PERIPHERAL VASCULAR DISEASE: CONCEPTS IN EVALUATION AND TREATMENT

W. Anthony Lee, MD, FACS
Chief, BocaCare Vascular Surgery
Christine E. Lynn Heart and Vascular Institute
Boca Raton, Florida
Disclosures

- No disclosures relevant to this presentation
Q1.

- 79 yo M, R calf cramping at 100 feet, relieved with rest and palpable R pedal pulse. The patient
  1. does not have vasculogenic claudication
  2. may have vasculogenic claudication
  3. definitely has vasculogenic claudication
Q2.

- 79 yo M, h/o CAD, HTN with 6m h/o constant calf pain and numbness relieved with walking. ABI 0.6/0.7. Next step should be

1. immediate referral to vascular surgeon
2. immediate angiogram and intervention
3. initiate w/u for non-vasculogenic etiologies of leg pain
Q3.

- 79 yo M, with 1 block thigh/calf claudication. The NEXT diagnostic test should be:
  1. ABI w/ exercise
  2. arterial duplex ultrasound only
  3. angiogram
Q4.

- 79 yo M, severe COPD/DOE, home O2/steroids, ambulates 5 steps w walker, c/o calf-ankle swelling/redness/pain. Arterial/venous leg dopplers show no DVT, SFA occlusion and ABI 0.6/0.7. Treatment options may include all of the following EXCEPT:

1. compression stockings for lymphedema and/or venous insufficiency
2. antibiotics for cellulitis
3. angioplasty and/or stent for SFA occlusion
Scope of Peripheral Vascular Disease
Peripheral Vascular Disease

- Aortic Aneurysms
- Carotid Stenosis
- Lower Extremity Occlusive Disease
- Venous Thrombosis
Brief Anatomic Review

- **Internal iliac artery**
- **External iliac artery**
- **Superficial femoral artery**
- **Deep femoral artery**
- **Popliteal artery**
- **Anterior tibial artery**
- **Posterior tibial artery**
- **Peroneal artery**
Peripheral Vascular Disease

- Progressive process of stenosis and acute-on-chronic occlusion (typically from atherosclerosis) in the major and medium-sized arteries
Lesion Types

- Focal vs. diffuse
- Stenosis
- Chronic total occlusion (CTO)
- Soft plaque
- Calcific disease
- Intimal hyperplasia
- Acute thrombosis
- Embolic
Demographics

- **Prevalence**
  - 8-10 million people in US
  - 12 - 20% of adults over the age of 65
  - 75% (50% asymptomatic + 25% atypical leg pain) require NO treatment
    - Don’t look for it!!!
Spectrum of Clinical PVD

- Claudication: ~20-25%
- Critical limb ischemia: ~1-2%
  - Untreated CLI: ~25% amputation, ~25% CV-related death @ 6-months
Risk Factors

- Age >70 years
- CAD/Stroke
- Smoking
- Diabetes
- Hyperlipidemia
- Hypertension
- Antiplatelet tx
- Sedentary lifestyle

MODIFIABLE
Classifications for LE Ischemia

### Table 1: Fontaine Classification System for Peripheral Artery Disease

<table>
<thead>
<tr>
<th>Stage</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>IIa</td>
<td>Mild claudication</td>
</tr>
<tr>
<td>IIb</td>
<td>Moderate-severe claudication</td>
</tr>
<tr>
<td>III</td>
<td>Ischemic rest pain</td>
</tr>
<tr>
<td>IV</td>
<td>Tissue loss or ulceration</td>
</tr>
</tbody>
</table>


### Table 2: Rutherford’s Classification of Peripheral Arterial Disease*

<table>
<thead>
<tr>
<th>Grade</th>
<th>Category</th>
<th>History</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Asymptomatic</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>Mild claudication</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Moderate claudication</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Severe claudication</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Ischemic rest pain</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Tissue ulceration (minor)</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Tissue loss/gangrene</td>
</tr>
</tbody>
</table>

Critical Limb Ischemia (CLI)

- Rest pain (Fontaine III, Rutherford Grade II-Category 4)
- Tissue loss (Fontaine IV, Rutherford Grade III-Categories 5, 6)
TASC Classification
Trans-Atlantic Inter-Societal Consensus

ENDOVASCULAR

SURGERY

Type A lesions
- Single stenosis ≤10 cm in length
- Single occlusion ≤5 cm in length

Type B lesions:
- Multiple lesions (stenoses or occlusions), each ≤5 cm
- Single stenosis or occlusion ≤15 cm not involving the infrageniculate popliteal artery
- Single or multiple lesions in the absence of continuous tibial vessels to improve inflow for a distal bypass
- Heavily calcified occlusion ≤5 cm in length
- Single popliteal stenosis

Type C lesions
- Multiple stenoses or occlusions totaling >15 cm with or without heavy calcification
- Recurrent stenoses or occlusions that need treatment after two endovascular interventions

Type D lesions
- Chronic total occlusions of CFA or SFA (>20 cm, involving the popliteal artery)
- Chronic total occlusion of popliteal artery and proximal trifurcation vessels
Examples

TASC A
TASC B
TASC B
TASC C
TASC D
# Intrainguinal PAD

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Claudication</th>
<th>Rest Pain</th>
<th>Tissue Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rutherford</strong></td>
<td>0</td>
<td>1-3</td>
<td>4</td>
<td>5-6</td>
</tr>
<tr>
<td><strong>Fontaine</strong></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td><strong>ABI</strong></td>
<td>1.1-0.9</td>
<td>0.8-0.5</td>
<td>0.4-0.0</td>
<td></td>
</tr>
<tr>
<td><strong>TASC</strong></td>
<td>N/A</td>
<td>A-B</td>
<td></td>
<td>C-D</td>
</tr>
</tbody>
</table>
Diagnosis: Symptoms

