



Cardiac Pathology 1: Blood Vessels

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Cardiac Pathology Outline

- Blood Vessels
- Heart I
- Heart II

Cardiac Pathology Outline

- Blood Vessels
 - Atherosclerosis
 - Hypertension
 - Aneurysms
 - Vasculitis
 - Tumors

Cardiac Pathology Outline

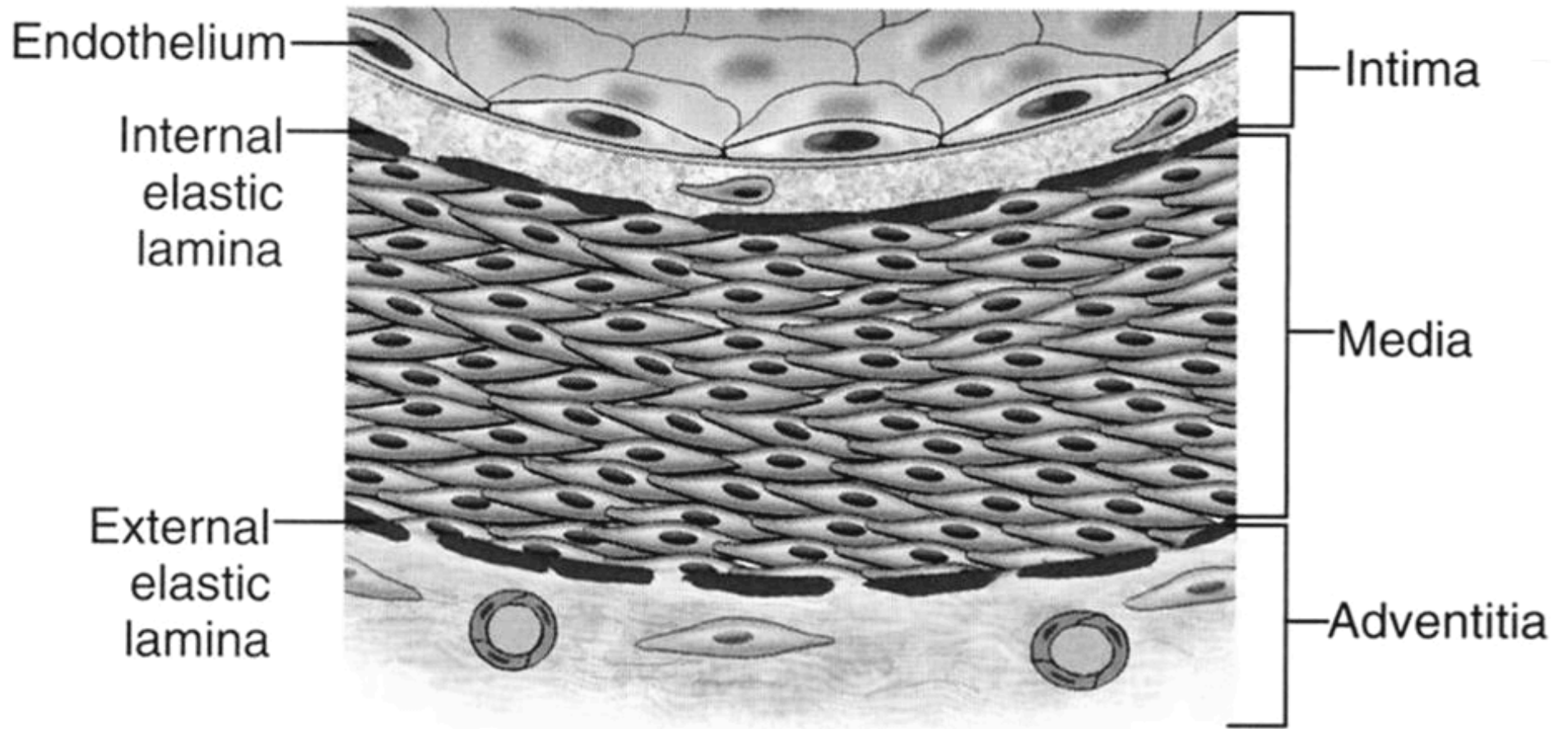
- Blood Vessels
- Heart I
 - Heart Failure
 - Congenital Heart Disease
 - Ischemic Heart Disease
 - Hypertensive Heart Disease

Cardiac Pathology Outline

- Blood Vessels
- Heart I
- Heart II
 - Valvular Heart Disease
 - Cardiomyopathies
 - Pericardial Disease
 - Tumors

Cardiac Pathology Outline

- Blood Vessels
 - Atherosclerosis



Normal blood vessel

Normal Blood Vessels

- Large (elastic) arteries
 - aorta, common carotid, iliac
 - lots of elastic fibers
 - pulsatile
- Medium (muscular) arteries
 - coronary, renal arteries
 - mostly smooth muscle cells
- Small arteries/arterioles
 - all smooth muscle cells
 - blood pressure controlled here

Normal Blood Vessels

- Capillaries
 - diameter of RBC
 - tons of them, with thin walls, slow flow
 - great for exchanging oxygen, nutrients
- Venules/veins
 - large diameter, thin walls
 - compressible, penetrable by tumor
 - valves
- Lymphatics
 - drain excess interstitial fluid
 - pass through nodes, checking for infection
 - return bugs (and tumor cells) to circulation

Atherosclerosis

- Characterized by atheromas
- Half of deaths in US!
- Coronary artery disease (MI)
- Carotid atherosclerotic disease (stroke)

Atherosclerosis: Major Risk Factors

Non-modifiable

- Increasing age
- Gender
- Family history
- Genetic abnormalities

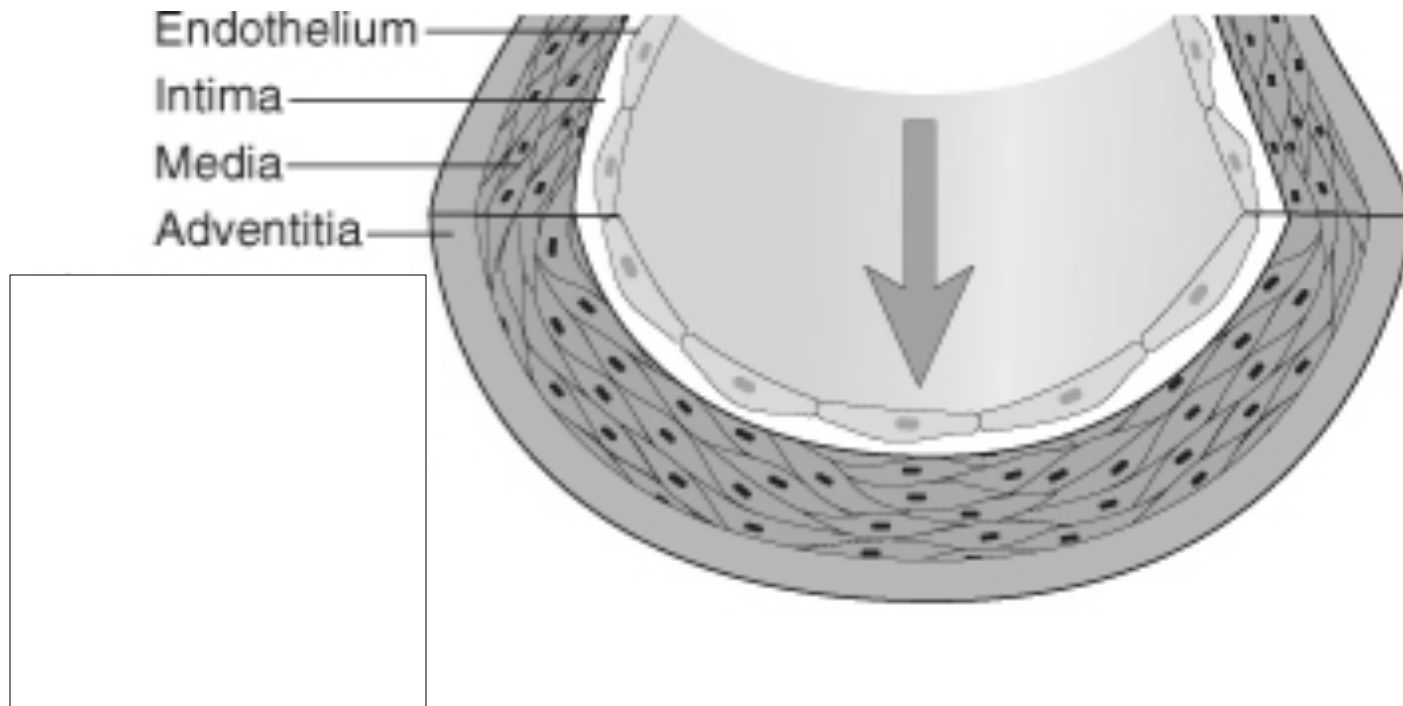
Potentially modifiable

- Hyperlipidemia
- Hypertension
- Cigarette smoking
- Diabetes
- C-reactive protein level

Atherosclerosis: Lesser Risk Factors

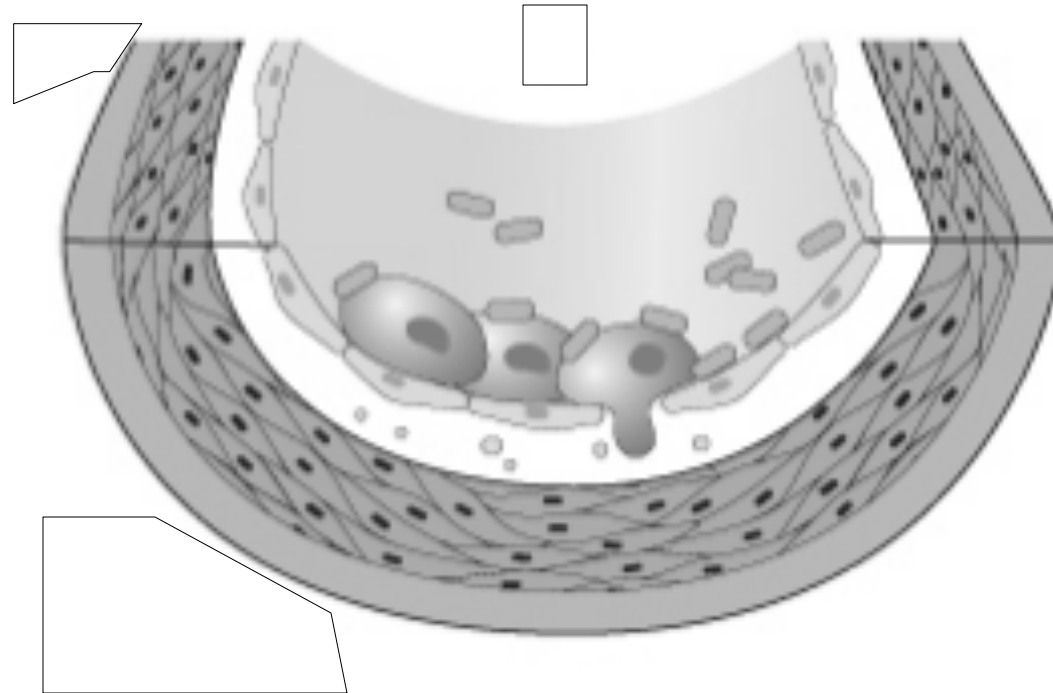
- Obesity
- Physical inactivity
- Stress
- Postmenopausal estrogen deficiency
- High carbohydrate intake
- Lipoprotein (a)
- Trans-fat intake
- *Chlamydia pneumoniae* infection

