Vascular Surgery

Peripheral Vascular Disease and Evaluation of the Acutely Cold Foot

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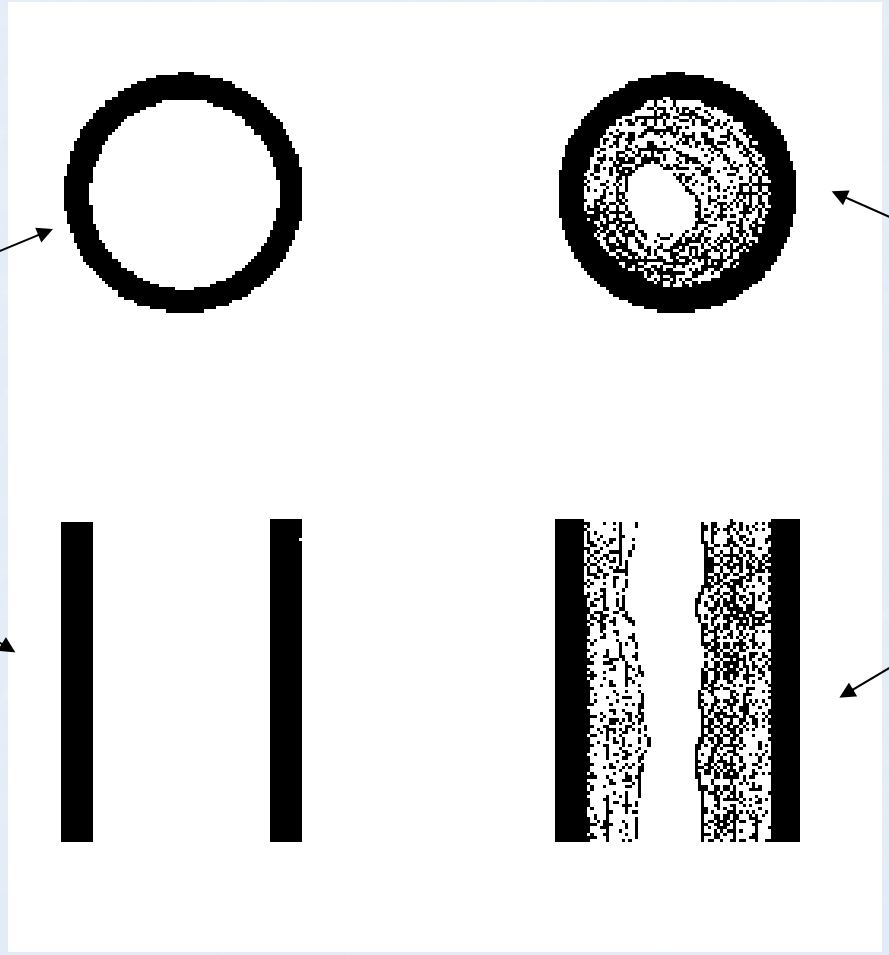
Peripheral Vascular Disease of the Lower Extremities

- 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

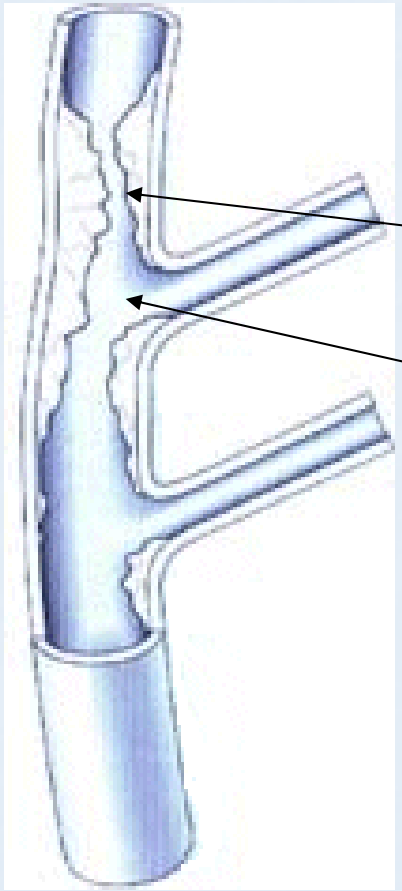
Atherosclerosis

- 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 → Decreased O2 supply → Anaerobic metabolism → Increased Lactic Acid → 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

