

# Vascular Surgery

Peripheral Vascular Disease and  
Evaluation of the Acutely Cold Foot

*Dr. Jason Alexander – Dr. Melanie Walker*

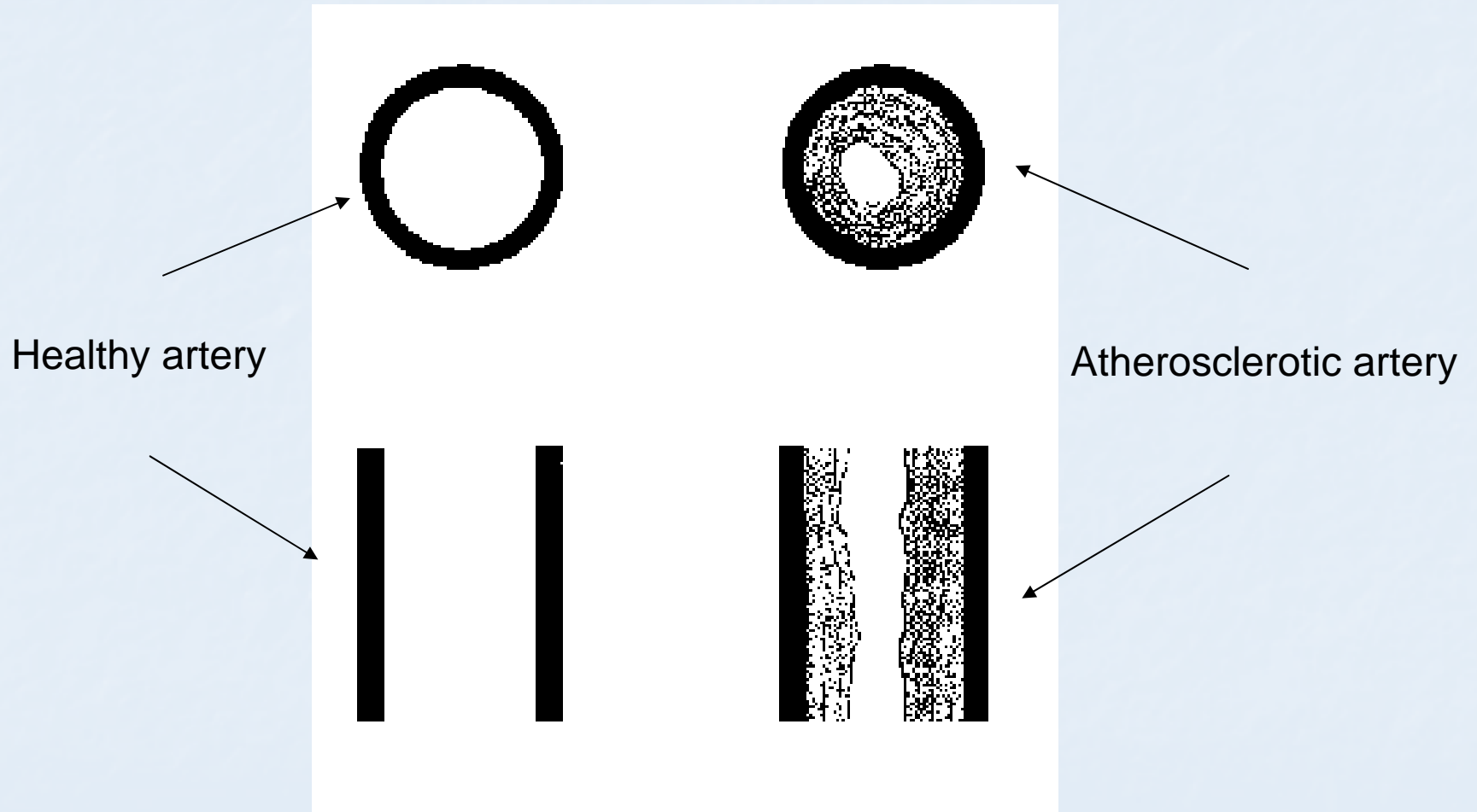
# Peripheral Vascular Disease of the Lower Extremities