How to Make an Atheroma



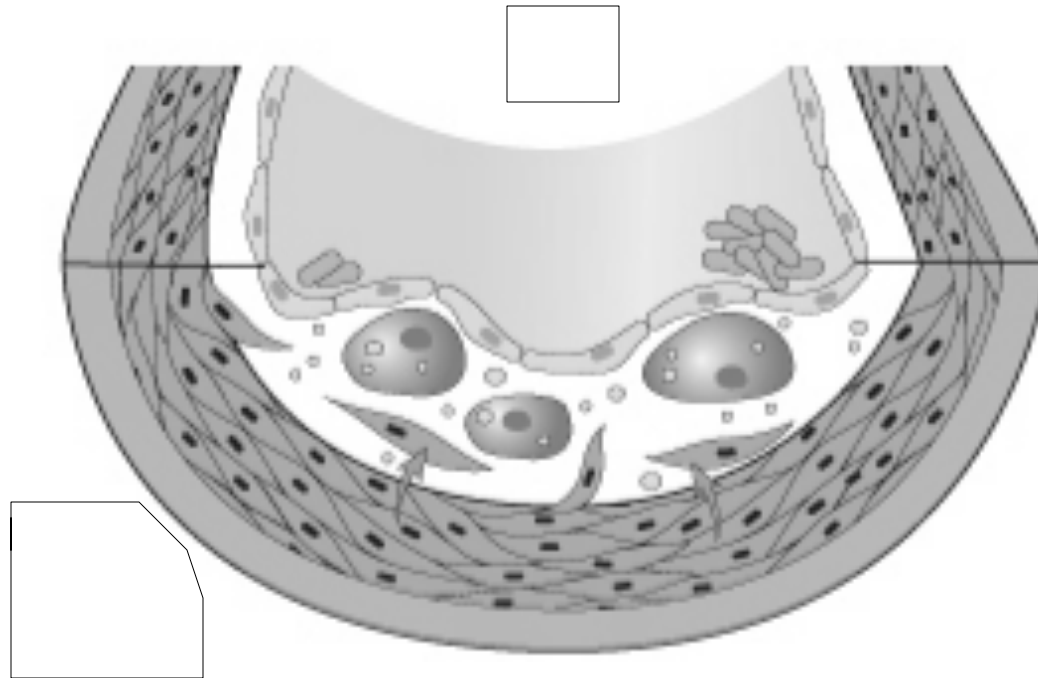
1 Chronic endothelial “injury”

How to Make an Atheroma



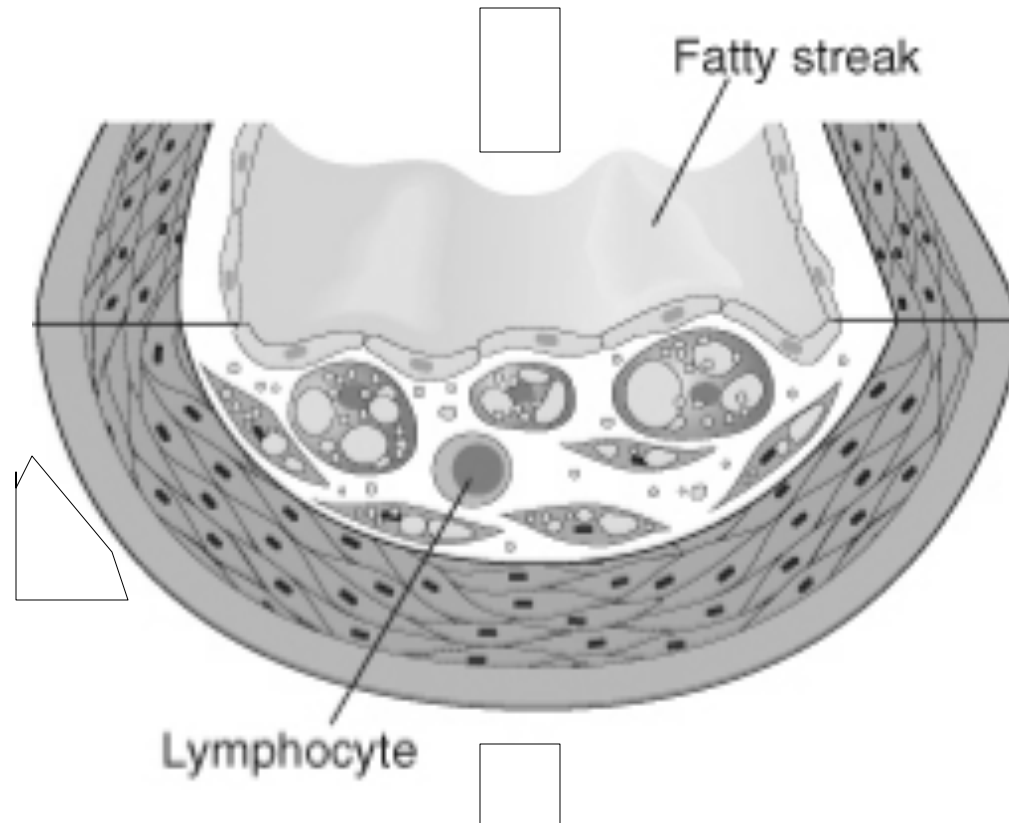
- 2 Endothelial dysfunction
Monocyte adhesion and emigration

How to Make an Atheroma

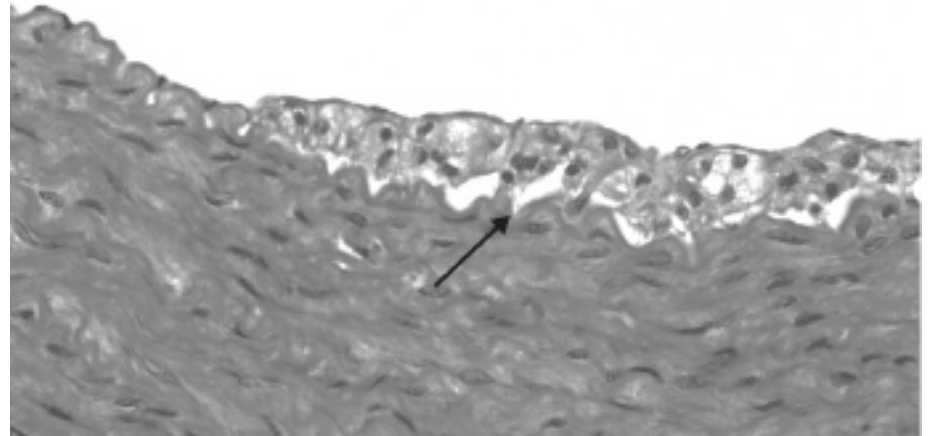
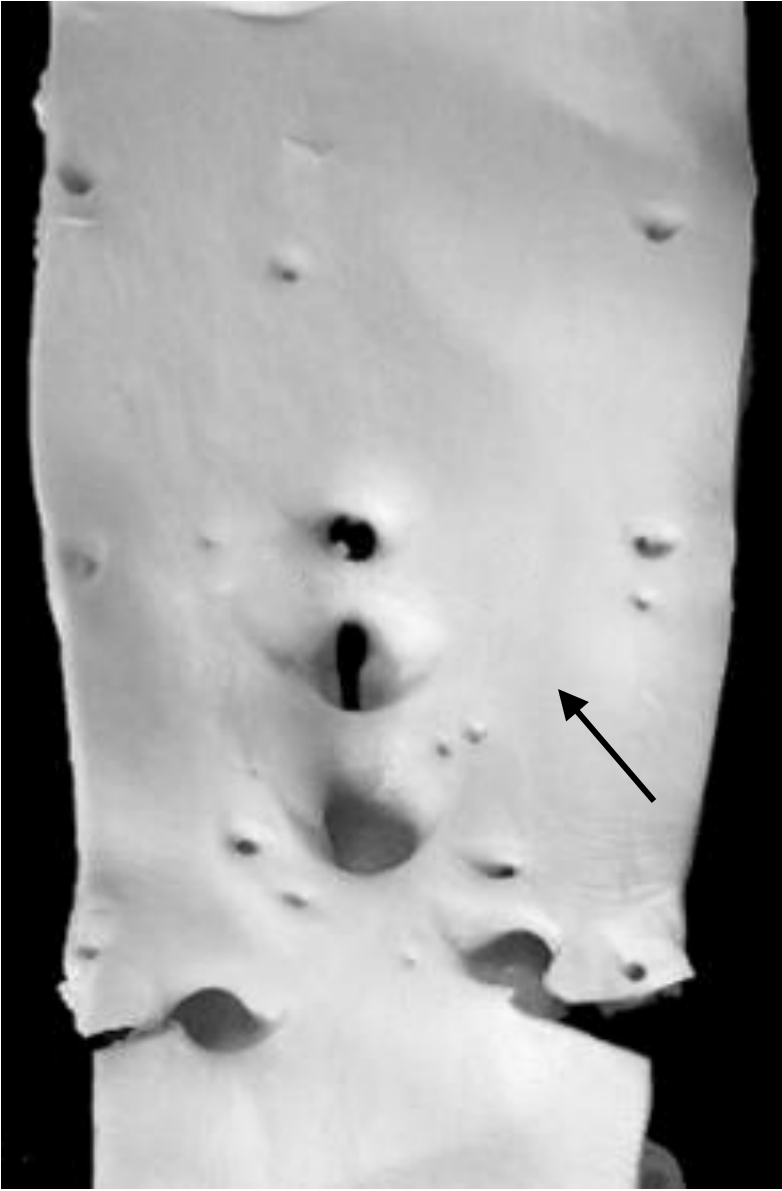


