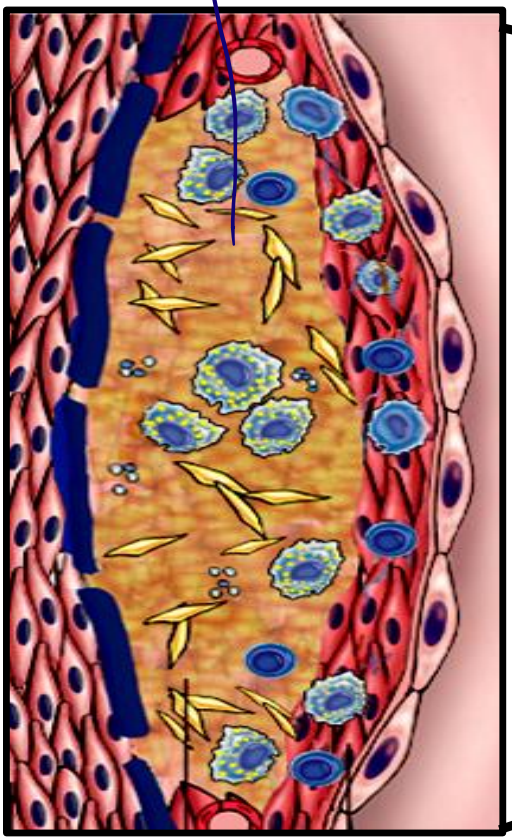
Free Radicals.

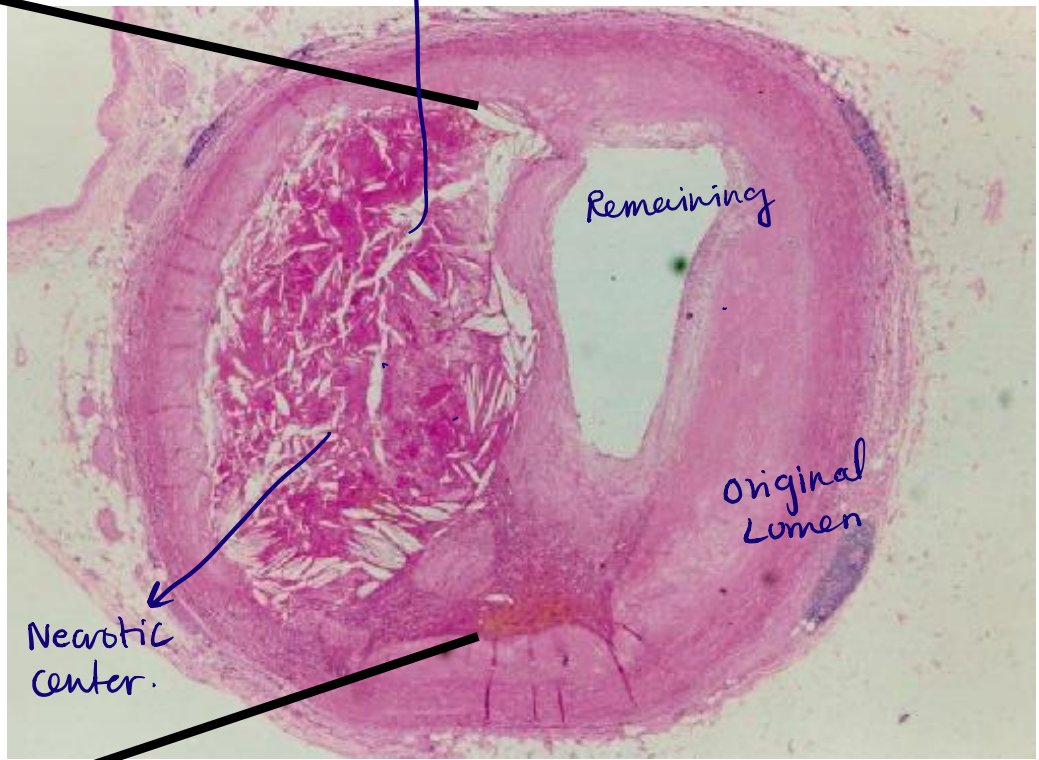
The major components of a well-developed intimal atheromatous plaque

→ Both layers give Atheroma, Precursor lesion.



