Peripheral Arterial Disease: Review and Updates

Katherin Leckie, MD, MS
Vascular and Endovascular Surgery
Disclosures

• None relevant to today’s talk

Outline

• Epidemiology and risk factors
• Pathology and clinical presentation
• Natural history and medical management
• Anatomy of disease
• Interventions options and outcomes
• BASIL-2 and BEST-CLI
Epidemiology of Peripheral Arterial Disease (PAD)

- Global prevalence 5.6% affecting 236 million adults
  - US prevalence of 7% affecting 8.5 million adults
- Over 40% of patients with CAD have PAD
  - PAD associated with left main and multivessel CAD
- 25-50% of TAVR patients have PAD

Risk Factors for PAD

- Increasing age
- Male sex
- Smoking
- HTN
- DM
- HLD
- Renal insufficiency

Risk Factors for PAD

- Male sex
- Smoking
- Hypertension
- Dyslipidemia
- Diabetes mellitus
- End-stage renal disease on dialysis

Pathology of PAD

- Atherosclerosis
  - Early lesions may regress
  - Progression, rupture/erosion with thrombosis


Pathology of PAD

- Other arterial occlusive disease:
  - Embolism
  - Popliteal artery entrapment syndrome
  - Popliteal artery aneurysm thrombosis
  - Large or medium vessel vasculitis
  - Cystic adventitial disease
  - Persistent sciatic artery
  - External iliac endofibrosis

Clinical Presentation of PAD

- PAD is conventionally defined as ABI < 0.9, TBI < 0.7 or significant drop in ABI post-exercise

- Clinically:
  - Asymptomatic 75%
  - Intermittent claudication (IC) 20-30%
  - Chronic limb threatening ischemia (CLTI) 1-3%
    - Rest pain > 2 weeks or tissue loss
Rutherford Categories of Chronic Limb Ischemia

<table>
<thead>
<tr>
<th>Grade</th>
<th>Category</th>
<th>Clinical description</th>
<th>Objective criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>Asymptomatic-no hemodynamically significant occlusive disease</td>
<td>Normal treadmill or reactive hyperemia test</td>
</tr>
<tr>
<td>1</td>
<td>Mild claudication</td>
<td>Completes treadmill exercise; AP after exercise &gt; 50 mmHg but at least 20 mmHg lower than resting value</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>2</td>
<td>Moderate claudication</td>
<td>Between categories 1 and 3</td>
</tr>
<tr>
<td>3</td>
<td>Severe claudication</td>
<td>Cannot complete standard treadmill exercise, and AP after exercise &lt; 50 mm Hg</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>Ischemic rest pain</td>
<td>Resting AP &lt; 40 mmHg, flat or barely pulsatile ankle or metatarsal PVR; TP &lt; 30 mm Hg</td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>Minor tissue loss non-healing ulcer, focal gangrene with diffuse pedal ischemia</td>
<td>Resting AP &lt; 60 mm Hg, ankle or metatarsal PVR flat or barely pulsatile; TP &lt; 40 mm Hg</td>
</tr>
<tr>
<td>6</td>
<td>Major tissue loss-extending above TM level, functional foot no longer salvageable</td>
<td>Same as category 5</td>
<td></td>
</tr>
</tbody>
</table>

AP: ankle pressure; PVR: pulse volume recording; TM: transmetatarsal; TP: toe pressure.

Intermittent Claudication

- Natural history of IC over 10 years
  - < 10% any amputation
  - 18% revascularization
  - 23% rest pain
  - 30% tissue loss

Chronic Limb Threatening Ischemia

- 1 year mortality of 20-25%, 4 year up to 50%
- 1 year major amputation rate of 25% without revascularization

**Presentation:**
- 29% rest pain
- 45% ulceration
- 26% gangrene

**Intervention:**
- Non-surgical 29%
- Revascularization 58%
- Primary amputation 13%

Chronic Limb Threatening Ischemia

Patient survival over 4 years following diagnosis of critical limb ischemia

Freedom from major amputation over 4 years following diagnosis of critical limb ischemia

Management of PAD

- Asymptomatic disease
  - Smoking cessation, antihypertensives, glycemic control
  - Antiplatelet +/-
  - Statin
  - Surveillance +/-
Management of PAD

• Intermittent Claudication
  • Risk factor modification, statin, Antiplatelet
  • Supervised exercise program
  • Cilostazol
  • Annual surveillance with non-invasive vascular testing

Management of PAD

• Intermittent Claudication
  • Revascularize for function NOT limb salvage
  • Intervention for good risk candidates with severe lifestyle limitations with expected durability of intervention > 2 years
  • Consider addition of Xaralto 2.5 BID after procedure
Management of PAD

• VOYAGER-PAD
  • 6,564 patients randomized to addition of Xaralto 2.5 BID or placebo to usual medical therapy after revascularization procedure
  • Reduction in cardiovascular event at 3 years at 17.3% compared to 19.9% (P=0.009) with increase in major bleeding 5.94% versus 4.06% (P=0.007).