3 Macrophage activation
Smooth muscle recruitment

How to Make an Atheroma

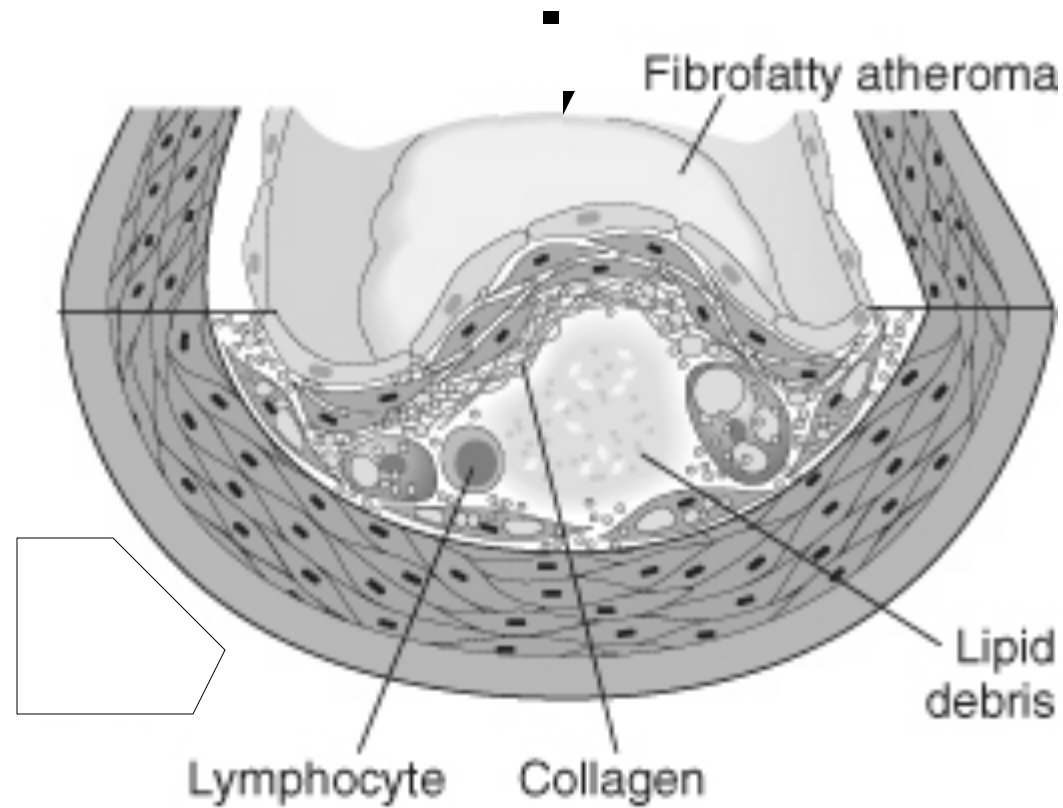


4 Macrophages and smooth muscle cells engulf lipid



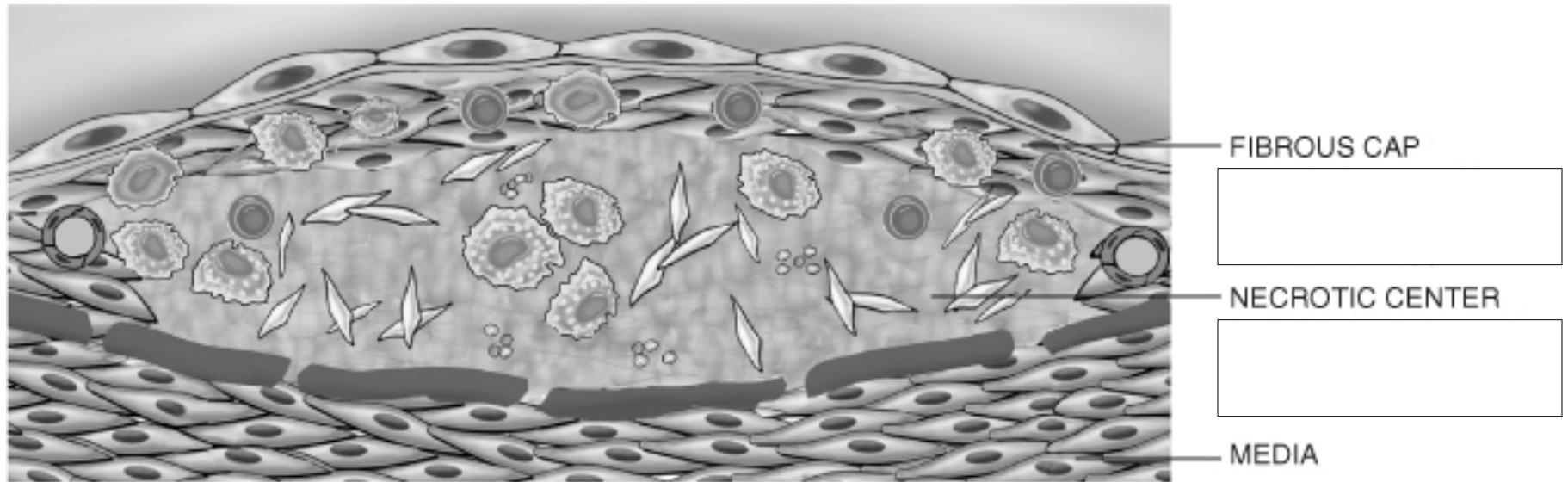
Fatty streaks

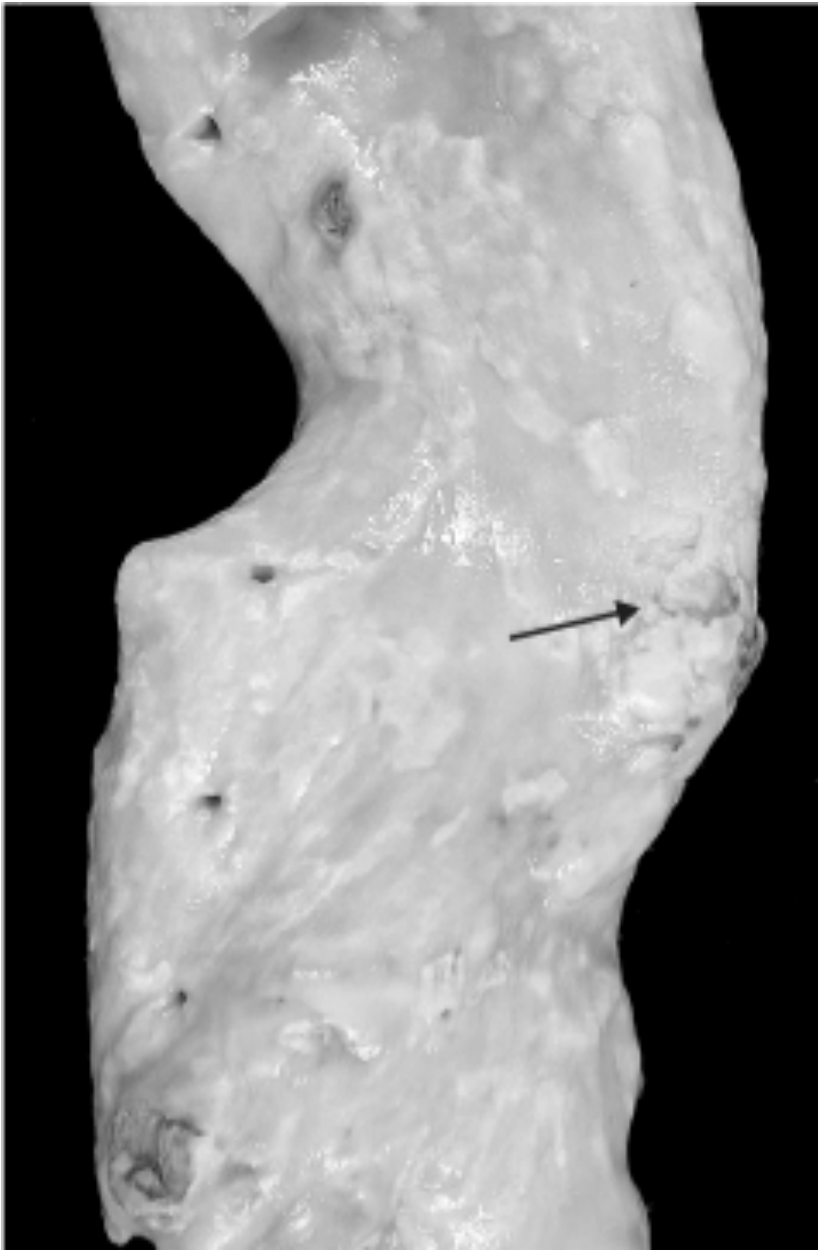
How to Make an Atheroma



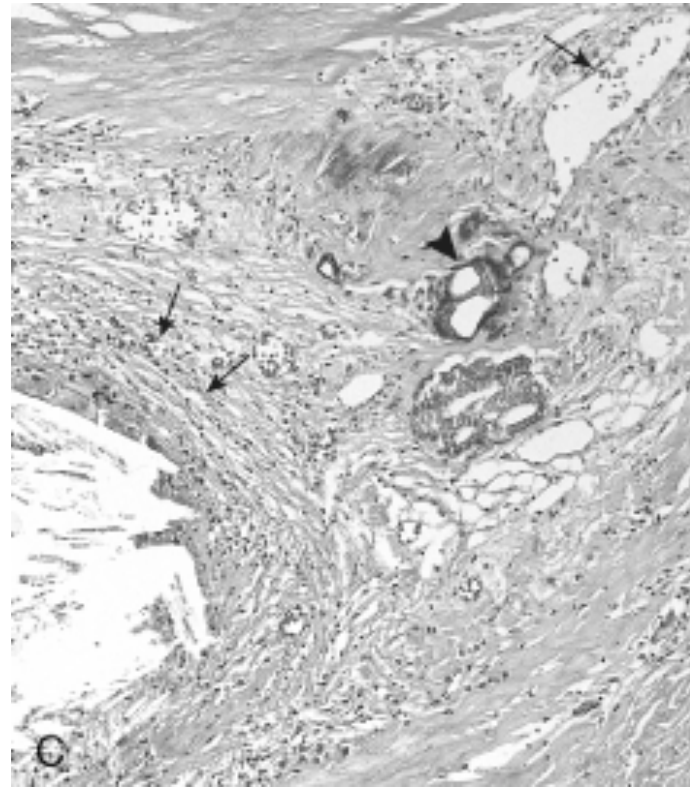
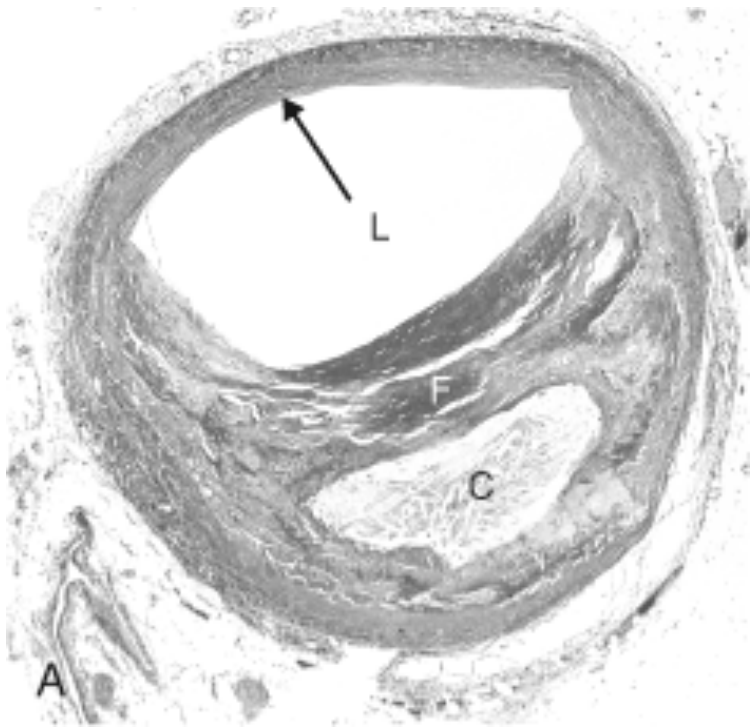
- 5 Smooth muscle proliferation
Collagen and extracellular lipid deposition