- 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



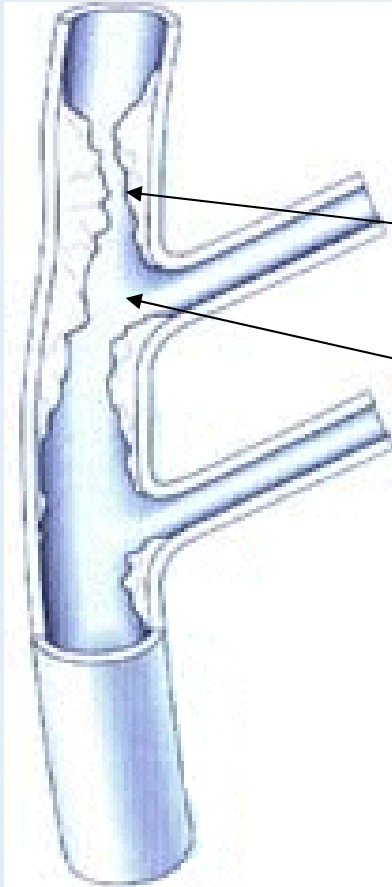
# Atherosclerosis

- 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 O<sub>2</sub> 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

|                               | <b>Claudication</b>                  | <b>Pseudo...</b> |
|-------------------------------|--------------------------------------|------------------|
| <b>Character</b>              | Cramping and tightness               | same             |
| <b>Location</b>               | Buttocks, hips, calves, thighs, feet | same             |
| <b>Exercise Induced</b>       | Yes                                  | No               |
| <b>Distance to symptoms</b>   | Reproducible                         | variable         |
| <b>Symptoms with standing</b> | No                                   | Yes              |
| <b>Relief</b>                 | 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

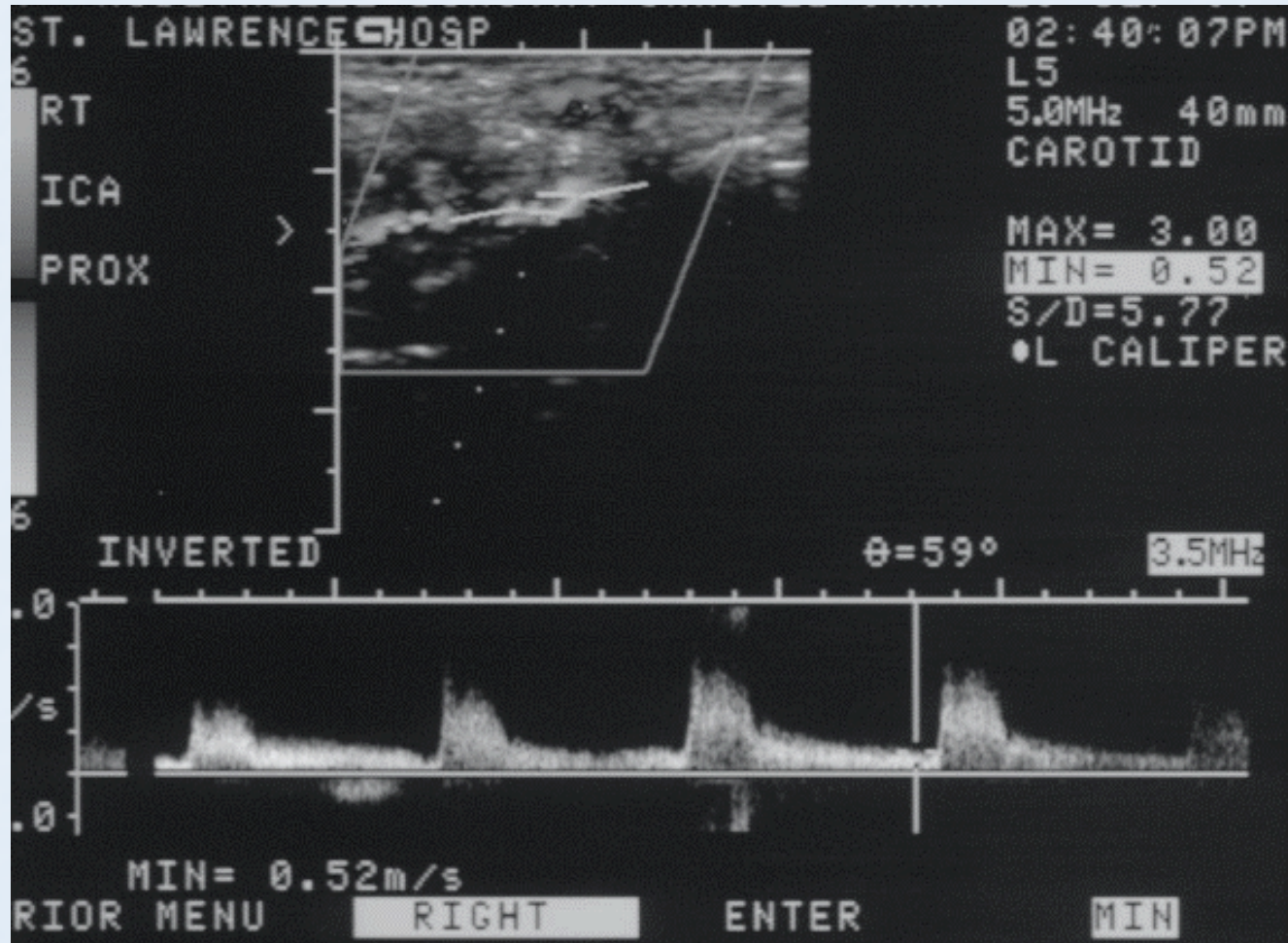
# Arteriography



# 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
  - Pentoxifyphylline
  - 75% improve with non-operative management

