Peripheral Vascular Disease

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Disclosers:
None

What IS Peripheral Vascular Disease?

- Also called Peripheral Artery Disease (PAD)
- **Narrowing** or **Occlusion** by (usually) atherosclerotic plaques of arteries outside of the heart and brain
- Arterial Insufficiency
Manifestations of PVD

- Arm or Leg Ischemia
- TIAs or strokes
- Bowel Ischemia
- Uncontrolled HTN/Renal Failure

Natural History of LE PVD

Normal Artery Structure & Function

Intima - endothelium, basement membrane, and the subendothelial space, which extends to the internal elastic laminae

Media - SMCs

Adventitia - vasa vasorum and connective tissue elements
Evolution of PVD

• Despite the wide range of manifestations, culprit lesions are more alike than different.

• Accumulation of large amounts of cholesterol ester in the arterial wall, formation of complex advanced plaque are common to all these lesions.

• Insidiously spans decades, atherosclerotic lesions can reach a clinical horizon within minutes and manifest as catastrophic MI, stroke, or limb ischemia.

Theories of Pathogenesis

• Lipid Hypothesis –
  - Nikolai Anitschkow produced vascular lesions in rabbits feeding them purified cholesterol dissolved in sunflower oil.
  - Discovery of the defective gene associated with familial hypercholesterolemia by Goldstein and Brown.

• Response to Injury Hypothesis –
  - All response-to-injury hypotheses have emphasized the primacy of the endothelium in stimulating the cascade of events leading to lesion formation.

• Monoclonal Hypothesis –
  - Each lesion of atherosclerosis is derived from a single SMC that serves as a precursor for the clonal expansion of proliferating SMCs.

Atherosclerotic Artery

Media SMCs: proteins involved in the contractile function of the cell.
Intima SMCs: lower levels of these proteins, higher proliferative index, and exhibit greater synthetic capacity for extracellular matrix, proteases, and inflammatory cytokines.

- 5 to 46 times more collagen than “contractile” SMCs can contribute to intimal thickening as a result of increased proteoglycan production, inflammatory cell recruitment, and retention of atherogenic particles within the subendothelial space.
Atherosclerotic Artery

- Advanced lesions, or fibrous plaque
- Extracellular lipid and fibrous connective tissue: whitish in gross appearance and are elevated so that they protrude into the lumen
- "Fibroatheromas" are prone to produce clinical sequelae by erosion of the surface endothelial cells, rupture of the fibrous cap, erosion of a calcium nodule, or intraplaque hemorrhage

Atherosclerosis - Chronic Inflammation

- LDL Retention
- Monocytes → Macrophages
- Lymphocytes and Adaptive Immunity
- Smooth Muscle Cells
- Calcification
- The Inflammasome
  (complex of intracellular proteins)

Plaque Regression


Atherosclerotic Risk Factors

- **Smoking**
- **Diabetes mellitus**
- **Hyperlipidemia**
- **Hypertension**

  - **Advanced age** (inc’d 1.5- to 2.0-fold for every 10-year rise)
  - **Overweight and obesity** (5-unit increase in BMI, about a 30% increase in PAD prevalence and incidence.)
  - **Physical inactivity**
  - **Gender**: male sex, postmenopausal women
  - **Insulin resistance**
  - **Family history** and genetics

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**Prevalence of PVD**

- Stroke
- PAD
- CHD

PAD prevalence affects 8.1 million Americans.

By 2030, the prevalence is expected to reach 13 million.

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**PVD Prevalence in At Risk Patients**

- The PARTNERS* program evaluated 8,979 patients in physicians’ offices.
- **Patient criteria:**
  - ≥70 years, or
  - 50-69 years with a history of smoking and/or diabetes

29% of patients were diagnosed with PAD.
Diagnosing PVD

- Ankle-brachial index
- Segmental limb pressures
- Pulse volume recordings
- Doppler velocity waveform analysis
- Functional testing
  - Treadmill exercise testing
- Duplex scanning
- Advanced imaging techniques

Diagnosing PVD

<table>
<thead>
<tr>
<th>ARTERIAL CONDITIONS</th>
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<tbody>
<tr>
<td>Intermittent</td>
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<tr>
<td>classification</td>
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<tr>
<td>classification</td>
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<td>of the leg, thigh,</td>
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<tr>
<td>buttocks</td>
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<tr>
<td>Physiologic</td>
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<td>entrapment</td>
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Diagnosing PVD

<table>
<thead>
<tr>
<th>VENOUS CONDITIONS</th>
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<tr>
<td>Venous</td>
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<tr>
<td>classification</td>
</tr>
<tr>
<td>Venous</td>
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<tr>
<td>compartment</td>
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<tr>
<td>syndrome:</td>
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<tr>
<td>Typical: DVT</td>
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Diagnosing PVD

