



## Peripheral Arterial Disease

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THE OHIO STATE UNIVERSITY  
 WEXNER MEDICAL CENTER

## Overview

- Definition
- Pathophysiology of disease
- Risk factors
- Clinical presentations
- Therapy: medical
- Therapy: surgical
  - Indications
  - Choice of intervention
  - Outcome measures
- Surveillance

## Overview

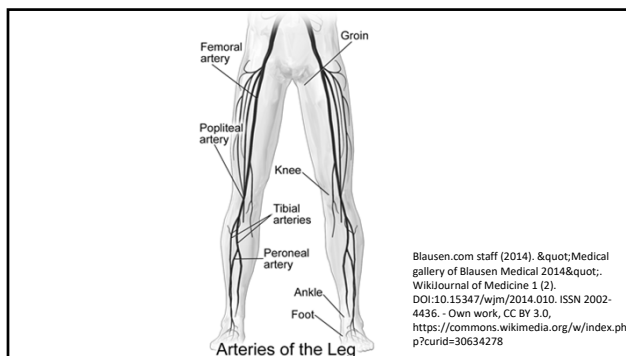
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## Definition: what is peripheral vascular disease?

- Atherosclerosis of the arteries of the lower extremity
- Accumulation and deposition of lipid and fibrous material between the layers of the arterial wall

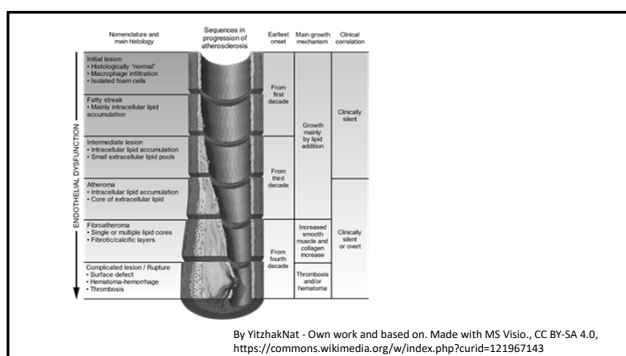
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## Pathophysiology

- Subintimal accumulation of lipid and fibrous material narrows the vessel lumen
- Can lead to eventual thrombosis or plaque rupture and distal embolic events
- Reduced skeletal muscle area and increased fat infiltration, development of sarcopenia



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## Risk factors

- Age (10% of adults over than 55 years old)
- F>M
- Tobacco abuse
- Hyperlipidemia
- Hypertension
- Diabetes
- Chronic Kidney disease



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## Clinical presentation: chronic

- Asymptomatic
  - Single-level disease
  - Development of collaterals
- Three times as many asymptomatic patients as symptomatic patients



### Clinical presentation: chronic

- Claudication: pain with ambulation
- “claudico”: to limp
- Reproducible discomfort of defined muscle group
  - Induced by exercise
  - Subsides with rest
- <1% risk of limb loss per year



### Clinical presentation: chronic

- Critical limb-threatening ischemia
  - Rest pain
  - Non-healing wounds
- 25% risk of limb loss per year



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### Clinical presentation: chronic

Rutherford classification

Stage	Symptom	Management
0	Asymptomatic	Medical management
1	Mild claudication	Medical management
2	Moderate claudication	Medical management
3	Severe claudication	Medical management vs. revascularization
4	Rest pain	Revascularization
5	Minor tissue loss (ischemic nonhealing ulcer, focal gangrene)	Revascularization
6	Major tissue loss (extending above transmetatarsal level)	Revascularization and amputation

### Clinical presentation: acute

- Acute pain – typically embolic in pathophysiology

Rutherford staging

Stage	Neuro exam	Pulse exam
1	No motorsensory deficit	Arterial and venous signals present
2A	Minimal sensory loss, No muscle weakness	Arterial signal often not present Venous signals present
2B	Sensory loss involving the foot Mild to moderate muscle weakness	Arterial signal not present Venous signal present
3	Profound sensory loss Paralysis	Arterial signal not present Venous signal not present

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## Diagnostic testing: physical examination

- Inspection:
  - Hair loss
  - Wound
  - Skin discoloration
  - Mottling
- Palpation:
  - Cool

## Diagnostic testing: physical examination

- Pulse examination:
  - Femoral, popliteal, posterior tibial, dorsalis pedis
  - \*\*pulses must be PALPABLE; if doppler only, then it is SIGNAL
  - Level of loss of pulse generally correlates with physical exam

## Diagnostic imaging: physical examination

- Neuro examination
  - Dorsiflexion, plantar flexion
  - Sensation

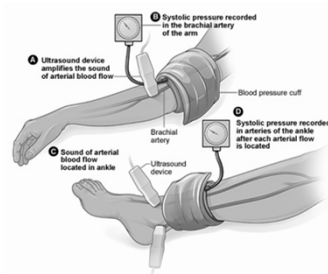
## Diagnostic testing:

- If decreased pulse or no pulse, first check ABI

ABI	Interpretation	Recommendation
>1.4	Generalized calcinosis	Referral to specialist
1.0 – 1.4	Normal	None
0.9 – 1.0	Reasonable	None
0.8 – 0.9	Mild PAD	Risk factor modification
0.5 – 0.9	Moderate PAD	Referral to specialist
<0.5	Severe PAD	Referral to specialist

## Diagnostic imaging

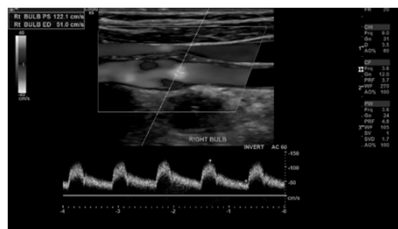
- Ankle-brachial index



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## Diagnostic imaging

- Arterial duplex
  - B mode: extent of atherosclerosis
  - Doppler: flow velocity, velocity ratio, waveforms