	Claudication	**Pseudo…**
Character	Cramping and tightness	same
Location	Buttocks, hips, calves, thighs, feet	same
Exercise Induced	Yes	No
Distance to symptoms	Reproducible	variable
Symptoms with standing	No	Yes
Relief	Stop walking	Change position

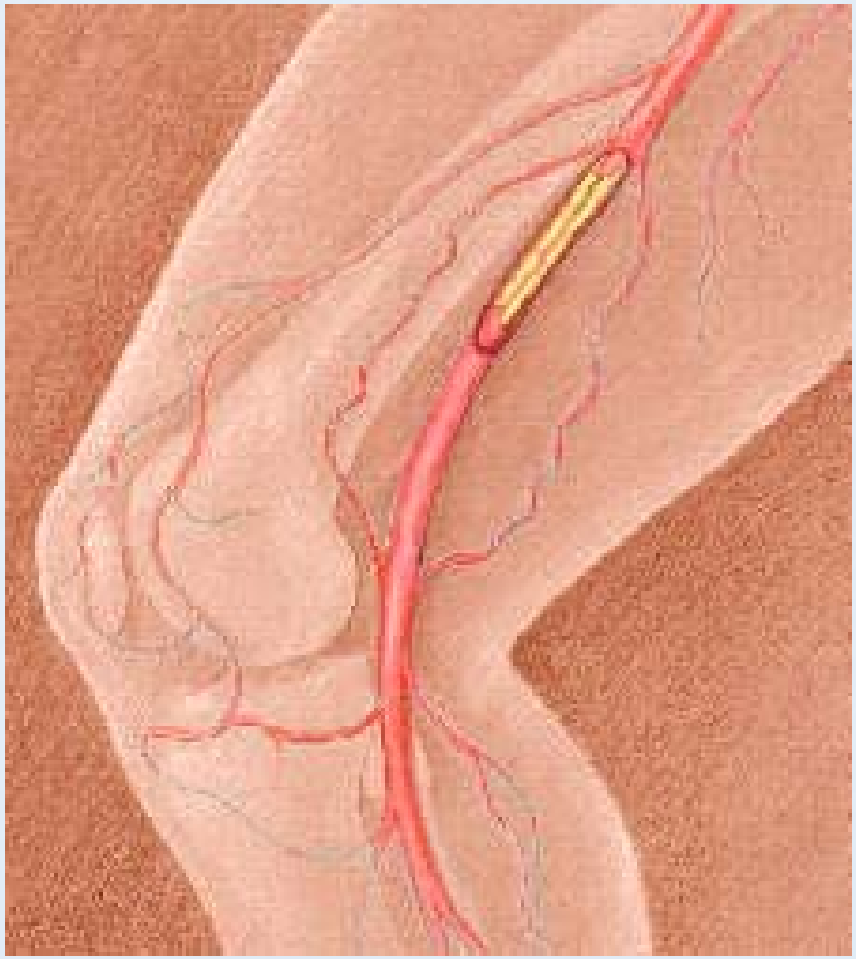
Clinical Presentation