### Neurologic Conditions
- Radiculopathy (radiating, usually posterior)
- Sharp lancinating pain
- Spasms, if not immediately after onset
- Not quickly relieved if present at onset
- Referral may be needed by adjustment of back position
- History of back problems

### Neuropraxia Conditions
- Hip flexion, radiculopathy (neuropathy)
- Weakness more than pain
- After walking or standing for some time
- Pain relieved by depending upon feet
- Less common
- History of back problems

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Diagnosing PVD

### Orthopedic Conditions

<table>
<thead>
<tr>
<th>Hip arthritis</th>
<th>Hip flexion, radiculopathy</th>
<th>march discomfort</th>
<th>not quickly relieved</th>
<th>patient is more comfortable sitting with weight on leg</th>
<th>variable, may relate to activity level, weather changes</th>
</tr>
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Asymptomatic PVD

- Multidisciplinary comprehensive smoking cessation interventions for patients with asymptomatic PAD who use tobacco (repeatedly until tobacco use has stopped)

- Do NOT recommend invasive treatments for PAD in the absence of symptoms, regardless of hemodynamic measures or imaging findings demonstrating PAD.
Medical Treatment for IC

- Smoking Cessation
- Statin
- BP control (SBP<140 or <130 with risk factors)
- DM control (HgbA1c <7%)
- ASA 75mg-325mg
- Supervised exercise program consisting of walking a minimum of three times per week (30-60 min/session) for at least 12 weeks to all suitable patients with IC.
- If no CHF, 3-month trial of Cilostazol (500 mg twice daily) to improve pain-free walking
- If cannot tolerate or have contraindications for cilostazol, we suggest a trial of Pentoxifylline (400 mg thrice daily) to improve pain-free walking.

Antiplatelet Therapy for PVD

An analysis of the risk of death, myocardial infarction, and stroke of antiplatelet therapy.
### Aspirin and Plavix?

- **Placeto + ASA:** 7.3%
- **Clopilol + ASA:** 8.8%
- **RRR:** 1.71% [95% CI 4.4%, 28.1%]  
  \( p = 0.01 \)

*For patients with prior myocardial infarction, stroke or symptomatic peripheral arterial disease in the CHARISMA trial.*


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### Cardiovascular Events with PVD

- **2–3x**
- **4x**
- **6x**

- **Patients with symptomatic PVD** have a 2–3x the greater risk of all-cause death from CVD compared with those who have no PVD.

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### Interventions for PVD

- **Specifically for Intermittent Claudication (IC)**
  - Significant functional or lifestyle-limiting disability
  - There is a reasonable likelihood of symptomatic improvement with treatment
  - Pharmacologic or exercise therapy, or both, have failed
  - Benefits of treatment outweigh the potential risks
Interventions for PVD

- Specifically for AIOD
- EVT preferred to open surgical therapy
- Exceptions: multiple failed attempts
- AIOD with concomitant CFA disease (hybrid procedures)
- AIOD with concomitant aneurysmal disease

Aortofemoral Bypass
- Primary patency at 5 years of 81-85%
- Perioperative mortality 5-8%
- Indicated for Rutherford class ≥ 3

Percutaneous Intervention
- Patency at 5 years of 65-80%
- Perioperative mortality 0.1%
- Treatment of choice
- Indicated for Rutherford class ≥ 2

AIOC and Aneurysmal Disease
Interventions for PVD

- Specifically for FPOD
- EVT over open surgery for focal occlusive disease of the SFA artery not involving the origin at the femoral bifurcation.
- Focal lesions (<5 cm) in the SFA that have unsatisfactory technical results with balloon angioplasty, use stent.
- Intermediate-length lesions (5-15 cm) in the SFA, adjunctive use of self-expanding nitinol stents (with or without paclitaxel) to improve the midterm patency.
- Preoperative ultrasound vein mapping to establish the availability.

Femoro-Popliteal Bypass Surgery
- Primary patency at 5 years of 60-80%
- Autologous veins preferred to synthetic grafts
- Perioperative mortality 0-3%

Femoro-Popliteal Angioplasty
- Patency at 2 years ranges between 40-70%
- Technical problems due several anatomic issues:
  - Occlusions vs stenosis
  - Diffuse disease
  - Adductor canal
  - Disease in run off vessels
- Perioperative mortality is very low

Femoropopliteal Disease
Interventions for PVD

- Infrapopliteal Disease

- EVT of isolated infrapopliteal disease for IC because this treatment is of unproven benefit and possibly harmful.
Infrapopliteal Disease

Surveillance

- Vein Grafts for IC monitored with a surveillance program that consists of clinical follow-up and duplex scanning
- If a significant graft stenosis on DUS be considered for prophylactic re-intervention (open or endovascular) to promote long-term bypass graft patency

Thank you