What’s New in the Management of Peripheral Arterial Disease

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Disclosure

My spouse, significant other, or I have not had any relevant financial relationships during the past 12 months.
Education Need / Practice Gap
Learning Objectives

Upon completion of this education activity, you will be able to:
Expected Outcome
Prevalence of Asymptomatic PAD

- Diagnosis of PAD ranges from 1%–22%, depending on population, risk factors, and diagnostic technique(s) used.
- Ratio of symptomatic to asymptomatic PAD patients ranges from ~1:1 to 1:6.
- For every IC patient, another 3 are estimated to have asymptomatic PAD.

Relative Prevalence of PAD and Intermittent Claudication

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Total Population (millions)</th>
<th>PAD (millions)</th>
<th>IC (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-59</td>
<td>68.9</td>
<td>2.1</td>
<td>0.9</td>
</tr>
<tr>
<td>60-69</td>
<td>19.8</td>
<td>1.6</td>
<td>0.8</td>
</tr>
<tr>
<td>≥70</td>
<td>24.8</td>
<td>4.7</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>113.5</td>
<td>8.4</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Web address www.census.gov/population/estimates/nation/infile2-1.txt
Age-Dependent Prevalence of PAD

Atheroma
Prevalence of Atherosclerotic Comorbidities

Adapted from Aronow WS. *Am J Cardiol*. 1994;74:64-5.
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
Risk Factors for Atherosclerosis

- Smoking
- Age
- Diabetes
- Obesity
- Genetics
- Dyslipidemia
- Hypertension
- Hypercoagulability States
- Hyperhomocysteinemia

Atherosclerotic Diseases (CAD, CVD, PAD)
Modifiable Risk Factors for PAD

- Hypertension
- Smoking
- Diabetes
- Dyslipidemia
- Obesity
- Hyperhomo-cysteinemia
Diabetes and Atherosclerosis

Diabetes mellitus:
- Accelerates atherosclerosis 200%–400%
- Risk of coronary artery ischemic events increases 2–4 times
- Results in 4 times risk of stroke
- PAD develops a decade earlier
- CV risk equivalent to 3 non-diabetic risk factors

Obesity and Diabetes in KY

Diabetes Statewide Prevalence 13.4%
Obesity in Adults 34.2%  Obesity in Adolescents 18.5%

KY Public Health & CDC
Effects of Smoking on PAD

- Direct injury to blood vessel endothelium
- Promotes systemic atherogenesis
- Increases carboxyhemoglobin levels
- Promotes coronary vasoconstriction
- Therefore, promotes coronary ischemic events, stroke, and progression of PAD
Diagnosis of Peripheral Arterial Disease and Intermittent Claudication
Diagnosis and Assessment of Disease Severity

- Vascular history
- Physical examination
- Ankle-brachial index (ABI) measurement
- Noninvasive vascular laboratory tests
Clinical Presentation of PAD Patients

Chronic Limb Ischemia
Acute Limb Ischemia
Stable Claudication
Asymptomatic PAD

Acute Arterial Insufficiency
Chronic Arterial Insufficiency (with ulcers)
Gangrene (smoker)
Office Measurement of the Ankle–Brachial Index (ABI)

Adapted from the PARTNERS Program.
Understanding the ABI

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

- Both ankle and brachial systolic pressures should be taken using a hand-held Doppler instrument.
- For both arm and leg, use higher of 2 pressures.
- The ABI is 95% sensitive and 99% specific for PAD.

# Interpreting the Ankle–Brachial Index

<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>≤0.40</td>
<td>Severe</td>
</tr>
<tr>
<td>&gt;1.30</td>
<td>Noncompressible vessels</td>
</tr>
</tbody>
</table>

Noninvasive Vascular Tests

- ABI measurements
- Pulse-volume recordings
- Segmental pressure measurements
- Duplex ultrasonography
- Treadmill exercise testing
ANGIOGRAPHY

- Conventional Angiography
- MRA
- CT Angiography
- ? Duplex Scanning with Contrast
Arterial Occlusion

a) normal vasculature
b) bilateral arterial occlusion and
c) an enlarged segment from different patient
Factors That May Improve Atherosclerosis

- Smoking cessation
- Lipid control
  - LDL-C, ≤ 100 mg/dL
  - Raise HDL-C
  - Lower triglycerides
- BP control
  - Use ACE inhibitors
- Diabetes control
  - HbA₁C ≤ 7.0%

- Antiplatelet therapy
  - ASA, clopidogrel

- Achieving ideal body weight
- Exercise
Effect of Smoking Cessation on Survival

133 patients observed after bypass graft or lumbar sympathectomy

Cumulative Survival (%)

Years Post-op

- Australian census
- Tobacco abstinence
- Continued tobacco use

Intermittent Claudication Exercise Programs

**Pros**
- Effective at improving exercise performance, walking distance, and physical functioning
- Safe, with no recorded morbidity or mortality
- Potential to improve other atherosclerosis risk factors
- Cost-effective

**Cons**
- Require motivated and compliant patient
- Limited availability of supervised programs
Exercise Training vs PTA: Relative Efficacy for Claudication

Claudication Distance (m)

