Vascular Surgery

Peripheral Vascular Disease and Evaluation of the Acutely Cold Foot

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Peripheral Vascular Disease of the Lower Extremities

- Definition: Decreased patency of the arterial supply to the lower extremities leading to claudication, ischemia and potentially limb loss
- “Compromised integrity”
Atherosclerosis

- Thickening and hardening of arteries
- Some hardening is normal with age
- **Plaque** may partially or totally block the blood's flow through an artery
Atherosclerosis

Healthy artery

Atherosclerotic artery
Atherosclerosis

- Two things that can happen where plaque occurs are:
  - Hemorrhage into the plaque
  - Plaque ruptures and a blood clot (thrombus) forms on surface
- Affects large and medium-sized arteries
Atherosclerosis

- Plaques can form from damage to arterial walls by:
  - ↑ levels of cholesterol and triglyceride in the blood
  - ↑ blood pressure
  - Tobacco smoke

- Cellular debris will adhere to plaques (cholesterol etc.)

- Endothelium becomes thick and the diameter of the artery is reduced
Atherosclerosis

Clogged artery
SO?

- Heart attack = ↓ blood supply to heart
- Stroke = ↓ blood supply to brain
- Gangrene = ↓ blood supply to arms and legs
Etiology

- Vasculitis
- Buerger’s Disease (Thromboangiitis Obliterans)
- Extrinsic compression (neoplasm)
Pathophysiology

- Narrowing of the lumen of the arterial supply to the lower extremity leads to decreased blood flow.
- Decreased blood flow $\rightarrow$ Decreased O2 supply $\rightarrow$ Anaerobic metabolism $\rightarrow$ Increased Lactic Acid $\rightarrow$ Pain with increased muscle use
Pathophysiology

- As decreased blood flow or compromised integrity continues, tissues can become ischemic leading to:
  - pain at rest
  - poor wound healing
  - painful ulceration
- As disease progresses patients are sometimes unable to ambulate and gangrene may set in with eventual need for amputation
Gangrene
Risk Factors

- Hypertension
- Cigarette smokers
- Diabetics
- Hyperlipidemia
- Increased age
- History of other atherosclerotic disease (coronary artery disease or carotid stenosis)
Clinical Presentation

- Claudication requires a sustained walk
  - cramping/burning muscular pain
  - localized to a muscle group (calf)
  - reproducible
  - relieved with rest
- Distribution of pain may suggest anatomic location of disease
Clinical Presentation

- Must differentiate from pseudoclaudication

<table>
<thead>
<tr>
<th>Character</th>
<th>Claudication</th>
<th>Pseudo…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Buttocks, hips, calves, thighs, feet</td>
<td>same</td>
</tr>
<tr>
<td>Exercise Induced</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Distance to symptoms</td>
<td>Reproducible</td>
<td>variable</td>
</tr>
<tr>
<td>Symptoms with standing</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Relief</td>
<td>Stop walking</td>
<td>Change position</td>
</tr>
</tbody>
</table>
Clinical Presentation

- Ischemic Rest Pain
  - Deep bone pain in toes at rest
  - May or may not be relieved by dependency
  - Indicative of limb threat
Clinical presentation

- Ischemic ulceration
  - ulcer on toes/between toes/dorsum of foot
  - localized skin necrosis
  - often noticed after trauma with persistent wound that will not heal
Ischemic Ulceration
Ischemic Ulceration
Clinical Presentation continued

- Toe gangrene
  - Blackened toe/s
  - often foul smelling
  - indicative of dead tissue
  - limb at extreme risk
Toe Gangrene
Physical Examination

- Pulse exam
  - Palpable vs. non-palpable
  - Audible by doppler vs. not audible
  - Compare limbs
  - Pulse exam helps define level of disease
  - May also examine pulses after exercise
Physical Examination

- Skin
  - Thin, brittle, shiny with thick opaque toes
  - Often cool
  - No toe hair
  - Poor capillary refill
Ankle/Brachial Index

- Ratio of Systolic Blood Pressure Ankle:Arm
  - Normal ratio $>1.0$
  - Claudication 0.8-1.0
  - Ischemic Rest Pain $<0.8$
- Results may be skewed by diabetes
Imaging

- Arteriography
- Duplex Ultrasound
- Magnetic Resonance
Arteriography

- **Advantages**
  - Gold standard for demonstrating anatomy of disease
  - Provides therapeutic opportunities: eg. PTA

- **Disadvantages**
  - Invasive: risk of hemorrhage, aneurysm, infection
  - Contrast load is nephrotoxic
Arteriography
Duplex Ultrasound

- Advantages
  - Noninvasive
  - Fast/cheap
  - Few complications

- Disadvantages
  - Dependent on ultrasonographers ability
  - Poor visualization below the knee
Duplex Ultrasound
Magnetic Resonance

- Advantages
  - Good resolution
  - Allows visualization of surrounding structures
  - Noninvasive with few complications

- Disadvantages
  - Efficacy has not been demonstrated
  - Cost/availability
Magnetic Resonance Angiography
Claudication: Treatment

- Claudication
  - STOP SMOKING
  - Exercise program
  - Control diabetes, lower cholesterol
  - Pentoxyphylline
  - 75% improve with non-operative management
Claudication: Treatment

- Ischemic rest pain/ulcer/gangrene
  - Must first determine how patient uses limb
  - Angioplasty vs. Revascularization
  - Gangrene or blackened toes require amputation but revascularization may preserve level and use of limb.
Acute Ischemia: Diagnosis

- “The cold foot”
- Rapid onset
- Pain
- Pallor
- No pulse
- Numbness or paralysis
Acute Ischemia: Therapy

- Angioplasty to disrupt thrombus
Acute Ischemia: Therapy

- Surgery to reestablish vascular integrity
Acute Ischemia: Therapy

- Thrombolysis with or without surgery
Acute Ischemia: Therapy

- Embolectomy
Acute Ischemia: Therapy

- ± Anticoagulation to assist in blood thinning
Acute Ischemia: Therapy

- Amputation if all of the above options fail
Surgical Options for Ischemia

- Autologous grafting
  - Sources
  - Life span of graft
- Synthetic grafting
  - Sources
  - Life span of graft
Follow up

- Full clinical examination
- Look for carotid and aneurysmal disease
- Establish need for continued anticoagulation

aneurysm
embolism
Follow up

- For the bypass surgery patient
  - Clinical examination
  - Ultrasound evaluation of the graft
    - Every 3-4 months for 2 years
    - Then every 6 months