Evaluation and Treatment of Common Vascular Conditions

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Evaluation and Treatment of Common Vascular Conditions

• Recognize the clinical presentation
• Have knowledge of available non-invasive vascular lab tests, and appropriate utilization
• Indications for specialty referral of vascular patients
• Identify urgent vascular conditions for immediate treatment
Common Vascular Conditions

- Peripheral Artery Disease (PAD)
- Carotid Occlusive Disease
- Abdominal Aortic Aneurysms
- Chronic venous insufficiency/varicose veins
Peripheral Artery Disease
Clinical Disease Spectrum

• Asymptomatic abnormality
• Intermittent claudication
• Ischemic rest pain*
• Tissue loss*
  Pedal ulceration
  Digital gangrene

*Critical Limb Ischemia (CLI)
Peripheral Artery Disease
Clinical Disease Spectrum

Intermittent Claudication

Latin: “to limp.”

• Definition: Pain in one or both legs, which worsens with continued walking, and resolves with rest.

• Important details: Onset, Walking range, Impact on Lifestyle/work, Recovery time, Anatomic location
Peripheral Artery Disease
Clinical Disease Spectrum

Ischemic Rest Pain

- Gravity-dependent perfusion
- Diurnal pattern
- Postural pattern
- Initially localized to the forefoot...
  may extend proximally
Peripheral Artery Disease

Clinical Disease Spectrum

Dependent Rubor

Elevation Pallor
Peripheral Artery Disease
Clinical Disease Spectrum
Full Thickness Heal Ulcer
Peripheral Artery Disease
Initial Clinical Evaluation

• History  
  (Include assessment of CV risk factors)
• Physical examination
• Pulses- Present? Absent? Bruits?
• Supplement with Doppler if available.
• Skin- Intact? Ulcerated?
• Trophic changes? Hair loss, skin atrophy, nails
Peripheral Artery Disease
Non-invasive Vascular Lab

Physiologic Non-imaging Arterial Study

• Assess disease severity, distribution
• Doppler pressures, Pulse volume recordings, Doppler waveform analysis, Digital Photoplethysmography
• Single level arterial study: “ABI”
• Multilevel arterial study (aids in localizing disease)
Peripheral Artery Disease
Non-invasive Vascular Lab

**Physiologic Non-imaging Arterial Study**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compressible</td>
<td>&gt; 1.25</td>
</tr>
<tr>
<td>Normal</td>
<td>0.95 – 1.25</td>
</tr>
<tr>
<td>Claudication</td>
<td>0.50 – 0.80</td>
</tr>
<tr>
<td>Ischemic rest pain</td>
<td>&lt; 0.40</td>
</tr>
<tr>
<td>Tissue loss</td>
<td>&lt; 0.25</td>
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</tbody>
</table>
Peripheral Artery Disease
Indications for Referral

• Severe claudication
  Disabling, Affecting work performance, Basic ADLs
• Ischemic rest pain
• Tissue loss
• ABI < 0.50
• Patient education/ preference
Peripheral Artery Disease
Medical Management

Mild-moderate Claudication, Asymptomatic

• Risk factor modification
  
  Lipids (secondary prevention- LDL target < 70)
  
  HTN, DM, Smoking cessation

• Anti-platelet therapy
• Graduated exercise program
• Cilostazol trial
• Monitor closely for clinical disease progression
Peripheral Artery Disease
Interventional Management

Severe claudication, Ischemic rest pain, Tissue loss

- Advanced imaging
  - CT angio, MR angio, conventional angio
- Percutaneous transluminal angioplasty (PTA)
- Stent placement
- Endarterectomy
- Bypass
- Hybrid procedures
Peripheral Artery Disease
Interventional Management
Peripheral Artery Disease
Surgical Management
Peripheral Artery Disease
Interventional Management

RISK

BENEFIT
Peripheral Artery Disease
Surgical Management

Risks

• Comorbid conditions
  Coronary artery disease
  Pulmonary disease

• Technical factors
  Level of reconstruction
  Previous operations
  Available vein conduit

Benefits

• Strength of indications
  Limb threat > Claudication

• Functional goals
  Ambulatory status
  Independent living
Peripheral Artery Disease

Indications for **Urgent** Referral

- Acute, severe *Limb Ischemia*

  6 p’s of ALI: Pain, Pallor, Pulseless, Poililothermia, Paresthesias, Paralysis

- Common causes: Trauma, thromboembolism

- Time frame: 6-8 hrs.
Common Vascular Conditions

• Peripheral Artery Disease (PAD)
• Carotid Occlusive Disease
• Abdominal Aortic Aneurysms
• Chronic venous insufficiency/ varicose veins
Carotid Artery Disease
Clinical Disease Spectrum

• Asymptomatic abnormality
  (incidental finding, neck bruit, pulsatile tinnitus)
• Transient Ischemic Attack- TIA
• Amaurosis fugax
• Stroke
Carotid Artery Disease
Initial Clinical Evaluation