Contents of a plaque

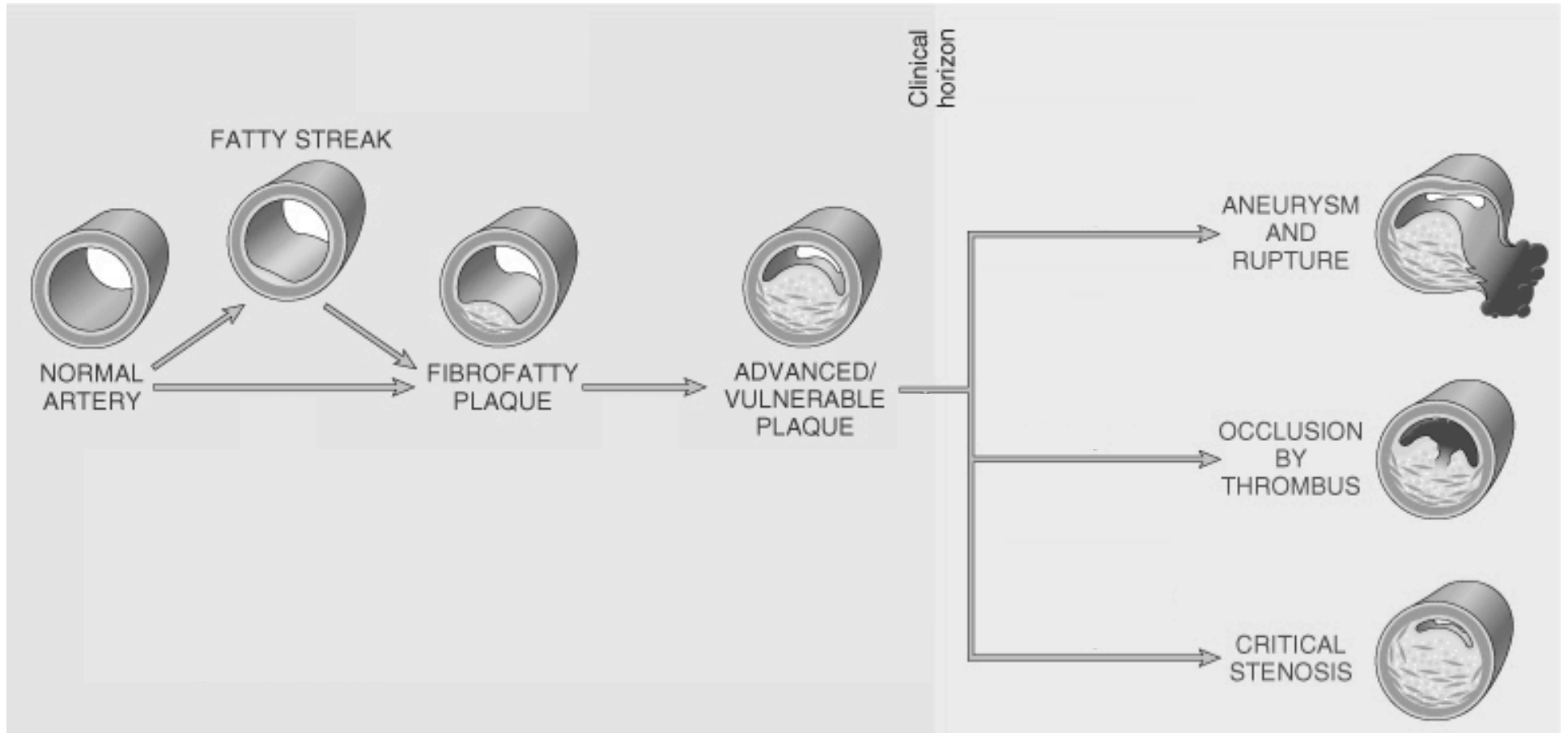




Mild (L) and severe (R) atherosclerosis



Atheromatous plaques



Natural history of atherosclerosis

Prevention of Atherosclerosis

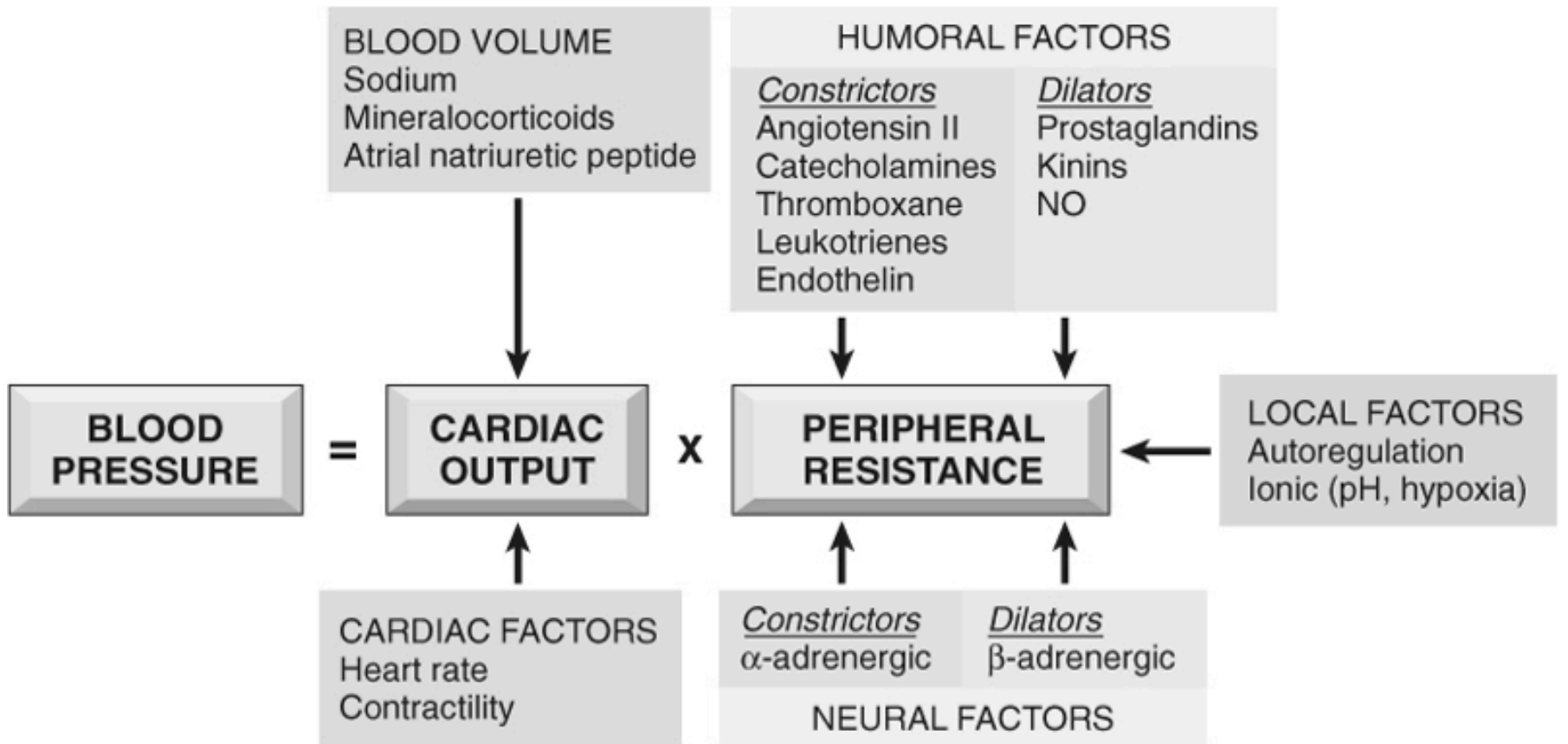
- Primary prevention
 - Lessen risk factors
 - Statins
- Secondary prevention
 - Aspirin, statins, beta blockers
 - Surgery

Cardiac Pathology Outline

- Blood Vessels
 - Atherosclerosis
 - Hypertension

Hypertension

- Common problem (25% of population)
- Asymptomatic until late
- Contributes to coronary artery disease, stroke, cardiac hypertrophy, heart failure
- Mechanisms largely unknown - called “essential hypertension”
- >140/90



Types of Hypertension

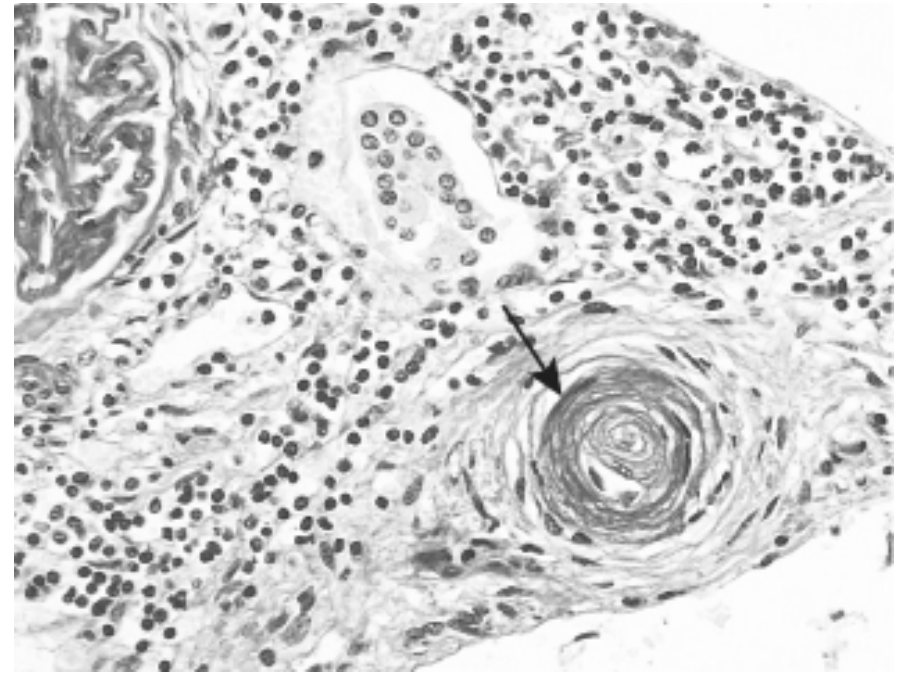
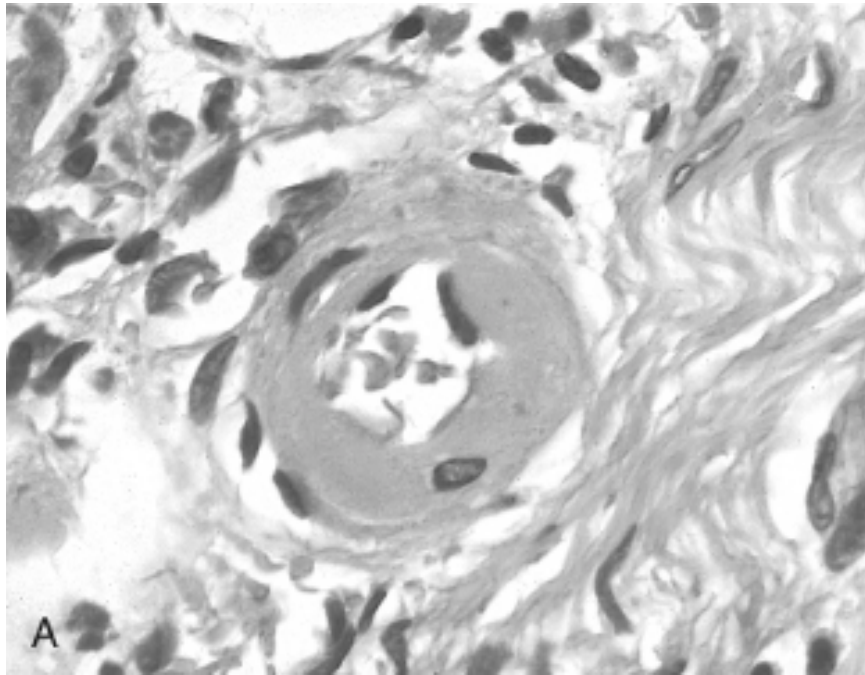
- Benign hypertension
 - Essential (idiopathic) hypertension
 - Secondary hypertension
- Malignant hypertension

Essential Hypertension

- Idiopathic! But probably related to...
- Reduced renal sodium excretion
- Vascular changes
- Genetic factors
- Environmental factors

Essential Hypertension

- Accelerates atherogenesis
- Potentiates aortic dissection and stroke
- Causes small blood vessel disease:
 - Hyaline arteriolosclerosis
 - Hyperplastic arteriolosclerosis



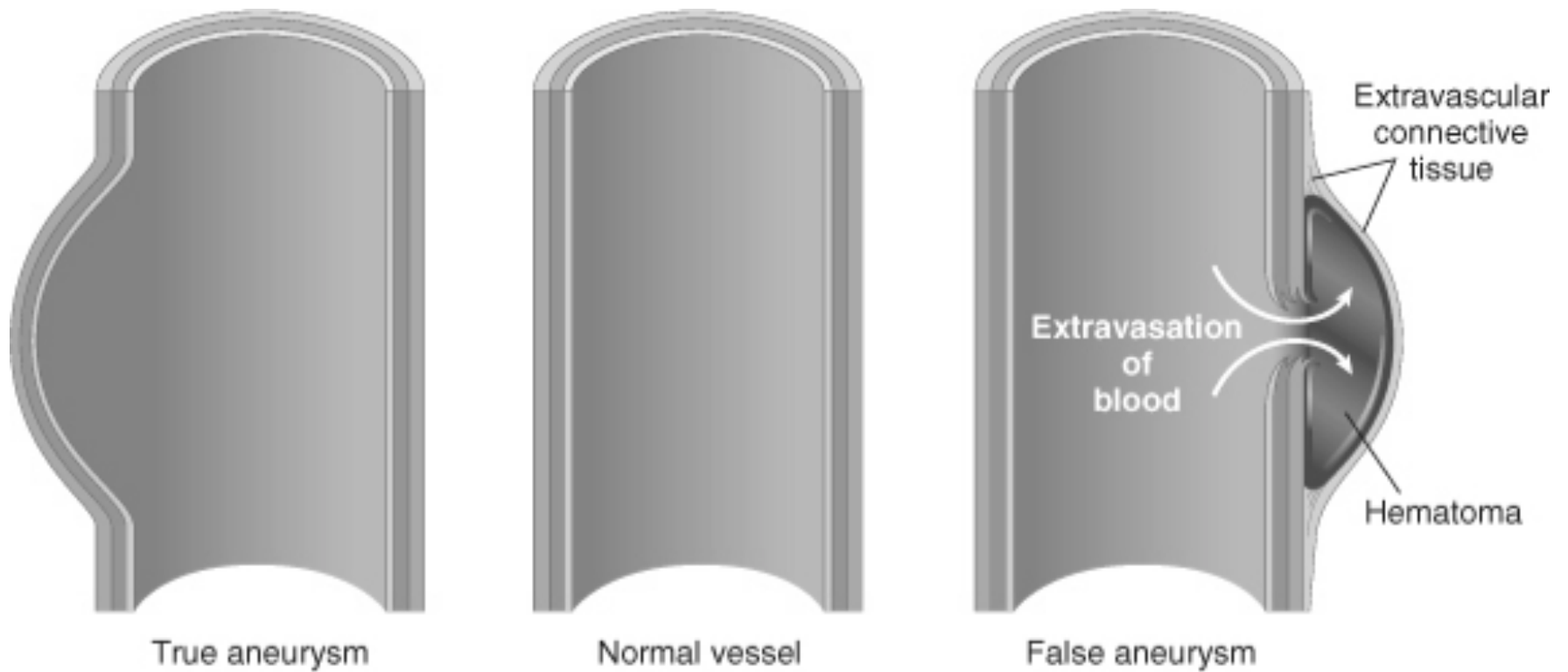
Hyaline (L) and hyperplastic (R) arteriolosclerosis