# Claudication: Treatment

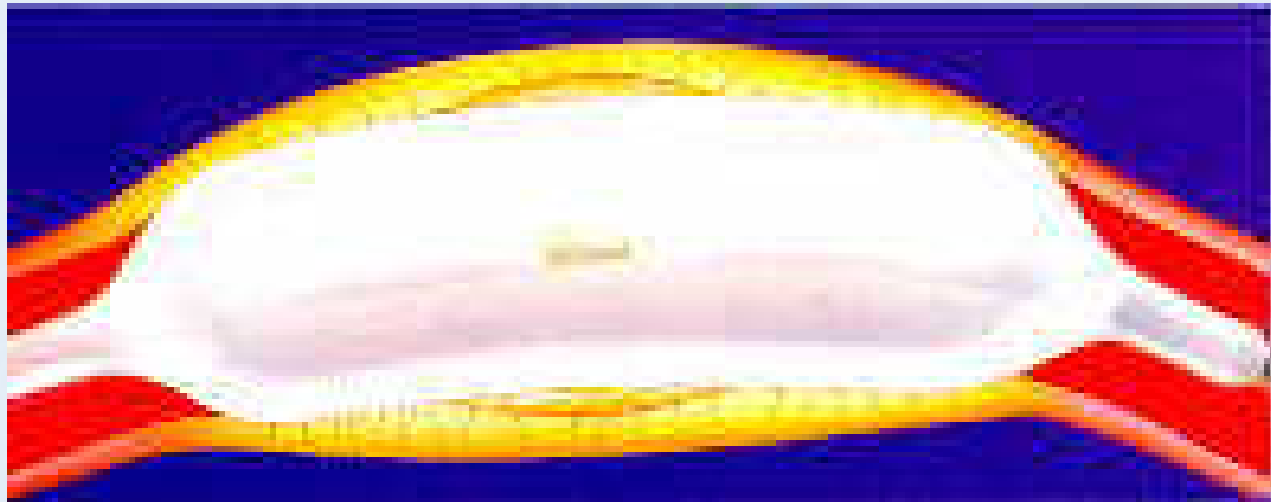
- Ischemic rest pain/ulcer/gangrene
  - Must first determine how patient uses limb
  - Angioplasty vs. Revascularization
  - Gangrene or blackened toes require amputation but revascularization may preserve level and use of limb.

# Acute Ischemia: Diagnosis

- “The cold foot”
- Rapid onset
- Pain
- Pallor
- No pulse
- Numbness or paralysis