Management of PAD

• Chronic limb threatening ischemia
  • Revascularization is recommended
  • A multidisciplinary approach with appropriate wound care is recommended
  • 30-50% will not be a candidate for revascularization
Anatomy of PAD

• Aortoiliac
  • Smoking claudics

• Femoropopliteal
  • Older smokers

• Tibial
  • DM/ESRD with CLTI

• Multilevel
  • Older smokers
Anatomy of PAD


ESRD Smoking


23

Intervention for PAD

• Open and endovascular


24
Intervention for PAD

• Open revascularization
  • Endarterectomy
    • Focal lesion
    • Common femoral, aorta, popliteal, tibial
    • Often used in conjunction with bypass or stent

Intervention for PAD

• Open revascularization
  • Bypass: Inflow, outflow, conduit
    • Conduit
      • Autologous
      • Prosthetic
      • Alternative biologics
Intervention for PAD

• Endovascular Revascularization
  • Angioplasty
  • Atherectomy
  • Stents
  • Drug coated balloons
  • Drug coated stents

• Endovascular Adjuncts
  • Wires, catheters, sheaths
  • Crossing and re-entry devices
  • Intravascular lithotripsy
  • Tackling stents
  • Intravascular ultrasound
  • Embolic protection devices
  • Suction and mechanical thrombectomy
Intervention for PAD

• TransAtlantic Inter-Society Consensus (TASC)
  • 2000 and 2007

• Aortoiliac occlusive disease
  • A – endovascular preferred
  • D – open surgery preferred

Intervention for PAD

• Durability of open intervention for aortoiliac disease

<table>
<thead>
<tr>
<th>Indication</th>
<th>5-year % patency (range)</th>
<th>10-year % patency (range)</th>
<th>Procedure</th>
<th>5-year % patency (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Claudication</td>
<td>CLI</td>
<td>Claudication</td>
<td>CLI</td>
</tr>
<tr>
<td>Limb based</td>
<td>91 (80–94)</td>
<td>87 (80–88)</td>
<td>86 (85–92)</td>
<td>81 (78–83)</td>
</tr>
<tr>
<td>Patient based</td>
<td>85 (85–89)</td>
<td>80 (72–82)</td>
<td>79 (70–85)</td>
<td>72 (61–76)</td>
</tr>
</tbody>
</table>
| Patency at 5 and 10 years after aortobifemoral bypass | Patency rates at 5 years after extra-anatomic bypass

**Intervention for PAD**

- **Patency after endovascular intervention for aortoiliac disease**
  - For TASC A-B, primary and secondary patency rates 5 years are 88% and 97%.
  - Meta-analysis of endovascular treatment of TASC C–D lesions, 5-year primary patency 60% - 86%, secondary patency 80% to 98%

---

**Intervention for PAD**

- **Femoropopliteal occlusive disease**
  - A – endovascular preferred
  - D – open surgery preferred
Intervention for PAD

• Durability of open intervention for femoropopliteal disease

<table>
<thead>
<tr>
<th></th>
<th>Claudication</th>
<th>CLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vein</td>
<td>80</td>
<td>66</td>
</tr>
<tr>
<td>Above-knee PTFE</td>
<td>75</td>
<td>47</td>
</tr>
<tr>
<td>Below-knee PTFE</td>
<td>65</td>
<td>65</td>
</tr>
</tbody>
</table>

5-year patency following femoral popliteal bypass


Weighted mean primary patency rates for vein versus PTFE grafts for above knee femoropopliteal bypass


Intervention for PAD

• Patency after endovascular intervention for femoropopliteal occlusive disease
  • Covered stent 5 year patency for >10cm SFA lesions of 62.4%
  • Bare metal stent 3 year patency for <8cm SFA lesions 71.0% and >8cm SFA lesions 50.5%
  • DCB 3 year patency for SFA lesions <18cm 69.5%
  • DES 5 year patency for SFA lesions < 13cm 66.4%
Intervention for PAD

• BASIL-2 and BEST-CLI
  
  • BASIL-2
    • UK, Denmark, Sweden, 2014-2022
    • Vein bypass versus endovascular therapy in 345 CLTI patients
  
  • BEST-CLI
    • United States, Canada, Finland, Italy, and New Zealand, 2014-2019
    • Bypass versus endovascular therapy, 2 cohorts based on presence of vein, in 1830 CLTI patients, all low surgical risk

Intervention for PAD

• BASIL-2
  
  • Primary outcome favored endovascular therapy
  • Bypass: 63% amputation/death
  • Endo: 53% amputation/death
  • Driven by higher mortality after bypass, no difference in limb loss
Intervention for PAD

- BEST-CLI – Cohort 1
  - Primary outcome favored bypass
  - Bypass: 42.6% MALE/death
  - Endo: 57.4% MALE/death
  - Driven by higher reintervention after endovascular therapy
Thank you!