Cardiac Pathology Outline

- Blood Vessels
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 - Aneurysms

Aneurysms

- Aneurysm: localized abnormal vessel dilation
- “True” aneurysm: involves all three layers
- “False” aneurysm: hole covered with hematoma



True and false aneurysms

Causes of Aneurysms

- Atherosclerosis
- Cystic medial degeneration of wall
- Trauma
- Congenital defects (berry aneurysm)
- Infection (mycotic aneurysms)

Abdominal Aortic Aneurysm

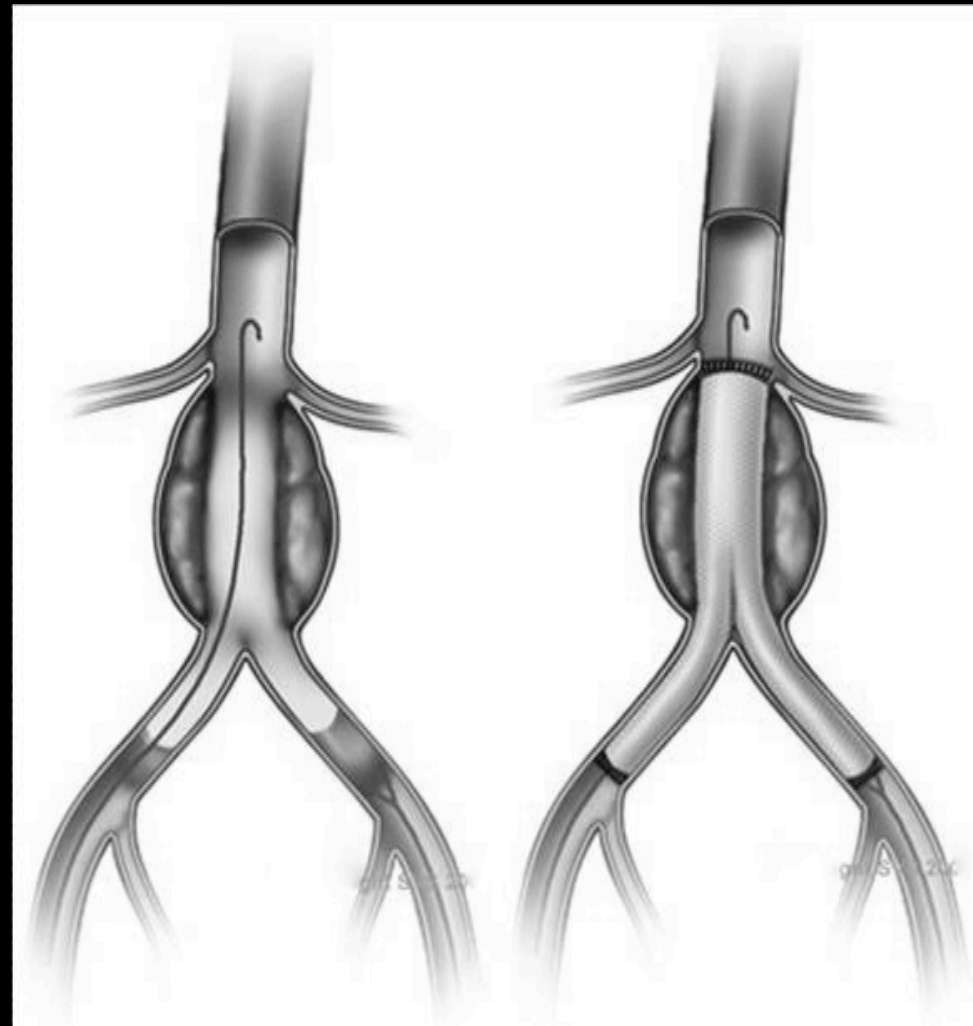
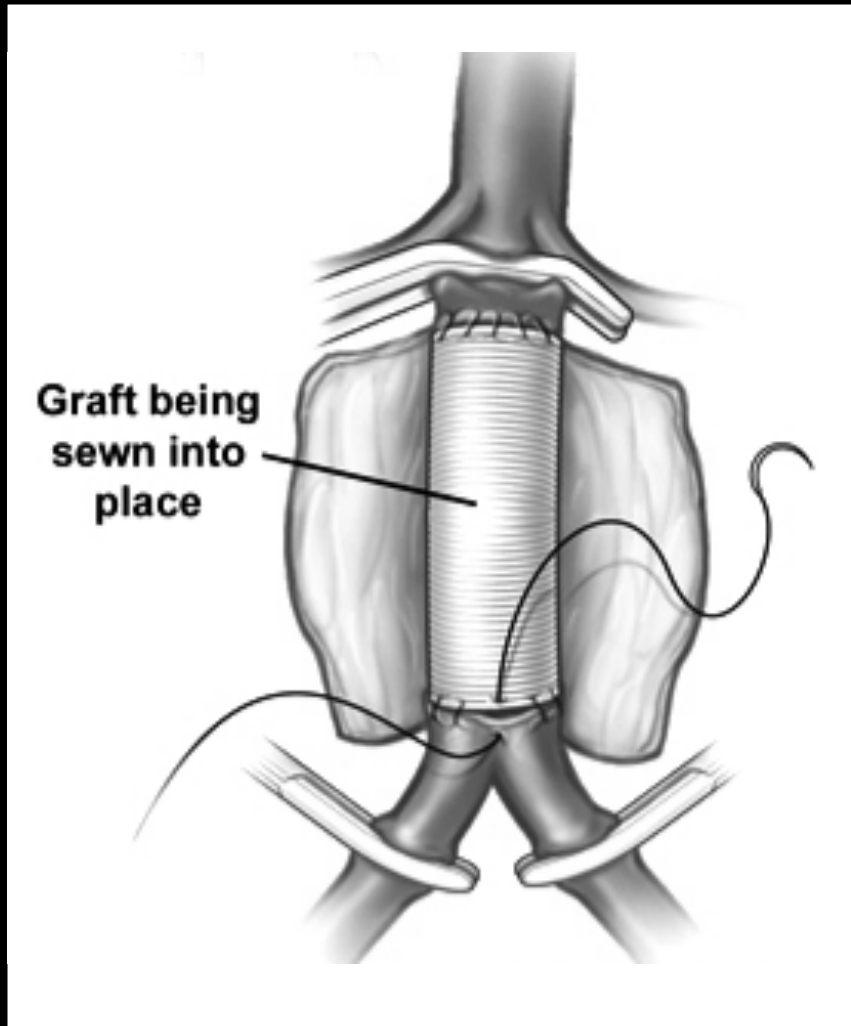
- Males >50
- Atherosclerosis, genetic defects (Marfan)
- Below renal arteries, above bifurcation
- May present as pulsating abdominal mass
- May rupture, obstruct branches or embolize



Abdominal aortic aneurysm



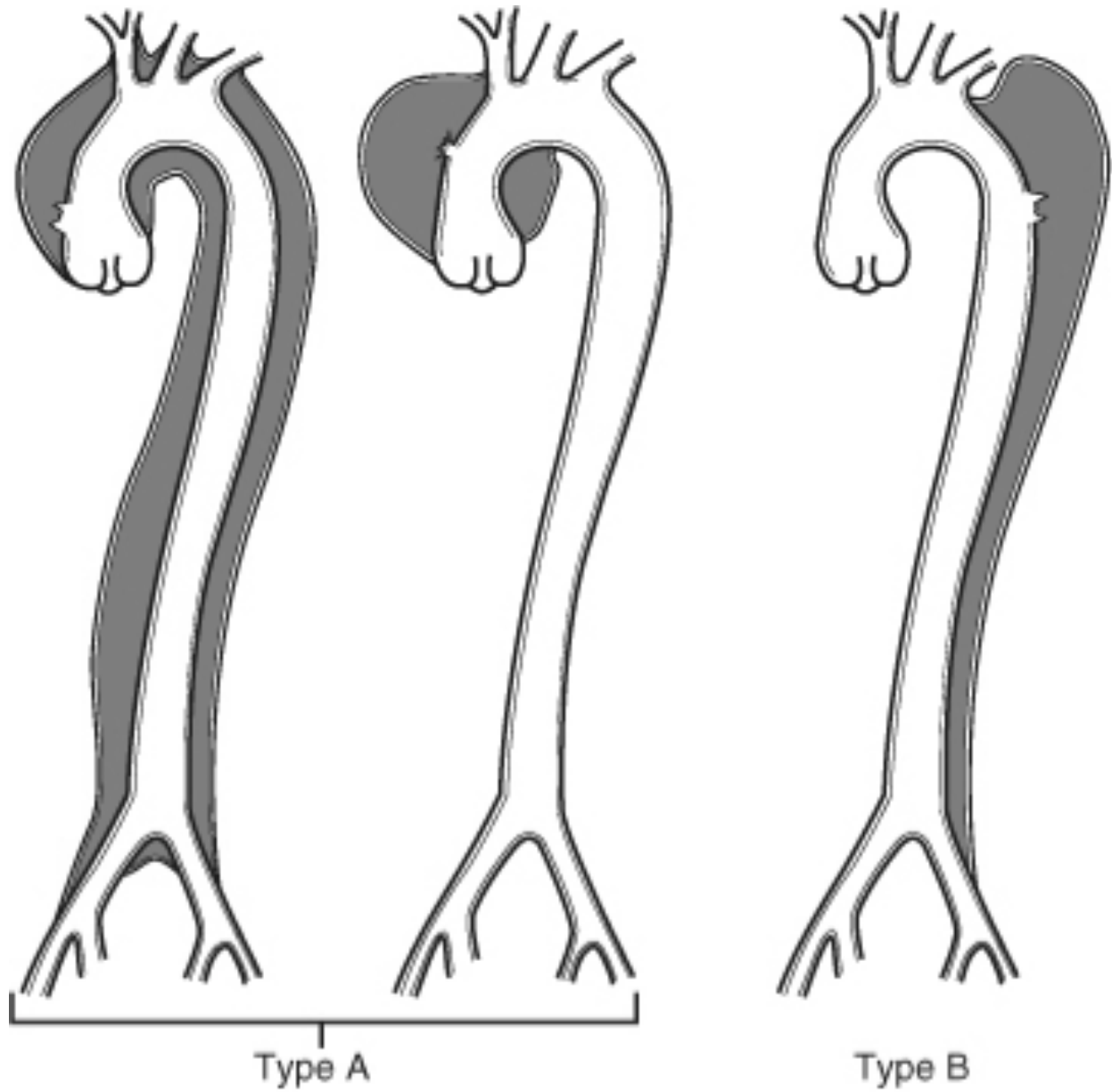
Abdominal aortic aneurysm



Abdominal aortic aneurysm repair

Aortic Dissection

- Blood tracks up through media, creating a channel
- Hypertensive men, 40-60 (most cases)
- Sudden onset excruciating pain
- Can rupture → massive hemorrhage or cardiac tamponade
- Rapid diagnosis, surgery = 65-75% of patients survive



Types of aortic dissection

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 - Vasculitis

Vasculitis

- Inflammation of vessel walls
- Many possible symptoms
- Constitutional signs/symptoms common
- Immune-mediated or infectious

Summary of Vasculitides

Vessel	Disease	ROS *
Large	Giant-cell arteritis	>50. Arteries of head.
	Takayasu arteritis	F <40. "Pulseless disease"
Medium	Polyarteritis nodosa	Young adults. Widespread.
	Kawasaki disease	<4. Coronary disease. Lymph nodes.
Small	Wegener granulomatosis	Lung, kidney. c-ANCA.
	Churg-Strauss syndrome	Lung. Eosinophils. Asthma. p-ANCA.
	Microscopic polyangiitis	Lung, kidney. p-ANCA.