Atheromatous plaque





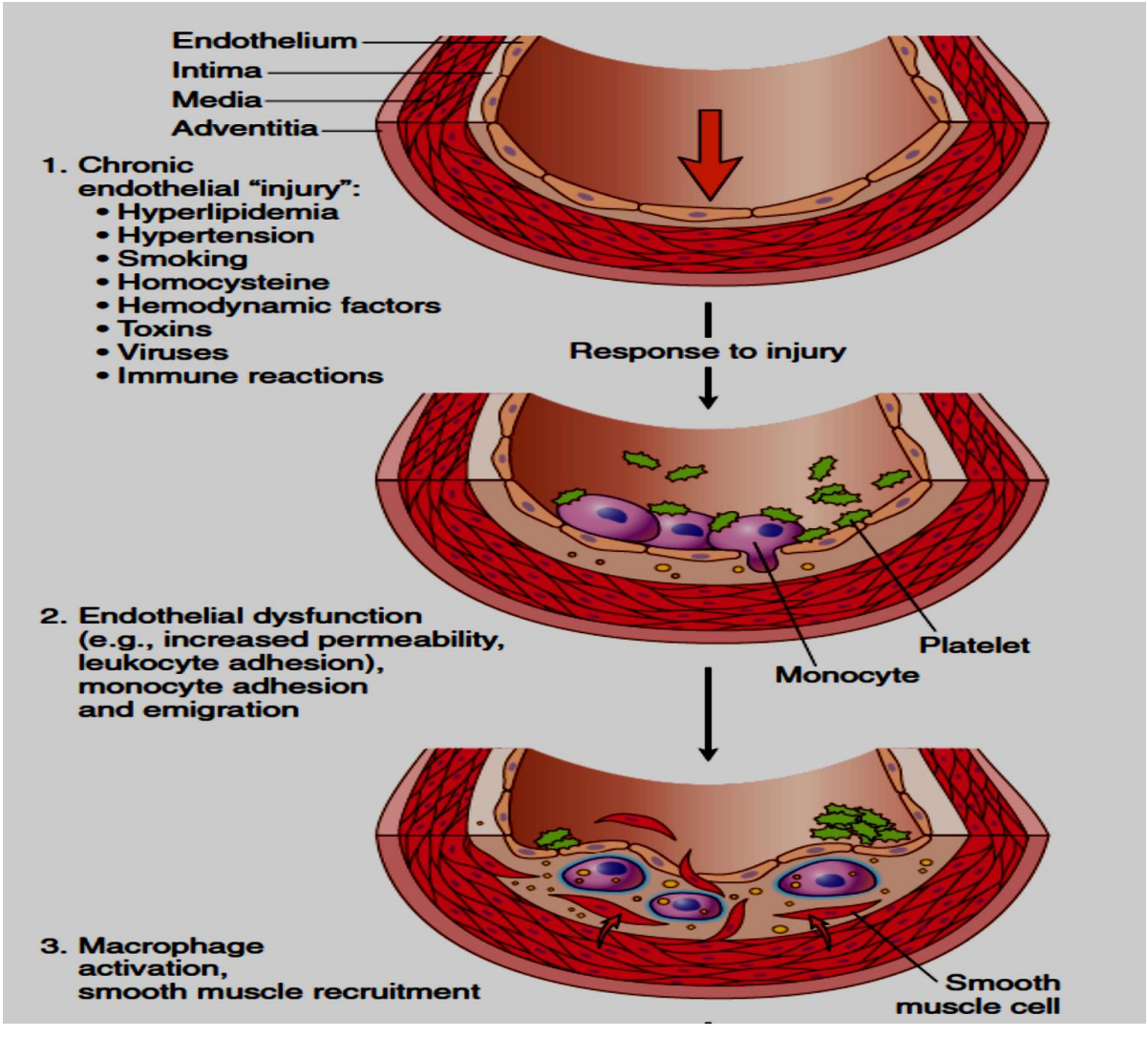
Yellow Needle shaped = White Needle shape.