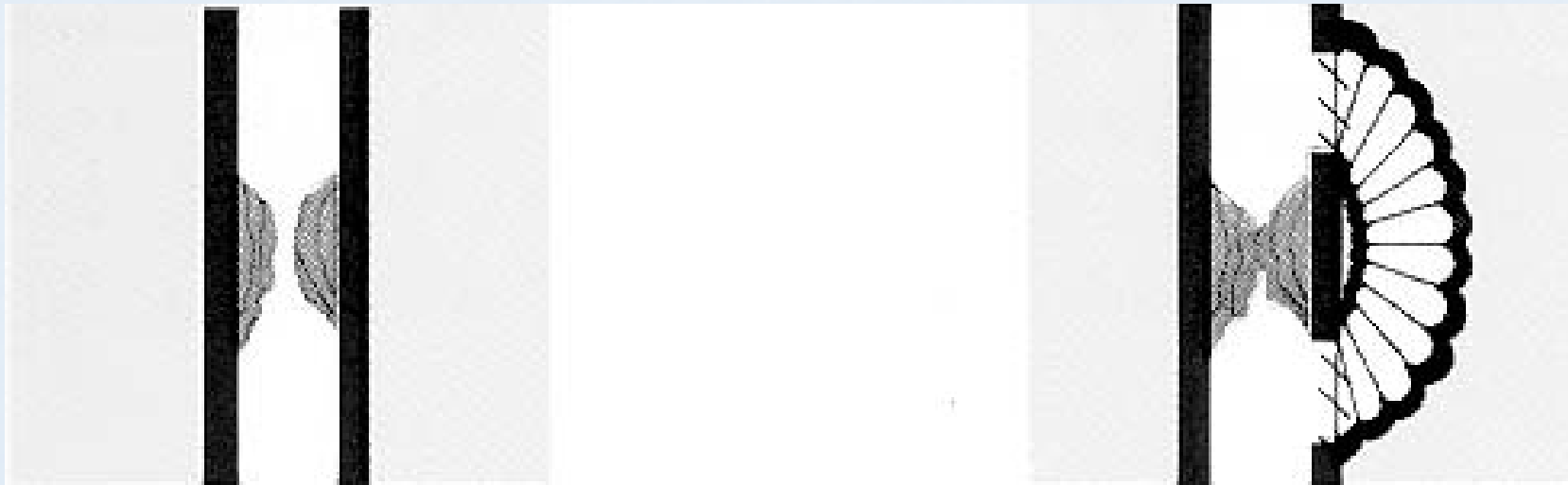
# Acute Ischemia: Therapy

- Angioplasty to disrupt thrombus



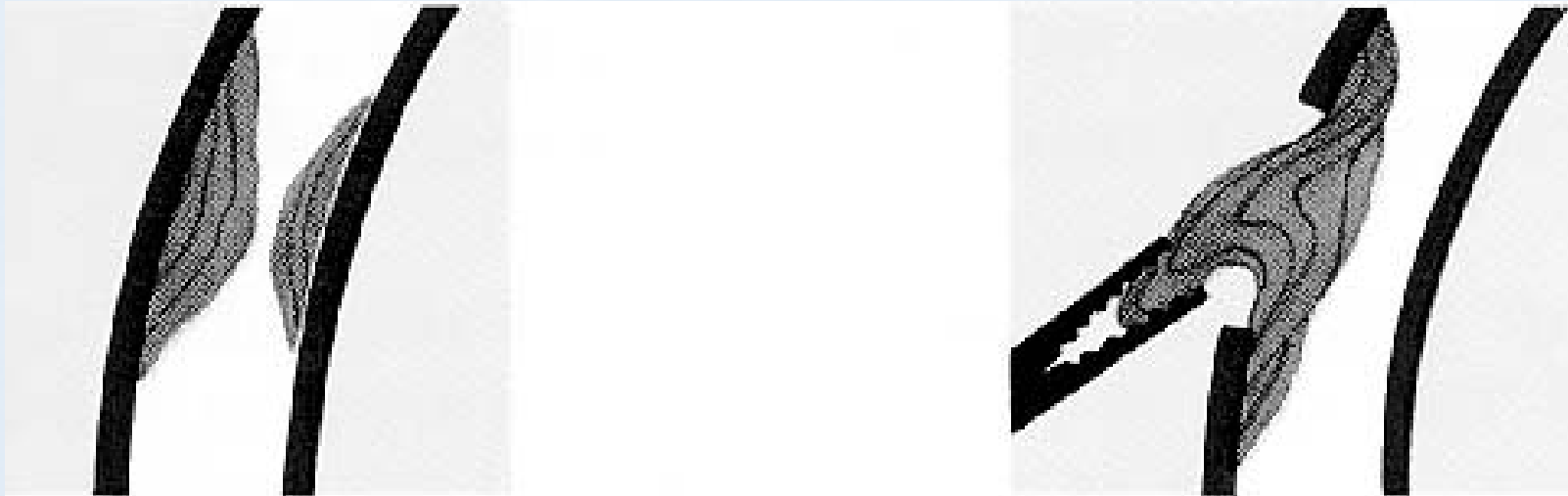
# Acute Ischemia: Therapy

- 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

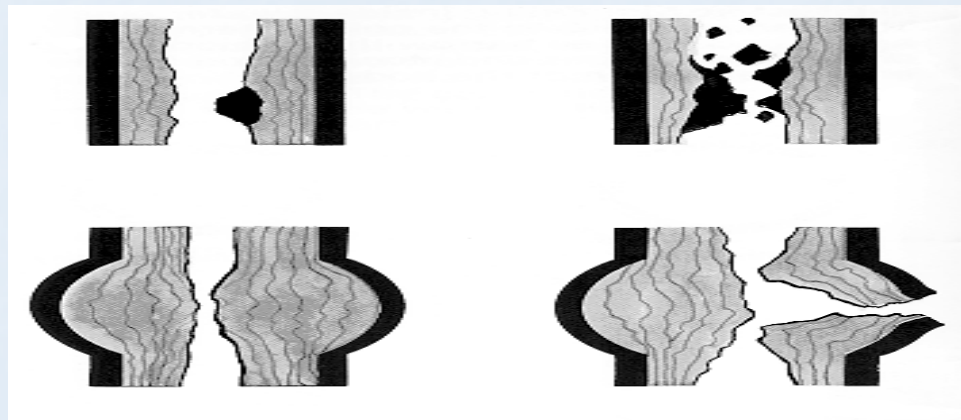
# Surgical Options for Ischemia

- 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