- 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

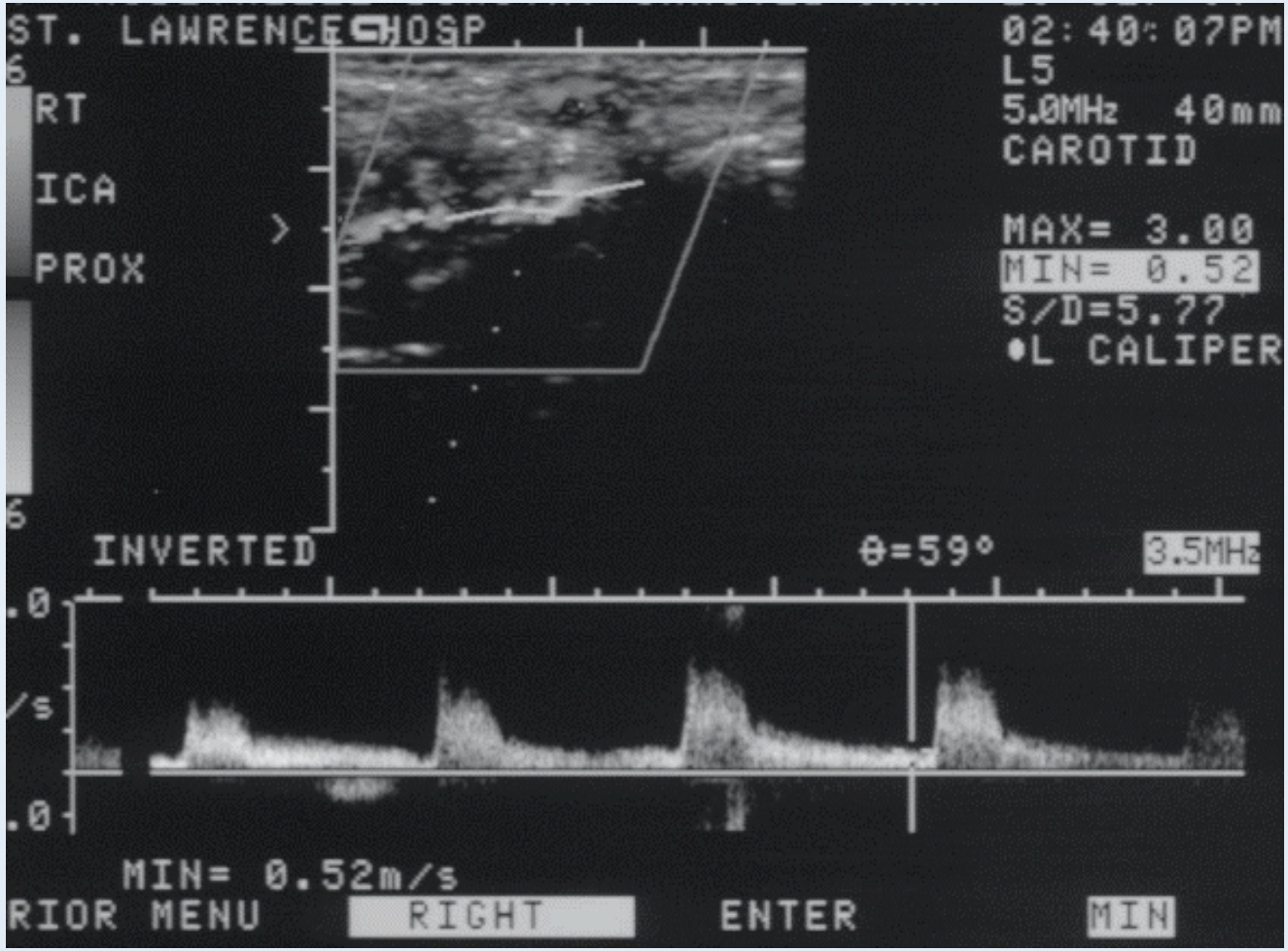
- Advantages
  - Gold standard for demonstrating anatomy of disease
  - Provides therapeutic opportunities: eg.PTA
- Disadvantages
  - Invasive: risk of hemorrhage, aneurysm,infection
  - Contrast load is nephrotoxic