*significant Narrowing
*significant Effect
downstream tissues

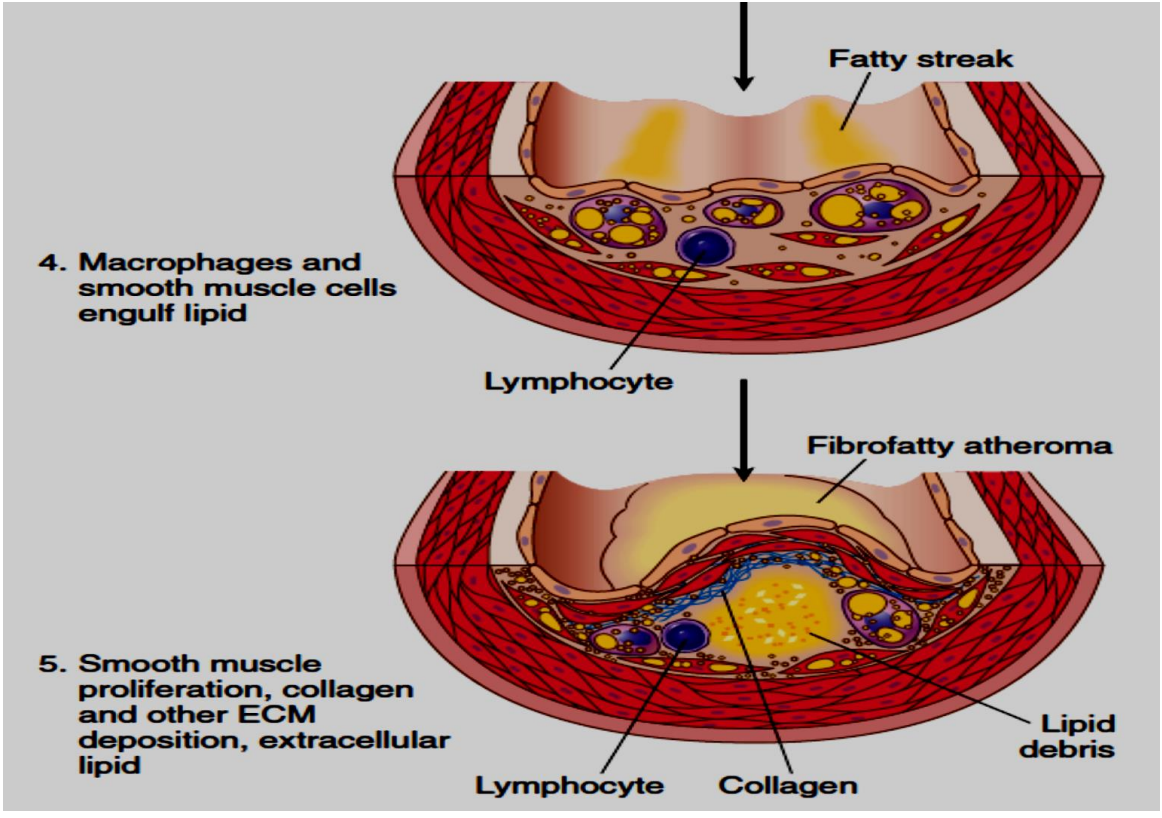