- Reproducible pain ("crampy") and/or fatigue with walking, relieved with rest (intermittent claudication)
- Numbness, pain, paresthesia localized to the toes (esp. 1st toe) and/or the instep at night, relieved with dependent positioning (metatarsalgia/rest pain)
Diagnosis: Signs

- None
- Mild muscle wasting
- Hair loss
- Shiny skin
- Dependent rubor

- Coolness
- Pallor
- Tissue loss
- Sensory change
- Motor change
Diagnostic Studies: Physiologic

- Vascular Lab
  - ICAVL accreditation ("Good Housekeeping" seal)—ACCEPT NO SUBSTITUTES
  - Validation
  - "garbage in, garbage out"

- The most important diagnostic tool (2\textsuperscript{nd} to a careful H&P)

- May be the ONLY preoperative diagnostic study required
Diagnostic Studies: Physiologic

- Single most important study
  - ABI (resting)—ankle-brachial index
  - Segmental pressures
- False negative (decreased arterial compressibility)
  - Diabetes
  - CKD/HD
  - Calcinosi
ABI

- The higher of the 2 ratios obtained by dividing the calf pressure required to occlude either DP or PT doppler signal by the higher of 2 brachial pressures
When ABI’s Fail

- PVR (pulse volume recording)—waveform analysis
- TBI (toe brachial indices)
- Exercise ABI
  - Increased sensitivity for hemodynamically significant lesion
Diagnostic Studies: Anatomic

- Do NOT order if you are going consult vascular surgery
- Optimal study dependent on clinical presentation
- Non-Invasive
  - Arterial duplex ultrasound
  - CT angiography (CTA)
  - MR angiography (MRA)
- Angiography
Non-Invasive Imaging

- Optimal approach to lesion (L vs. R, brachial vs. femoral, etc.)
- Technical risk assessment (single vs. multi-vessel runoff)
- Endovascular vs. surgical candidacy
- Limitations
  - Complex/multisegmental lesions $\rightarrow$ low flow
  - Duplex: Quality dependent on flow characteristics (eg. proximal lesions underestimate severity of distal lesions)
  - CT & MR: Quality dependent on contrast delivery and bolus timing
  - Pseudo-stenosis/occlusion
Contrast Angiography

- The “Gold Standard”
- Allows simultaneous diagnosis and catheter-based intervention

Limitations

- Contrast nephropathy (1-8%)
- Anaphylaxis (0.1-0.2%)
- Puncture site related complications (4-7%)
Comparing Severity Levels
Example of Migraine Headache

Adapted from Understanding Health Outcomes Educational Series (1998).
Treatment

- Medical
- Surgery
- Endovascular (angioplasty/stenting)

Goals
- Improve quality of life
- Relieve pain
- Heal ischemic ulcers/wounds
- Prevent limb loss
Medical Management

- Risk factor modification
- Drug
  - ASA
  - Statin
  - Pletal (cilostazol)
- Exercise
  - Min: 30 min x 5x/week
- Weight loss
Surgery

- Bypass/Endarterectomy
- “Salvage” therapy for
  - Failed endovascular treatment
  - Unfavorable lesion types
  - Unfavorable lesion locations
- Pros: Durable, Low-Cost
- Cons
  - Maximally-invasive
  - Conduit-limited
Endovascular

- Evidence-based/ “textbook” vs. “real-world”
- First line (invasive) treatment
- Pros: Minimally-invasive
  - Outpatient, low morbidity, rapid recovery
- Cons: Durability, Cost
- Favorable lesions: short, stenotic, non-calcified, large vessel, good outflow, non-diabetic, non-CKD
Tools & Techniques

- Intraluminal PTA +/- stent
- Subintimal PTA
- Cutting balloon PTA
- Cryoplasty
- Laser
- Directional atherectomy
- DES (drug-eluting stent)
- Absorbable stent
Stents

- Bare Metal
- Spiral (coil) stent
- Absorbable
- Drug-Eluting
- Balloon-expandable NiTi stent
Covered Stents

- PTFE + BE (iCast)
- PTFE + SE (Viabahn)
- Spiral covered stent
- PTFE + BE (Jostent)
- Dacron + SE (Wallgraft)
- PTFE + SE (Fluency)
Chronic Total Occlusions (CTO)

- 70-80% overall success
- Recanalization tools and techniques
  - Intraluminal
  - Subintimal
- Re-entry
Aspiration/Thrombus Management

- Thrombo- vs. athero-emboli
- Recognized complication in all interventional procedures
- Mechanical
  - Aspiration
  - Fragmentation
- Pharmaco-lysis
Challenges to SFA Intervention

- Diffuse disease more common (vs. focal)
- Occlusions more common (vs. stenoses)
- Adductor canal (repetitive flexion motion)
- Small diameter, low flow, high resistance
- Frequent outflow disease
66F, DM, ESRF, HTN, L great toe ulcer and rest pain
82 yo M w/ HTN, R LE short distance claudication
PVD Management

Clinical PVD?
- N (DDx, Exp Mgmt)
- Y

Symptoms
- N
- Y

Physiology
- N (DDx, Exp Mgmt)
- Y

Anatomy
- N (DDx, Exp Mgmt)
- Y (Intervention)

H & P

Vascular Lab

Angiogram