Advances in Diagnosis and Management of PAD

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Atherothrombosis in Contemporary Practice: The REACH REGISTRY
Steg et al. JAMA March 21, 2007; 927;1997-06.

Mean age 69 yrs; >75% on statin, ACE/ARB and anti-platelet agents

Revasc 5% 12.38%
Systemic Manifestations of Atherosclerosis

- TIA
- Ischemic stroke
- Q-wave MI
- Non-Q-wave MI
- Unstable angina pectoris
- Renovascular hypertension
- Intestinal ischemia
- Erectile dysfunction
- Claudication
- Critical limb ischemia, rest pain, gangrene, amputation

Arterial Disease Syndromes in the USA

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Annual Incidence (Millions)</th>
<th>Prevalence (Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>0.73</td>
<td>4.6</td>
</tr>
<tr>
<td>TIA</td>
<td>0.50</td>
<td>4.9</td>
</tr>
<tr>
<td>ACS</td>
<td>1.93</td>
<td>12.6</td>
</tr>
<tr>
<td>PAD</td>
<td>---</td>
<td>8–12</td>
</tr>
</tbody>
</table>

Case Presentation

FG is a 65-year-old man with the complaint of lower extremity pain with exertion. He visits his primary clinician who recommends an ABI. The ABI results are abnormal.

The most likely event that FG will experience in the next 10 yr is

1. Worsening leg pain
2. Gangrene and/or amputation
3. Death
4. Myocardial infarction and stroke

Limb and Cardiovascular Outcomes in PAD

Population >55 yr

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent Claudication</td>
<td>5%</td>
</tr>
<tr>
<td>Lower Extremity Amputation</td>
<td>4%</td>
</tr>
<tr>
<td>Major Cardiovascular Event</td>
<td>20%</td>
</tr>
<tr>
<td>Nonfatal Cardiovascular Event</td>
<td>30%</td>
</tr>
<tr>
<td>5-yr Mortality Cardiovascular Cause</td>
<td>75%</td>
</tr>
</tbody>
</table>

Quality of Life in PAD Is Comparable to Chronic Illnesses

Adapted from Ware JE. *Ann Rev Pub Health*. 1995;16:327-354

Assessment of Disease

- Vascular history
- Physical examination
- Noninvasive vascular laboratory tests

Risk Factors for Developing PAD/Intermittent Claudication

<table>
<thead>
<tr>
<th>Protective</th>
<th>Harmful</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2 -1 -1 0 1 2 3 4</td>
<td>-2 -1 0 1 2 3 4</td>
</tr>
<tr>
<td>Male gender (vs female)</td>
<td>Male gender (vs female)</td>
</tr>
<tr>
<td>Age (per 10 yr)</td>
<td>Age (per 10 yr)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Smoking</td>
<td>Smoking</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>Hypercholesterolemia</td>
</tr>
<tr>
<td>CRP (&gt;2)</td>
<td>CRP (&gt;2)</td>
</tr>
</tbody>
</table>

Despite the relative risk associated with male gender (which is age-dependent), the prevalence of PAD is gender-equal in the post-menopausal years.

PAD Anatomy: Sites of Claudication

Regardless of the location of PAD within the lower extremity vasculature, claudication is most frequently localized to the muscles of the calf.
### Understanding the ABI

<table>
<thead>
<tr>
<th>ABI</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.90–1.30</td>
<td>Normal</td>
</tr>
<tr>
<td>0.70–0.89</td>
<td>Mild</td>
</tr>
<tr>
<td>0.40–0.69</td>
<td>Moderate</td>
</tr>
<tr>
<td>&lt;0.40</td>
<td>Severe</td>
</tr>
<tr>
<td>&gt;1.30</td>
<td>Noncompressible vessels</td>
</tr>
</tbody>
</table>

- The ABI does not correlate closely with limb symptoms or severity of claudication
- Request a Toe Brachial Index if vessels noncompressible