ischemia ←

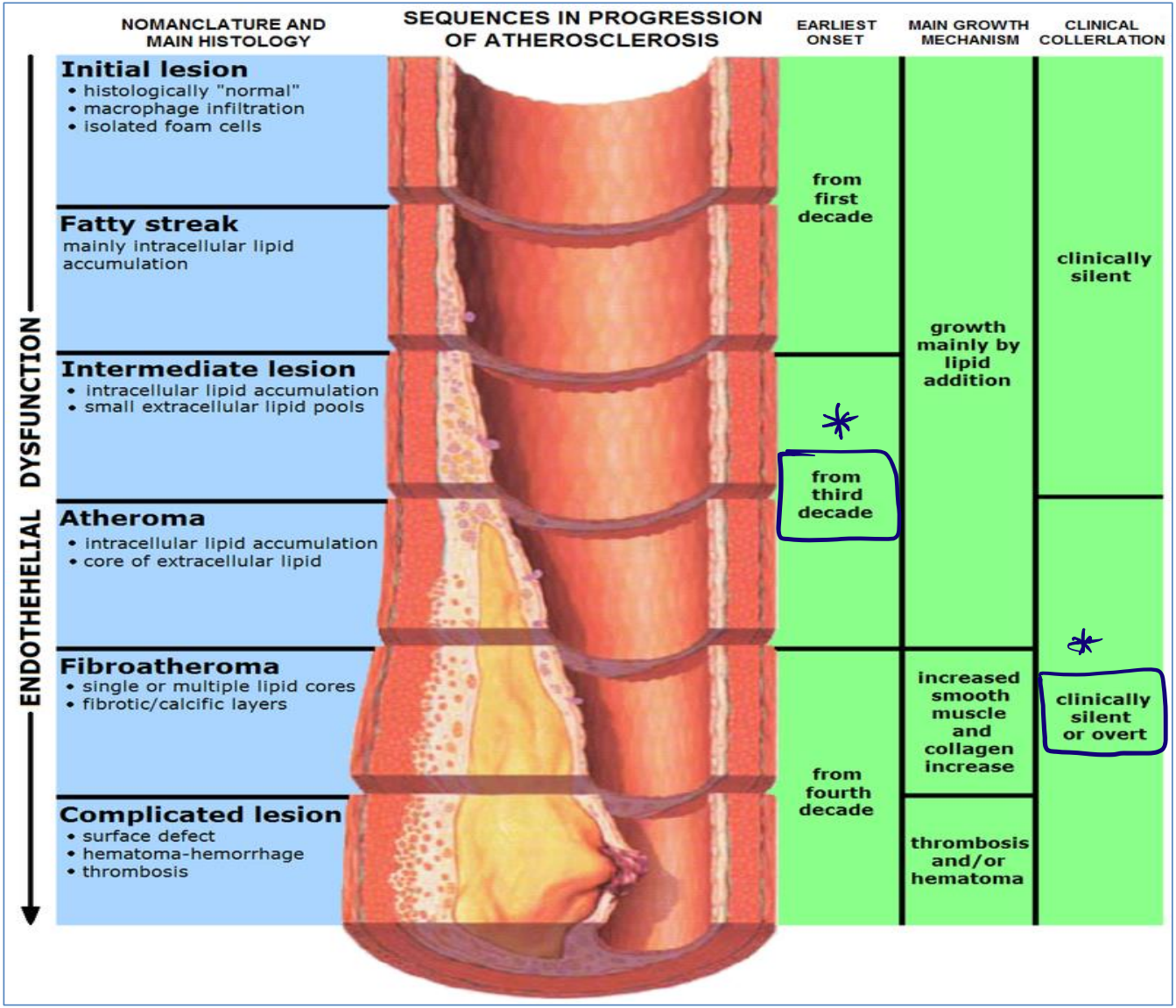
Formation of atheromatous plaque

*Adults.