# Efficacy of Intermittent Claudication Drugs

<table>
<thead>
<tr>
<th>Drug/Class</th>
<th>Efficacy</th>
</tr>
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<tbody>
<tr>
<td>Cilostazol</td>
<td>Effective</td>
</tr>
<tr>
<td>Pentoxifylline</td>
<td>Minimally effective</td>
</tr>
<tr>
<td>Propionyl-L-carnitine</td>
<td>Under study/possibly effective</td>
</tr>
<tr>
<td>Prostaglandins</td>
<td>Under study</td>
</tr>
<tr>
<td>Antiplatelet therapy</td>
<td>Under study</td>
</tr>
<tr>
<td>Angiogenic factors</td>
<td>Under study</td>
</tr>
<tr>
<td>L-arginine</td>
<td>Under study</td>
</tr>
<tr>
<td>Others</td>
<td>Under study</td>
</tr>
</tbody>
</table>
**CAPRIE Trial**

- Randomized trial comparing clopidogrel 75 mg/d with aspirin 325 mg/d
- Population: 19,185 patients with recent MI, ischemic stroke, or symptomatic PAD
- Results
  - Clopidogrel reduced combined risk of stroke, MI, and vascular death by 8.7% vs aspirin \((P = 0.043)\)
  - Risk reduction was 23.7% for PAD subgroup
  - Adverse event rates were similar for 2 groups
  - GI hemorrhages occurred in 2.0% of clopidogrel users vs 2.7% of aspirin users \((P < 0.002)\)

<table>
<thead>
<tr>
<th>Drug</th>
<th>To Reduce Ischemic Events</th>
<th>To Improve Claudication Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clopidogrel (Plavix®)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Cilostazol (Pletal®)</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Rationale for Lipid-Lowering Interventions

- Patients with intermittent claudication have systemic atherosclerosis and are at increased risk for MI and stroke.
- Major lipid risk factors in PAD are:
  - Elevated LDL-C
  - Elevated triglyceride level
  - Low HDL-C
- Recent trials indicate that lipid modification stabilizes femoral atherosclerosis or induces its regression.
- NCEP recommends lipid screening in PAD and treatment to normalize LDL-C, raise HDL-C, and lower triglycerides.
Cardiovascular Morbidity and Mortality Trials

<table>
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<tr>
<th>Study</th>
<th>Population</th>
<th>Intervention</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>4S</td>
<td>CAD</td>
<td>Simvastatin vs placebo</td>
<td>↓ 30% mortality</td>
</tr>
<tr>
<td>CAPRIE</td>
<td>CAD, PAD,</td>
<td>Clopidogrel vs ASA</td>
<td>↓ 8.7% CV events overall</td>
</tr>
<tr>
<td></td>
<td>CVD</td>
<td></td>
<td>↓ 23.7% for PAD subgroup</td>
</tr>
<tr>
<td>Antiplatelet Trialists’</td>
<td>CAD</td>
<td>Antiplatelet agents</td>
<td>↓ 30% MI, CV events</td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
<td>(usually ASA)</td>
<td></td>
</tr>
<tr>
<td>STIMS</td>
<td>PAD</td>
<td>Ticlopidine vs placebo</td>
<td>↓ 29% mortality</td>
</tr>
</tbody>
</table>

Indications for Surgical Intervention

- Gangrene
- Non-healing ulcers
- Ischemic rest pain
- Claudication causing lifestyle deterioration refractory to pharmacologic intervention and behavioral modification
Right Iliac Stenosis
Pre- and Post-PTA
Superficial Femoral Artery Stenosis
Pre- and Post-PTA
Report of
A Case

RB, a 75 year-old gentleman, first presented to vascular service in 1992, with non-healing ulcer of the right great toe. He was found to have severe aorto iliac disease and underwent successful aortobifemoral bypass. He has been followed annually at the clinic with PVR studies. One and a half years later, he presented with severe claudication. His ABI was .56 on the left and .54 on the right. Angiogram showed occluded right limb of the graft and severe disease in the left limb of the bypass graft. He had repeat aortobifemoral bypass graft on 12/07/1993. He did well until June of 2000, when he presented with rest pain and was found to have a total occluded af bypass graft. At that time he had left axillofemoral bypass graft. He did very well until April of 2013. He had recurring symptoms and occluded native aorta and iliac arteries and thrombosed axillofemoral bypass graft. On April 18,2013, he underwent infrarenal aortic endovascular revascularization with construction of parallel Viabahn endografts. Patient continues to do well, free of symptoms with normal ABI as so September 2014.
Pre-Op CTA
Case Report

This 66 years old gentleman presented with severe claudication and rest pain. Risk factors included diabetes mellitus, hypertension and tobacco abuse (2 to 3 packs a day for 57 years).
Angiogram Showing Totally Occluded Popliteal Artery
Picture Showing Retrograde Arterial Cannulation
Picture Showing Atherectomy Device In Place
Picture Showing Atheromatous Material Removed
Picture Showing Open Popliteal and Trifurcation Vessels

Patient’s Symptoms are Relieved After This Procedure
SUMMARY

Aggressive medical management is necessary for the salvage of limb and life for our patients with PAD.
Thank You

This is Kentucky Basketball
2000 Wins and Counting

Derby Hats