* Ridiculously oversimplified summary

Giant-Cell (Temporal) Arteritis

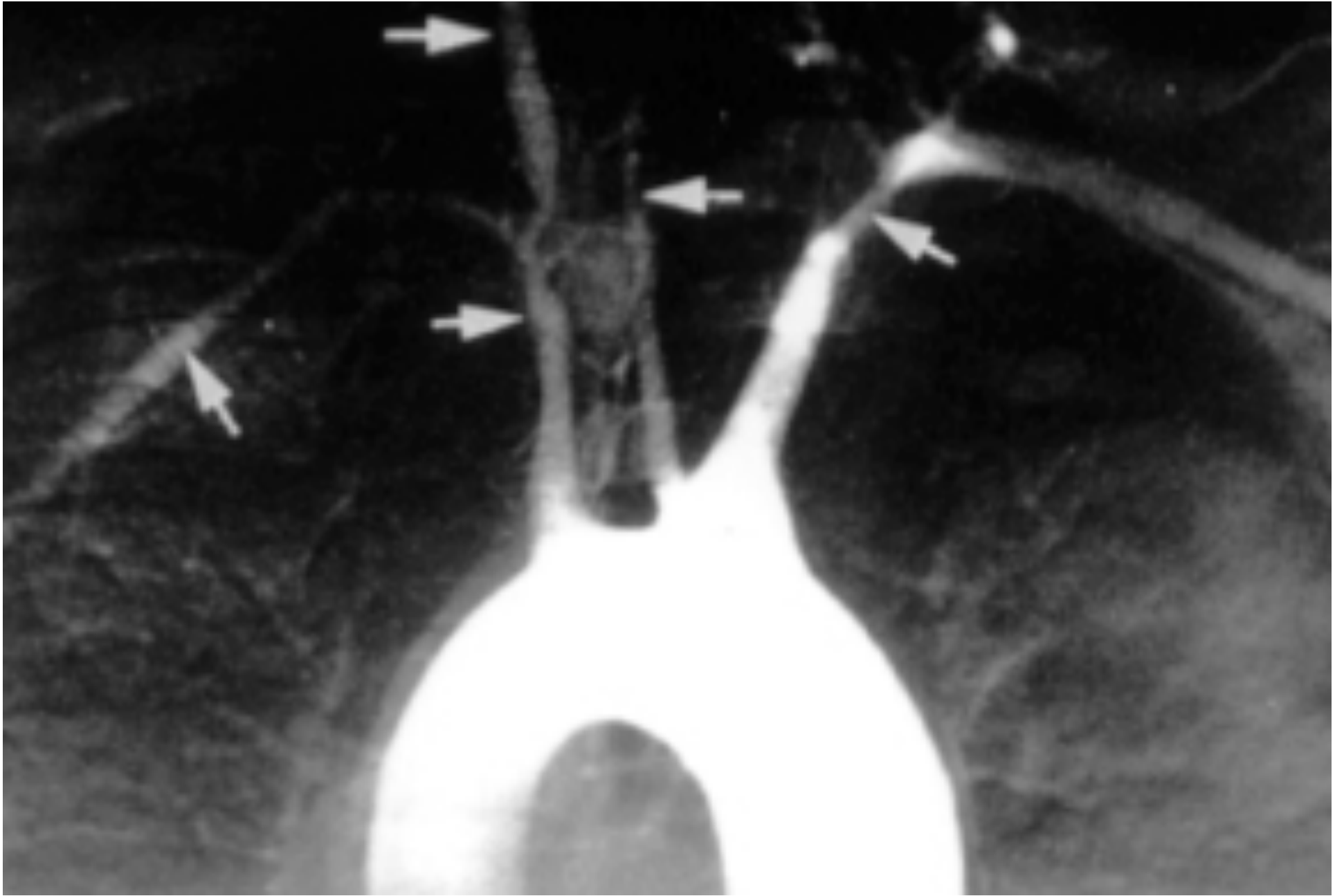
- Most common type of vasculitis
- Patients >50
- Chronic, granulomatous inflammation of large to small arteries, especially in head
- Symptoms vague (fever) or localized (headache, vision loss)
- Treatment: corticosteroids



Giant cell (temporal) arteritis

Takayasu Arteritis

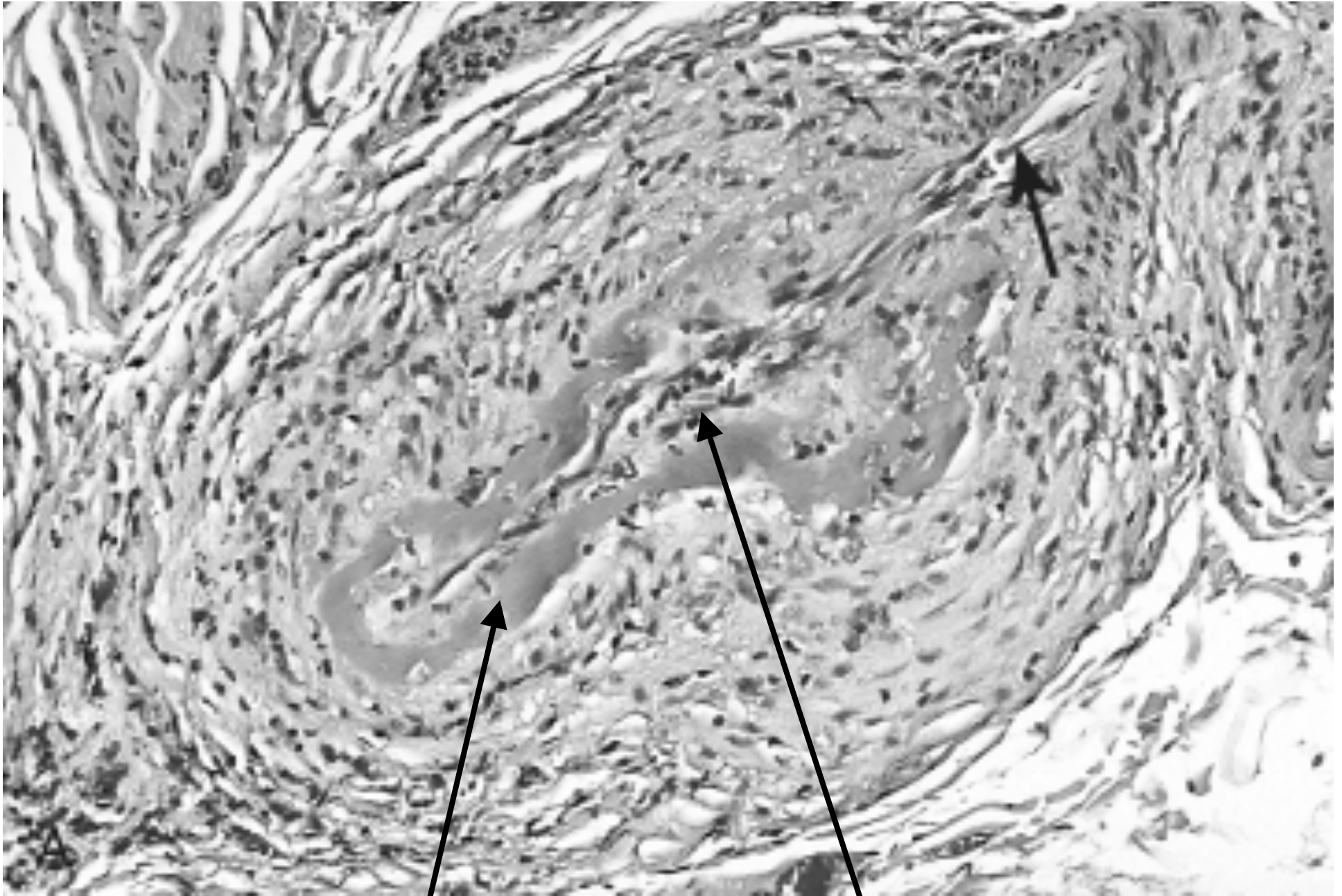
- Women <40
- Granulomatous vasculitis of aortic arch
- Severe narrowing of major branches
- Weakening of pulses in upper extremities (“pulseless disease”)
- Ocular disturbances



Takayasu arteritis

Polyarteritis Nodosa

- Young adults
- Necrotizing vasculitis in many different organs
- Different stages coexist even in same artery
- Puzzling, varied symptoms
- Fatal if untreated, but steroids and cyclophosphamide are curative



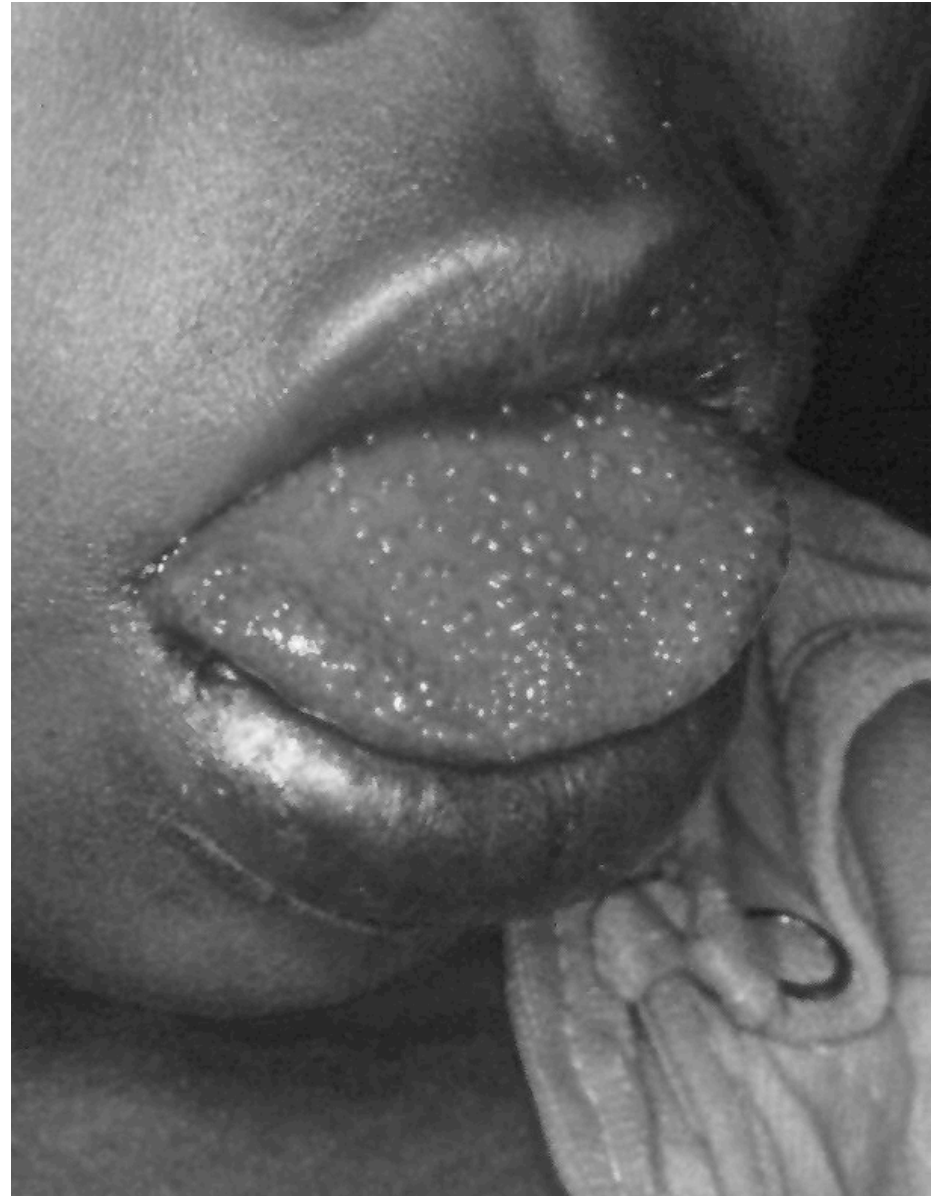
PAN: fibrinoid necrosis and thrombotic occlusion

Kawasaki Disease

- Children <4
- Acute, febrile, usually self-limiting
- Danger: involvement of coronary arteries
- “Mucocutaneous lymph node syndrome”
- Delayed-type hypersensitivity reaction?
- Treatment: intravenous Ig