## Diagnostic imaging

- CT Angiogram
  - Generally not useful for assessing infra-geniculate vasculature

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## Therapy: medical

- Risk factor modification:
  - Anti-platelet therapy
  - Lipid-lowering therapy
  - Diabetes management
  - Hypertension therapy
  - Smoking cessation
  - Diet
  - Exercise
- Supervised walking program
- Vasodilator therapy
- Foot care

## Therapy: Anti-platelet

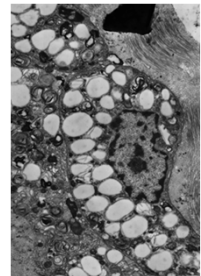
- Long-term antiplatelet therapy has been demonstrated to reduce risk of future cardiovascular events
- Either aspirin or Plavix are appropriate
  - +/- low dose Xarelto



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## Therapy: lipid-lowering agent

- At least moderate-dose statin irrespective of LDL cholesterol recommended
  - Heart Protection Study: 22% risk reduction in first major vascular event
  - Retrospective study of statin therapy in CLTI patients – lower mortality and major adverse limb event rate over median 380 days



Cells with myelin figures and lipid droplets. Credit: Rob Young. Attribution-NonCommercial 4.0 International (CC BY-NC 4.0)

### Therapy: glycemic control

- Hgb A1c goal <7
- Improved cardiovascular outcome
- Improved wound healing



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### Therapy: hypertension

- Selection of therapy consistent with current published guidelines based upon epidemiology
- Normotension does not worsen claudication or functional status in patients
- Beta-blockade – typically utilized given concomitant coronary artery disease



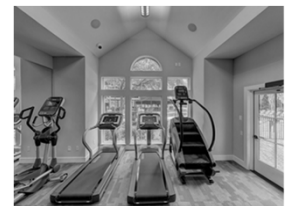
### Therapy: smoking cessation

- Should include pharmacotherapy
  - Varenicline
  - Bupropion
  - Nicotine replacement
- Referral to smoking cessation program
- No increased cardiovascular event rates with pharmacotherapy



### Therapy: walking program

- Supervised preferred
- All programs should be progressive and individually prescribed
- Aim to accumulate 30 minutes of aerobic activity, three times a week, for three months
- Walking exercise to near-maximal claudication pain
- Treadmill or walking
- Resistance training as alternative modality





### Therapy: vasodilator (cilostazol)

- Phosphodiesterase inhibitor
  - Suppression of platelet aggregation
  - Direct arterial vasodilator
- Several meta-analyses have shown significantly greater increases in maximal walking distance and pain-free walking distance
- Benefits noted at 4 weeks after initiation of therapy
- Safe to use concomitantly with DAPT without increase in bleeding time
- Side effects:
  - Headache, loose stool, diarrhea, dizziness, palpitations
- Contraindicated in severe heart failure

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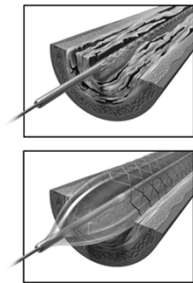
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### Therapy: surgical

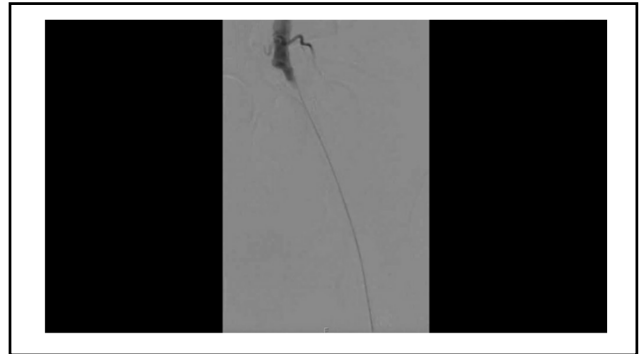
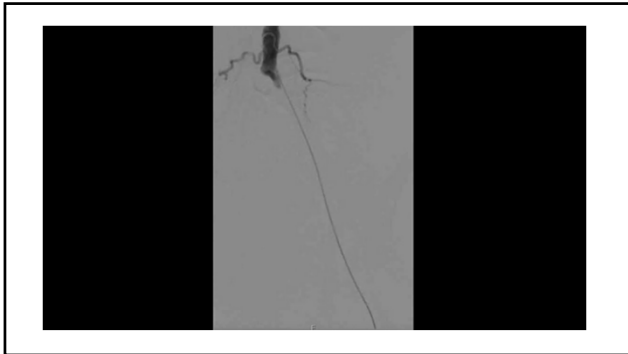
- Indications
  - Lifestyle-limiting claudication
  - Rest pain
  - Non-healing wound
  - Acute limb ischemia

### Therapy: Endovascular

- Angiography:
  - Diagnostic
  - Therapeutic
- Therapeutic options:
  - Balloon angioplasty
  - Drug-coated balloon angioplasty
  - Stent
- Adjuncts post-procedure
  - Anti-platelet therapy (DAPT)
  - Anti-thrombotic therapy



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### Therapy: surgical bypass

- Extensive lesions
- Failure of endovascular therapy
- Contraindication:
  - Limited functional capacity
  - Non-ambulatory
  - Prohibitive medical risk
  - Non-salvageable extremity

### Therapy: surgical bypass

- Target selection
  - Good inflow vessel
  - Adequate outflow vessel
- Conduit
  - Vein
    - Better patency overall
  - Prosthetic
- Overall patency
  - level of bypass (infrainguinal, infrageniculate)
  - conduit

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## Surveillance

- Clinical exam
- Post-procedure ABI, graft duplex (if bypass)
  - 1 month, 3 month, every 6 months thereafter