### Determination of Ankle-Brachial Index (ABI)

\[
\text{ABI} = \frac{\text{Ankle systolic pressure}}{\text{Brachial systolic pressure}}
\]

- Measure ankle and brachial systolic pressures with handheld Doppler device
- Use highest arm and each ankle pressure
- ABI is 95% sensitive, 99% specific for PAD
- Lower ABI values are inversely related to increased mortality and risk of limb loss

### Other Noninvasive Diagnostic Tests

- Segmental blood pressure recording
- Segmental pulse volume recording
- Exercise Doppler (ABI) stress testing
- Duplex ultrasound
- Magnetic resonance angiography (MRA)
- CT angiography

The tools of the noninvasive vascular laboratory provide additional details related to PAD diagnosis, including anatomic localization (to aid choice of revascularization options) and objective physiologic assessment of PAD severity.
Peripheral Arterial Disease: Management

Reduction in Mortality and Morbidity Is the Primary Goal!

Essentials of PAD Disease Management

Therapies to lower risk of MI, stroke, and death

- Risk factor normalization
  - Smoking cessation
    - Goal: complete cessation
  - Lipid management
    - Goal LDL <70* mg/dL
  - Blood pressure control
    - Goal <135/85 mm Hg
  - Blood sugar control (diabetic patients)
    - Goal: A1C <7%

- Antiplatelet therapies
  - Clopidogrel, aspirin

- Symptom-directed therapies
  - Supervised exercise rehab
  - Cilostazol
  - Selective use of revascularization (PTA, bypass)
If Your Patient Did This….

<table>
<thead>
<tr>
<th>Medications Proven to Improve Outcomes in Individuals with PAD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Drug</strong></td>
</tr>
<tr>
<td>Aspirin</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Clopidogrel vs aspirin</td>
</tr>
<tr>
<td>Ramipril</td>
</tr>
<tr>
<td>Simvastatin</td>
</tr>
<tr>
<td>Cilostazol</td>
</tr>
</tbody>
</table>

CVA = cerebrovascular accident

But they don’t!

Indications for Revascularization for Intermittent Claudication

- Lifestyle-limiting symptoms
- Continued disability despite appropriate nonsurgical management
- Technically feasible revascularization options exist
- Expectation of favorable risk/benefit ratio
### Surgical Intervention Results

<table>
<thead>
<tr>
<th>GRAFT</th>
<th>5-yr Type</th>
<th>5 year (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorto-Bifemoral</td>
<td>Bypass</td>
<td>90%</td>
</tr>
<tr>
<td>Aortic Endarterectomy</td>
<td>Fem-Pop AK</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Fem-Pop BK</td>
<td>56-65</td>
</tr>
<tr>
<td></td>
<td>Fem-Pop AK</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Fem-Pop BK</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Fem-Distal</td>
<td>50-75</td>
</tr>
<tr>
<td></td>
<td>Fem-Distal</td>
<td>25</td>
</tr>
</tbody>
</table>

Outcome depends on a number of factors including context, diabetic status, state of the outflow vessels etc.


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### Aorto-Iliac Disease Surgical Results Morbidity/Mortality

<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound infection</td>
<td>10-30</td>
</tr>
<tr>
<td>Mortality</td>
<td>1.3-6</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>1.9-3.4</td>
</tr>
<tr>
<td>Early Graft Failure</td>
<td>0-24</td>
</tr>
<tr>
<td>Surgical Revision</td>
<td>&gt;20</td>
</tr>
</tbody>
</table>

TASC J Vasc Surg 2000

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### Systemic Atherosclerosis: An Interventionalist’s Perspective

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Division of Cardiovascular Medicine
Director, Peripheral Vascular Interventions, Ross Heart Hospital
Director, Cardiovascular Cath Lab, University Hospital East

The Ohio State University Medical Center

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### Systemic Atherosclerosis Current Treatments

2 therapeutic goals

- **Symptom Relief**
  - Mechanical Revascularization
  - Therapeutic walking program
  - Anti-claudication drugs