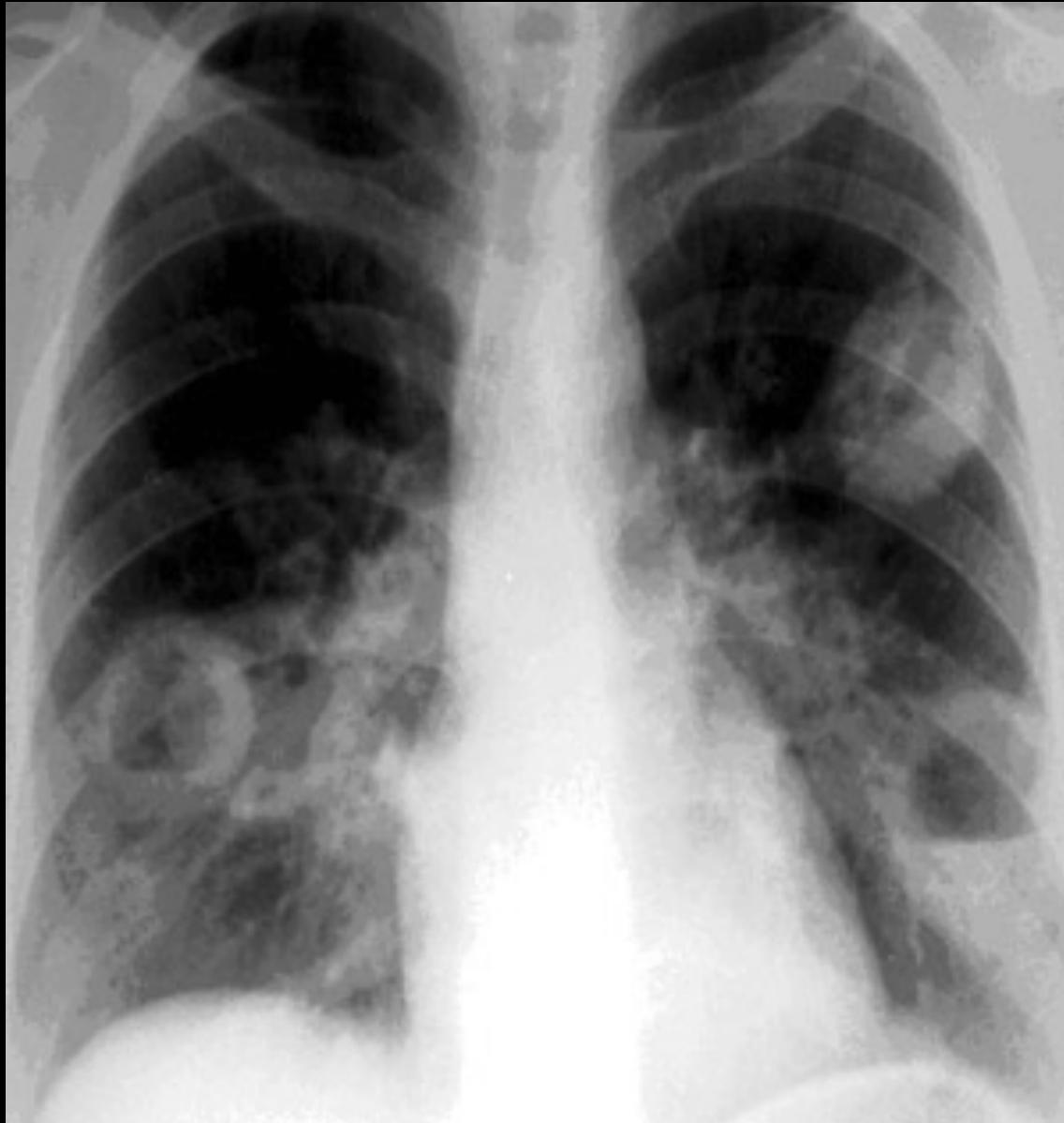
Kawasaki Disease: hand edema, mouth lesions



Kawasaki Disease: “strawberry” tongue

Wegener Granulomatosis

- Most common age = 40s
- Triad: respiratory tract granulomas, vasculitis, renal disease
- c-ANCA positive
- T-cell mediated hypersensitivity response?
- Untreated: fatal in 1 year
- Churg-Strauss: similar, but associated with allergies and asthma, and no renal disease



Wegener granulomatosis: cavitating lung lesions



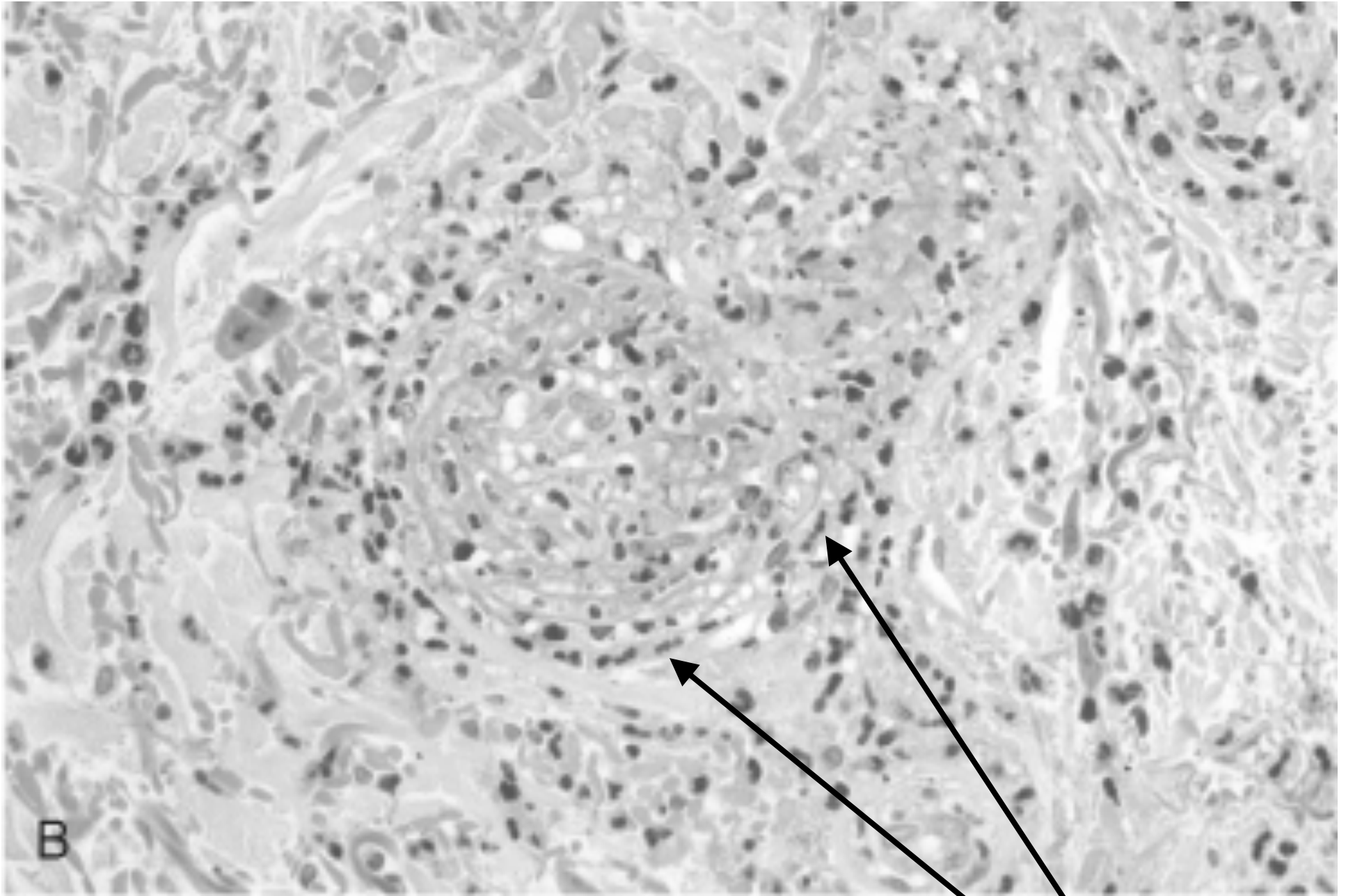
Wegener granulomatosis: palatal ulceration



Wegener granulomatosis: palatal destruction

Microscopic (Leukocytoclastic) Polyangiitis

- Widespread, necrotizing vasculitis of smaller vessels
- Lung and kidney especially
- Antibody response to drugs or bugs
- Neutrophils in vessels
- Type III hypersensitivity reaction?
- Removing offending agent usually works



Leukocytoclastic polyangiitis: vessel with fragmented PMNS

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Hemangioma

- Very common benign tumor of blood vessels
- Capillary hemangioma
 - Skin, oral mucosa, sometimes organs
 - “Strawberry” type present at birth, regresses
- Cavernous hemangioma
 - Organs, sometimes skin
 - Cosmetic problem (unless in brain)
- Pyogenic granuloma
 - Rapidly growing red nodule on skin, in mouth
 - Microscopically resembles granulation tissue



Capillary hemangioma



Pyogenic granuloma

Glomus Tumor

- Benign but very painful
- Arise from glomus body cells
- Distal digits, especially under fingernails
- Excision is curative