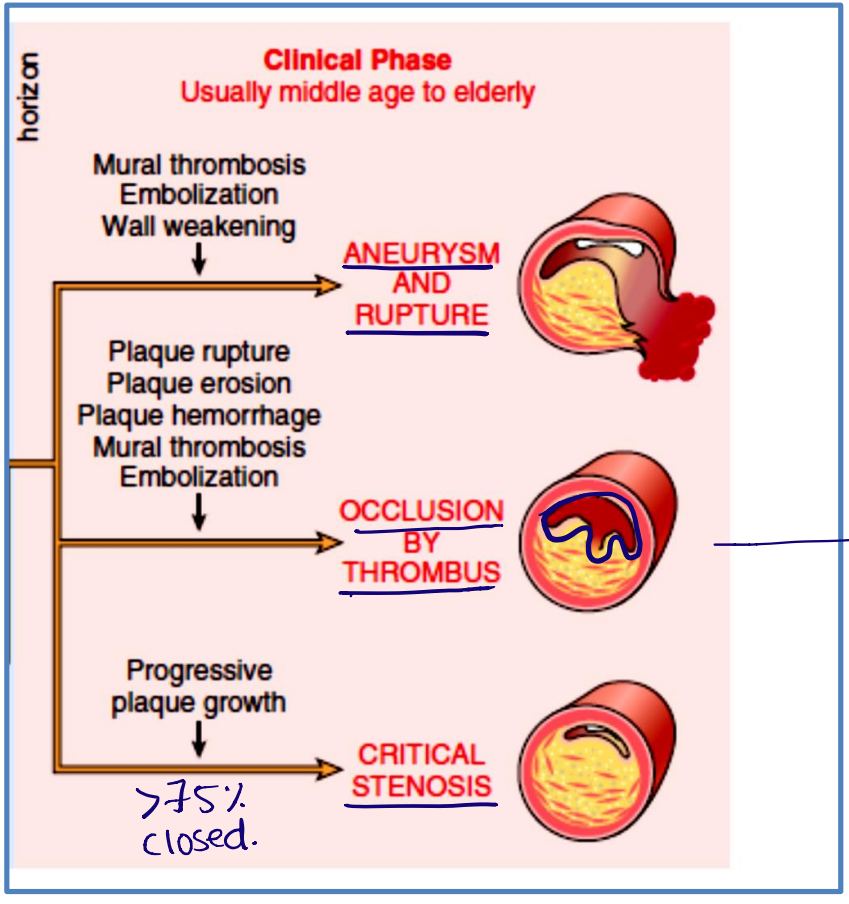
Formation of atheromatous plaque




NOMANCLATURE AND MAIN HISTOLOGY
SEQUENCES IN PROGRESSION OF ATHEROSCLEROSIS
EARLIEST ONSET
MAIN GROWTH MECHANISM
CLINICAL COLLERLATION
ENDOTHEHELIAL DYSFUNCTION
Initial lesion
• histologically "normal"
• macrophage infiltration
• isolated foam cells
Fatty streak
mainly intracellular lipid accumulation
Intermediate lesion
• intracellular lipid accumulation
• small extracellular lipid pools
Atheroma
• intracellular lipid accumulation
• core of extracellular lipid
Fibroatheroma
• single or multiple lipid cores
• fibrotic/calcific layers
Complicated lesion
• surface defect
• hematoma-hemorrhage
• thrombosis
from first decade
from third decade
from fourth decade
growth mainly by lipid addition
increased smooth muscle and collagen increase
thrombosis and/or hematoma
clinically silent
clinically silent or overt

*Complications.