- **CV Event Reduction**
  - Mechanical revascularization
  - ACE inhibitors
  - Statins
  - Aspirin
  - Pravix
**Systemic Atherosclerosis Current Treatment**

- **Symptom Relief**
  - Mechanical Revascularization
    - Surgical
      - Endarterectomy
      - Bypass
      - Thrombectomy
    - Percutaneous
      - PTA
      - Stent
      - Laser
      - Atherectomy
      - Thrombectomy

**Trans-Atlantic Inter-Society Consensus Document (TASC)**

  - (radiology, surgical, cardiology, medical societies collaborated)
  - Evidence and experience-based guidelines for revascularization of LE atherosclerotic disease

- “A”: Endovascular approach recommended
- “B”: Endovascular likely better than surgery
- “C”: Surgery likely better than endovascular
- “D”: Surgical approach recommended

**Trans-Atlantic Inter-Society Consensus Document (TASC): Progress in Endovascular Approaches**

- **What happened from 2000 to 2007?**
  - More aggressive approaches to endovascular mgmt
  - New technology
    - Atherectomy
    - Self-expanding stents
    - Cryoplasty
    - Laser
  - Medical approaches to retard progression of atherosclerosis (statins, ACE inh)
### Trans-Atlantic Inter-Society Consensus Document (TASC): Progress in Endovascular Approaches

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot;: SFA stenosis &lt;3 cm</td>
<td>&quot;A&quot;: SFA stenosis up to 10 cm/SFA occlusion up to 5 cm</td>
</tr>
<tr>
<td>&quot;B&quot;: SFA stenosis up to 10 cm</td>
<td>&quot;B&quot;: SFA stenosis or occlusion up to 15 cm</td>
</tr>
<tr>
<td>&quot;B&quot;: popliteal stenosis</td>
<td></td>
</tr>
</tbody>
</table>

### Stent vs PTA in SFA Disease

- **104 patients with Rutherford 3-5 PAD**
- SFA stenosis/occlusion >3 cm
- **Primary Endpoint**
  - Restenosis >50% at 6-months as determined by CTA or DSA
- **Secondary Endpoints**
  - DUS restenosis >50% at 3, 6, 12 months or finding of stent fracture
  - Clinical and Resting ABI

### Case 1: Severe LLE Claudication

*CT and DSA Patency*  
*Duplex US Derived Patency*

*N Engl J Med 2006;354:1879-88*
Case 1: Severe LLE Claudication

Case 2

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Case 1: Atherectomy of occluded L SFA

Case 2

- Multifocal lesions in diffusely diseased SFA/popliteal
- Post atherectomy/balloon angioplasty
- ABI=0.85

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Excised plaque

De novo atherosclerotic lesion

In-stent restenotic lesions in SFA/popliteal
Case 2
- Multifocal lesions in diffusely diseased SFA/popliteal
- Post laser atherectomy/balloon angioplasty
- ABI=0.85

Debris captured from distal protection device

Case 3
- Severe bilateral LE claudication

Balloon angioplasty of in-stent lesion in aorta

Case 3
- Severe bilateral LE claudication

Focal in-stent restenosis
Infrarenal aorta

Case 4
- Angioseal collagen plug device in CFA
### Case 4

- New, severe RLE ischemia, ABI 0.5
- 2 days after cardiac cath

**Step 1:** Advance distal protection device

**Step 2:** "Vaporize" with laser

**Step 3:** Debulk with atherectomy catheter

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### Preliminary results:

- Filling defect still visible

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### Case 4

- New, severe RLE ischemia, ABI 0.5
- 2 days after cardiac cath

**Step 4:** Prolonged balloon angioplasty (4 min) required

- New, severe RLE ischemia, ABI 0.5
- 2 days after cardiac cath

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### Case 4

- Fragments of collagen plug captured in distal protection device
Case 4

- New, severe RLE ischemia, ABI 0.5
- 2 days after cardiac cath

Final result: ABI=0.9

... think of this!

Remember:
When you see this . . .