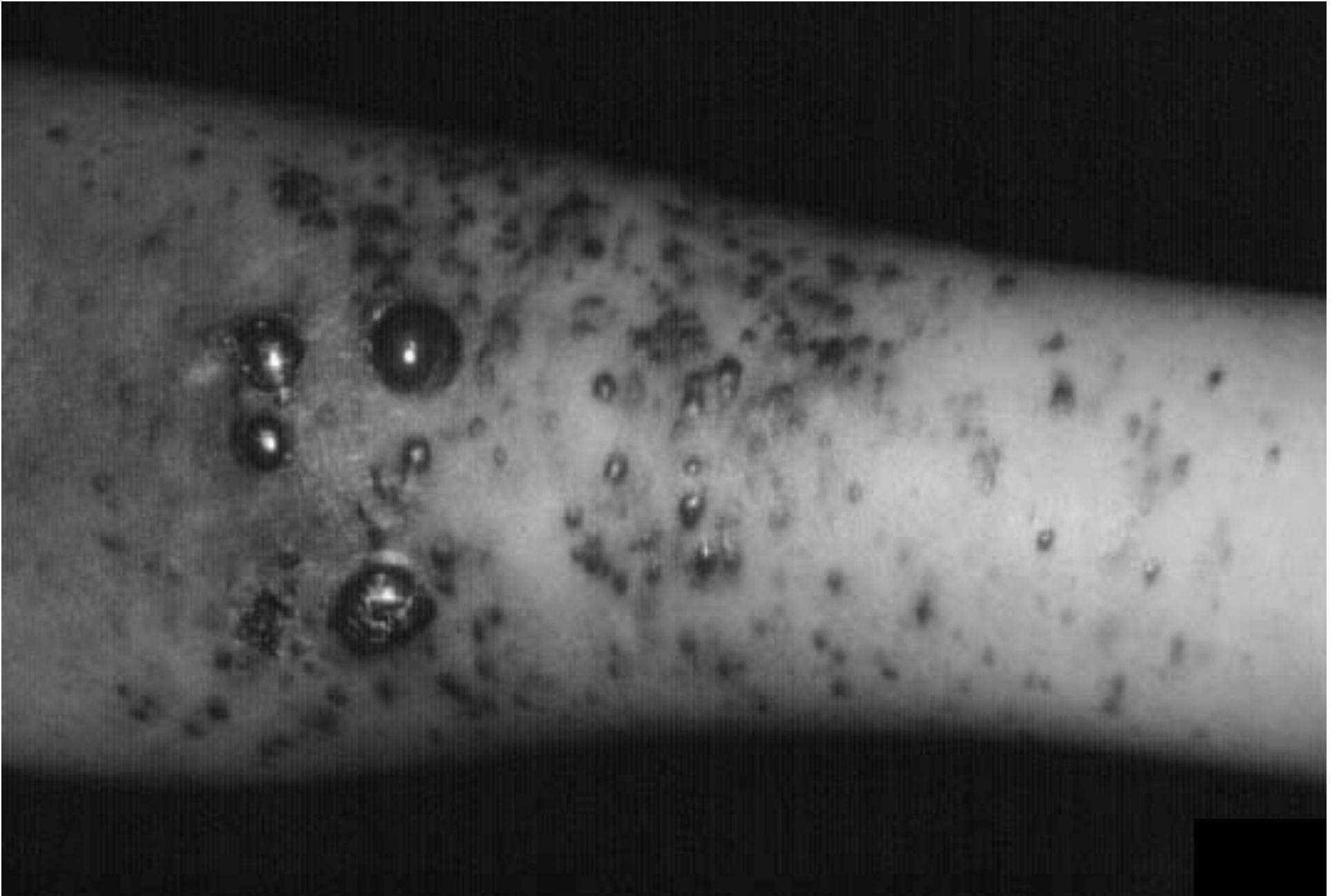
Glomus tumor

Kaposi Sarcoma

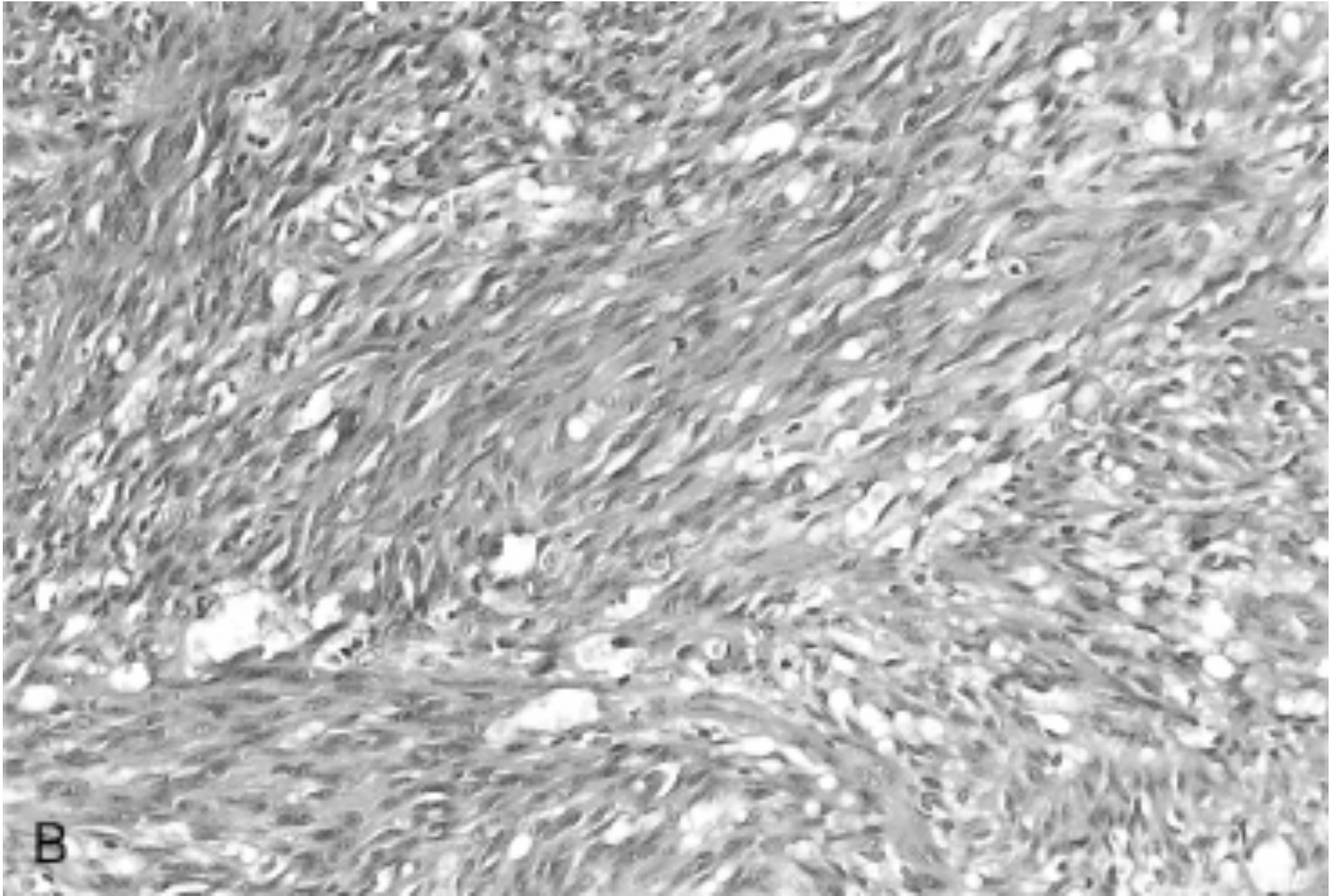
- Low-grade malignancy of endothelial cells
- Four forms: Chronic (older Ashkenazi Jewish males), African, transplant-associated, AIDS-associated
- Clinical course varies (chronic = best)
- Excision can be curative



Kaposi sarcoma



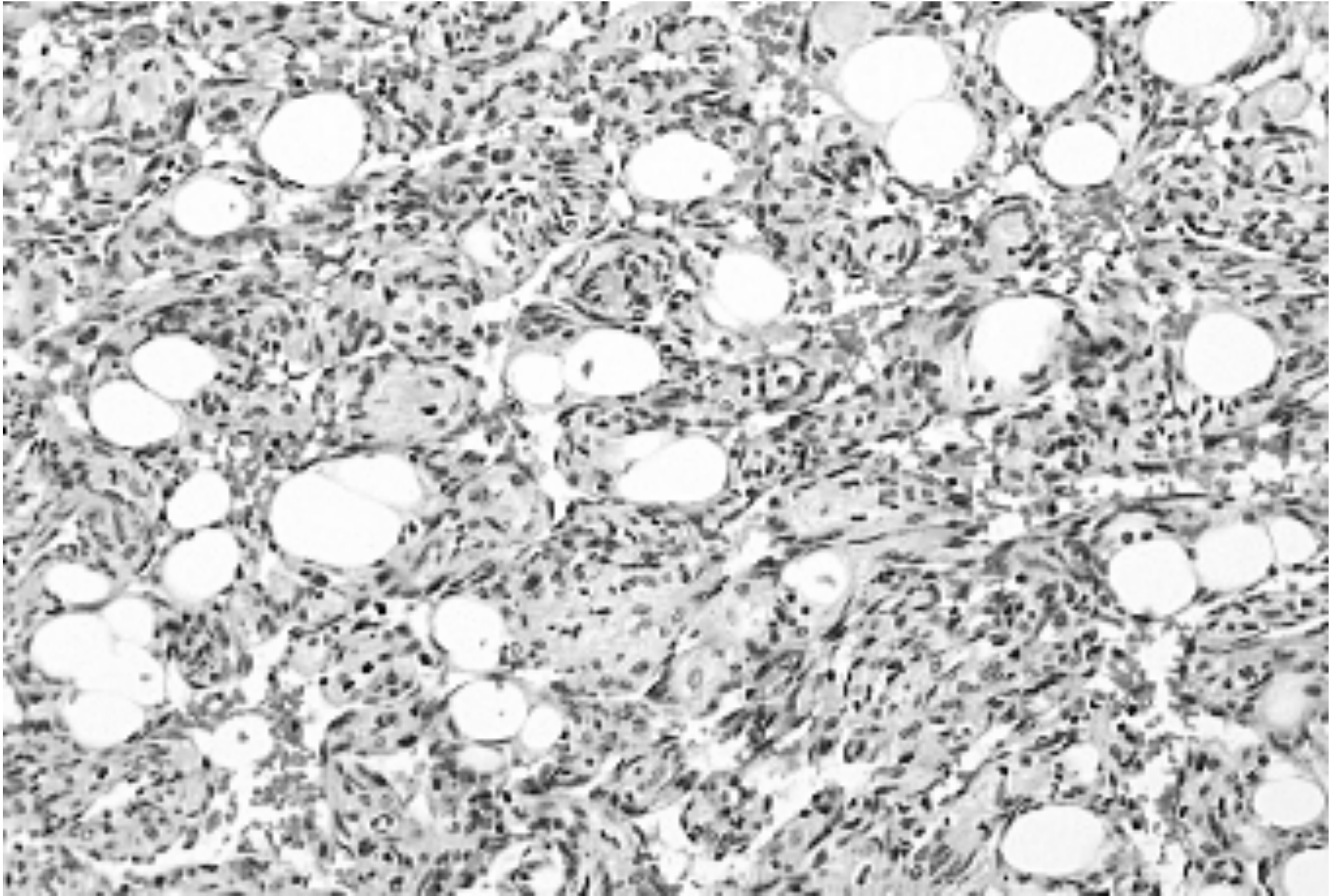
Kaposi sarcoma



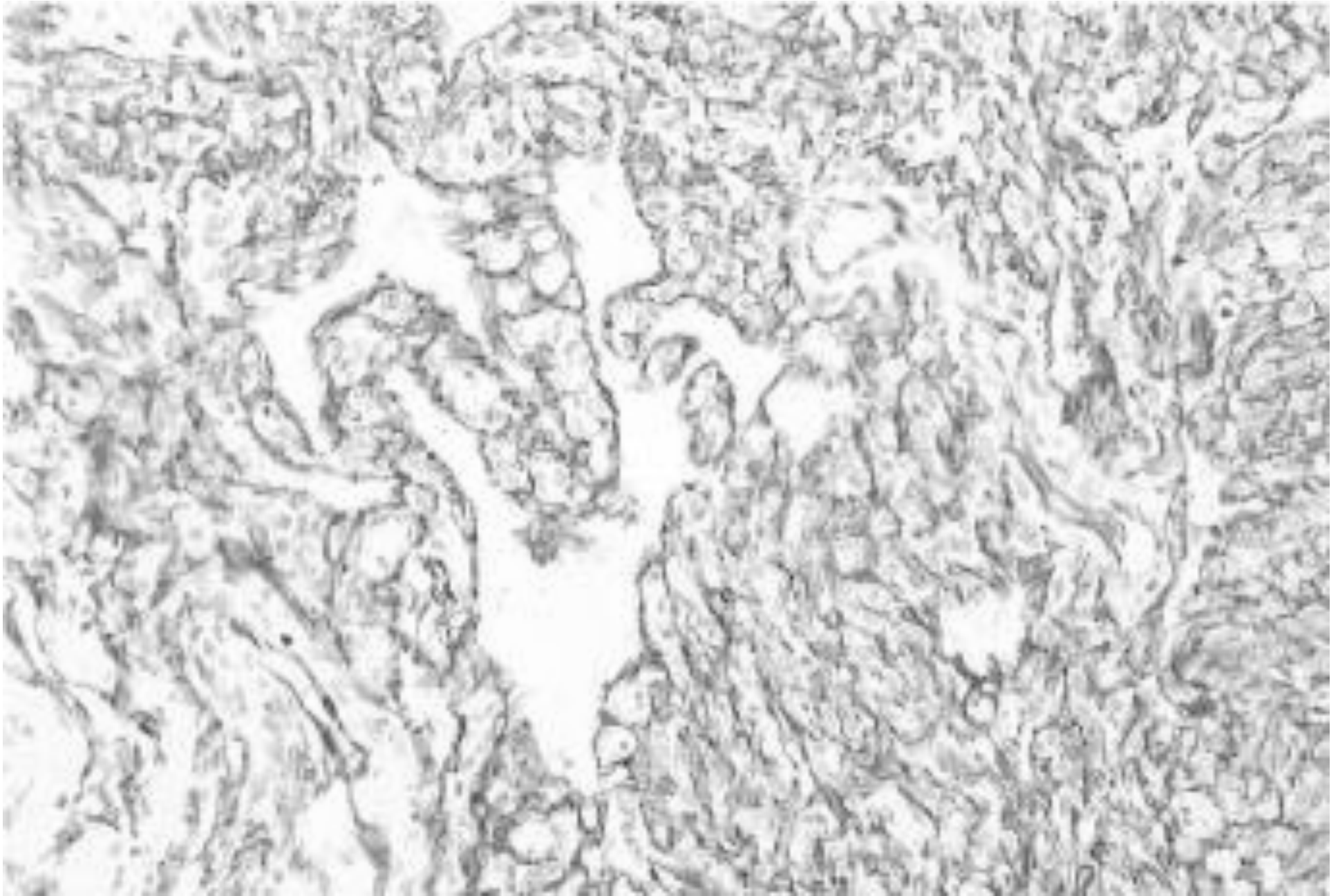
Kaposi sarcoma

Angiosarcoma

- Malignancy of endothelial cells
- Prefers skin, soft tissue, breast, liver
- Arsenic and PVC increase risk
- Well-differentiated to anaplastic
- Metastasize rapidly. 5ys 30%.



Angiosarcoma



Angiosarcoma cells positive for CD31 (an endothelial marker)

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