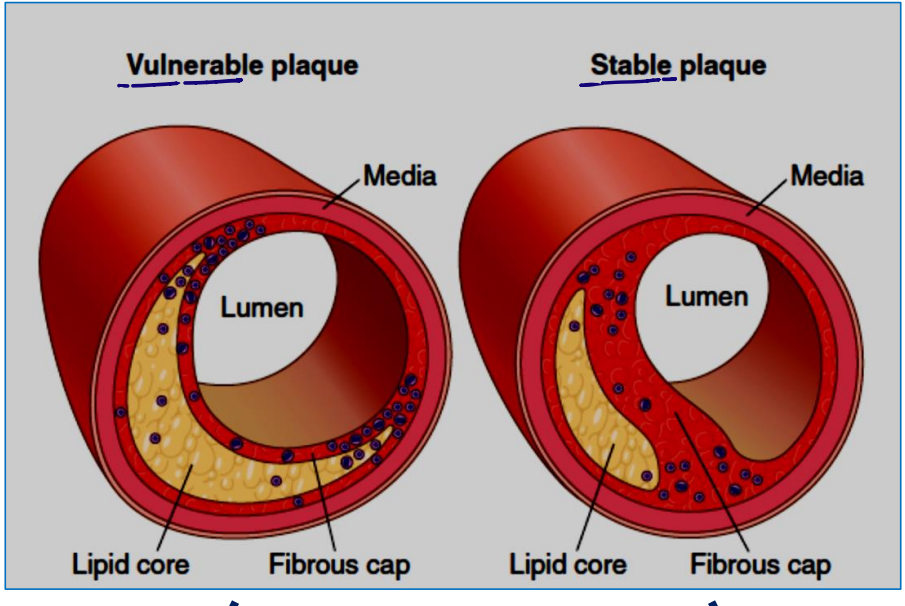
Atherosclerosis: progression



Atheroma + Thrombi
↳ complete occlusion of Blood Flow.

→ Progression.

Vulnerable vs stable plaque



Might break and lead to complications ←

1. Thick fat core
2. Thin fibrous cap
3. More inflammation

1. Thin fat core
2. Thick fibrous cap
3. less inflammation

Risk Factors for Atherosclerosis

Major Risks	Lesser, Uncertain, or Non-quantitated Risks (Minor)
① Non-modifiable (non-controllable)	Obesity
Increasing age	Physical inactivity
Male gender	Stress ("type A personality)
Family history	Postmenopausal estrogen deficiency
Genetic abnormalities	High carbohydrate intake
	Lipoprotein(a)
② Potentially modifiable (Controllable) How can we Modify?	Hardened (trans)unsaturated fat intake
Hyperlipidemia → ① Diet ② Drugs ③ Physical Activity ④ Life style.	
Hypertension → ① Diet ② Drugs ③ Physical Activity ④ Life style.	Chlamydia pneumoniae infection
Cigarette smoking → Quit Smoking.	
Diabetes	
C-reactive protein (inflammation) → Anti inflammatory.	

Major Risk Factors for atherosclerosis

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

- **Epidemiology ….**
- ***Multiple risk factors have a multiplicative effect:* 2 risk factors increase the risk 4X.**
- **E.g. if 3 risk factors are present (e.g., hyperlipidemia, hypertension, and smoking), the rate of myocardial infarction is increased 7X.**

1-age

Major, Non-modifiable

- **ages 40 to 60, incidence of MI in men increases 5 x**
- **Death rates from IHD rise with each decade**

2-Gender

Males → independent factor

- **Premenopausal* → protected against atherosclerosis compared with age-matched men.**
- **After menopause → incidence of atherosclerosis-related diseases increases**

- *** unless they are otherwise predisposed by diabetes, hyperlipidemia, or severe hypertension.**

3-Genetics

- **familial predisposition is multifactorial.**
- **Either :**

1- familial clustering of other risk factors

- e.g. HTN or DM

or :

2- well-defined genetic derangements in lipoprotein metabolism , Mutations.

- e.g. familial hypercholesterolemia

Patient might not have definite genetic mutations including Lipoprotein, However, they might have familial clustering of risk factors.

Additional Risk Factors for atherosclerosis

- 20% of cardiovascular events occur in the *absence of identifiable risk factors:*

- **Hyperhomocystinemia**
- ***Metabolic syndrome***
- **Lipoprotein a levels**
- **Factors Affecting Hemostasis (***Elevated levels of procoagulants; Clonal hematopoiesis)*
- **Others:**

-lack of exercise

-competitive, stressful lifestyle ("type A" personality)

-obesity

-High carbohydrate intake