Cardiac Pathology 1: Blood Vessels
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Cardiac Pathology Outline
- Blood Vessels
- Atherosclerosis
- Hypertension
- Aneurysms
- Vasculitis
- Tumors

Normal blood vessel

Atherosclerosis
- Characterized by atheromas (plaques)
- Half of deaths in US!
- Most common cause of myocardial infarction
- Most common cause of cerebral infarction
Major Risk Factors for Atherosclerosis

Non-modifiable
- Increasing age
- Male gender*
- Family history
- Genetic abnormalities

Modifiable
- Hyperlipidemia
- Hypertension
- Cigarette smoking
- Diabetes

* Sort of. MI is uncommon in premenopausal women, but after menopause, incidence in women exceeds that in men.

Other Risk Factors for Atherosclerosis

- Inflammation
- Metabolic syndrome
- Obesity
- Lack of exercise
- “Stress”

How Plaques Form

It all starts with chronic endothelial injury (from smoking, hyperlipidemia, etc.). The endothelium looks normal at first.

Monocytes slip into the subendothelium and become macrophages. Smooth muscle cells proliferate in the subendothelium. Lipid accumulates.

Eventually, the injured endothelium shows signs of damage. It becomes more permeable, and monocytes and platelets begin to stick to it.
How Plaques Form

Smooth muscle cells proliferate in the intima and start laying down collagen. Now there’s a plaque with a soft core and a brittle surface.

Fatty streak

Mild (L) and severe (R) atherosclerosis

Atheromatous plaques

Prevention of Atherosclerosis

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

Natural history of atherosclerosis
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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
- Arterioles eventually become damaged
  - Hyaline arteriolosclerosis
  - Hyperplastic arteriolosclerosis
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Hyaline (L) and hyperplastic (R) arteriolosclerosis

Aneurysms

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

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 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

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Vasculitis

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

Summary of Vasculitides

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Disease</th>
<th>ROS</th>
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<tr>
<td>Large</td>
<td>Giant-cell arteritis</td>
<td>&gt;50</td>
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<tr>
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<td>F&lt;40</td>
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<tr>
<td>Medium</td>
<td>Polyarteritis nodosa</td>
<td>Young adults</td>
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<tr>
<td></td>
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<td>Small</td>
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<td>Churg-Strauss syndrome</td>
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<td></td>
<td>Microscopic polyangiitis</td>
<td>Lung, kidney</td>
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* 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

Takayasu Arteritis

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

**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

**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

Mnemonic:
Wegener Granulomatosis is the “C” disease

- C through the body: in through nose, out through kidneys
- c-ANCA
- Cell-mediated response
- Saddle nose “C” shaped
- Treatment: cyclophosphamide, corticosteroids
- Churg-strauss similar

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
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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

Angiosarcoma

- Malignancy of endothelial cells
- Prefers skin, soft tissue, breast, liver
- Arsenic and PVC increase risk
- Well-differentiated to anaplastic
- Metastasize rapidly. Sys 30%.
Angiosarcoma cells positive for CD31 (an endothelial marker)