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

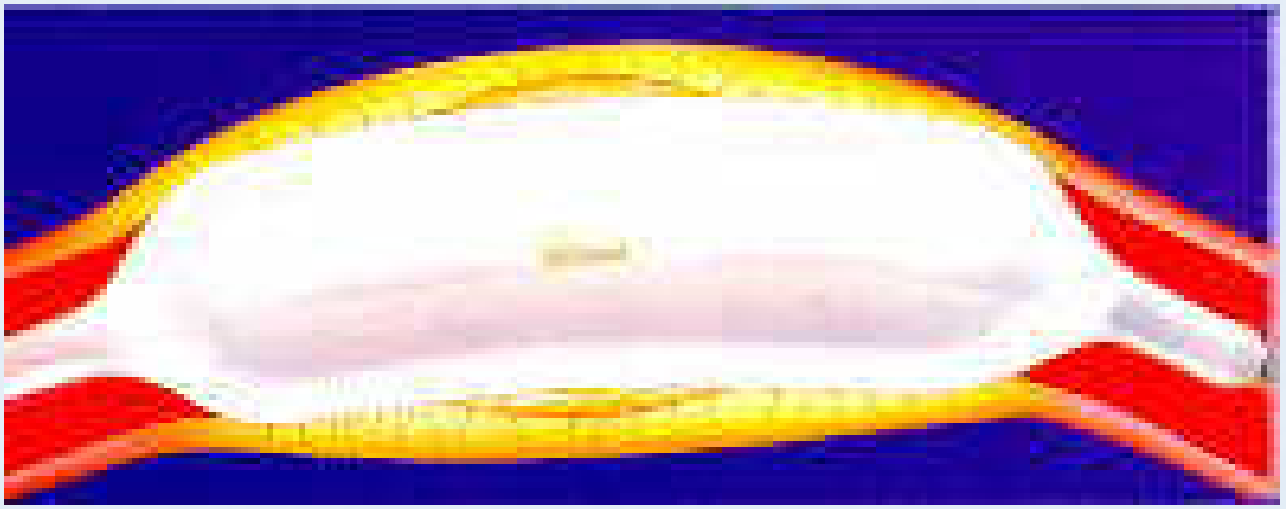
- Ischemic rest pain/ulcer/gangrene
  - Must first determine how patient uses limb
  - Angioplasty vs. Revascularization
  - Gangrene or blackened toes require amputation but revascularization may preserve level and use of limb.

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

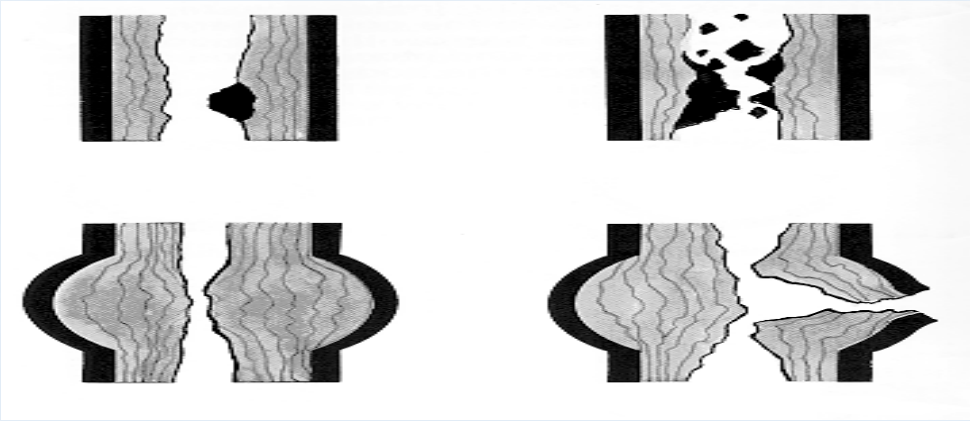
Surgical Options for Ischemia

- 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