• History
  (Include assessment of CV risk factors)
• Duration of symptoms
  (TIA vs. CVA)
• Physical examination
  (Carotid Bruits? Peripheral pulse deficits?)
• Neurologic exam
Carotid Artery Disease
Non-invasive Vascular Lab

Carotid Duplex Scan

- High resolution B-mode ultrasound
- Pulsed wave, directional Doppler
- Color flow Doppler imaging
Carotid Duplex Scan

University of Washington
Prototype Duplex System
1972

Slide courtesy of R. Eugene Zierler, MD, Seattle, WA
Carotid Duplex Scan
Philips iE33 Scanner
Carotid Duplex Scan
Normal B-mode image
Carotid Duplex Scan
Abnormal B-mode image
Carotid Duplex Scan
Abnormal Triplex image
### Carotid Duplex Scan
**Consensus Diagnostic Criteria**

<table>
<thead>
<tr>
<th>Degree of Stenosis</th>
<th>ICA PSV (cm/sec)</th>
<th>Plaque Estimate</th>
<th>ICA:CCA Ratio</th>
<th>ICA EDV (cm/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 125</td>
<td>None</td>
<td>&lt; 2.0</td>
<td>&lt; 40</td>
</tr>
<tr>
<td>&lt;50 %</td>
<td>&lt; 125</td>
<td>&lt; 50 %</td>
<td>&lt; 2.0</td>
<td>&lt; 40</td>
</tr>
<tr>
<td>50-69 %</td>
<td>125-230</td>
<td>&gt; 50 %</td>
<td>2.0-4.0</td>
<td>40-100</td>
</tr>
<tr>
<td>70-99 %</td>
<td>&gt;230</td>
<td>&gt; 50 %</td>
<td>&gt; 4.0</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Occluded</td>
<td>0</td>
<td>No lumen</td>
<td>N/A</td>
<td>0</td>
</tr>
</tbody>
</table>

Carotid Artery Disease
Medical Management

Asymptomatic < 70%, Symptomatic <50%

• Risk factor modification
  Lipids (secondary prevention- LDL target < 70)
  HTN, DM, Smoking cessation

• Anti-platelet therapy

• Monitor “breakthrough” symptoms on therapy
  patient education

• Surveillance duplex scan for disease progression
Carotid Artery Disease

Indications for Referral

• Asymptomatic: >70% diameter stenosis
• Symptomatic: >50% diameter stenosis
• Stroke: “with recovery”*
• Patient education/ preference

*(Recovery to point that second event in same distribution would cause incremental disability)
Carotid Artery Disease
Management

Carotid Endarterectomy vs. Carotid Artery Stenting

- Advanced imaging
  - CT angio, MR angio, conventional angio
- Assessment of anesthetic/operative risk
- Anatomic factors
  - Arch anatomy, vertical level of lesion
  - Primary vs. Recurrent disease
  - History of tracheostomy, Neck XRT
Carotid Artery Disease Management

Carotid Endarterectomy

- symptomatic stenosis: >50% - most patients
- asymptomatic stenosis: >70% most patients
- acceptable operative risk
- accessible lesion
- age > 70 years
- absence of XRT or tracheostomy
Carotid Artery Disease Management

Carotid Artery Stenting

- Symptomatic > 50%
- High operative risk, < 70 years
  - Severe Uncorrectable CAD, COPD, CHF
  - Requires surgical consultation
- Regional XRT, adjacent tracheostomy
- Recurrent stenosis after prior CEA
- Asymptomatic >80% in clinical trial
Carotid Artery Disease

Indications for Urgent Referral

• Acute stroke
  (3 hour window for thrombolysis)

• “Crescendo” pattern of TIAs
Common Vascular Conditions

• Peripheral Artery Disease (PAD)
• Carotid Occlusive Disease
• Abdominal Aortic Aneurysms
• Chronic venous insufficiency/ varicose veins
Abdominal Aortic Aneurysm
Demographics

- Prevalence: 5-7% in > 65 years old
- 2010 US Census →
  2.8 million Americans
- 15,000 deaths from aneurysm rupture/year
- 10th leading cause of death
Abdominal Aortic Aneurysm

Risk factors

- Age: > 65 years
- Male Gender 4:1
- Family history: 20%
- Smoking: > 10 pack-years
- Aneurysmal disease elsewhere
- Hypertension
- Caucasian Race
- Absence of diabetes
Abdominal Aortic Aneurysm
Clinical Presentation

- Asymptomatic
- Chronic back pain
- Physical examination
- Incidental finding
  - CT, MRI, KUB, or U/S
- Rupture
Abdominal Aortic Aneurysm
Initial Clinical Evaluation

- History
  (Include assessment of CV risk factors)
- Physical examination
- Pulses- Present? Absent?
- Tenderness to palpation of the aneurysm?
- Any evidence of peripheral aneurysm disease?
Abdominal Aortic Aneurysm

Rupture Risk

- **Laplace’s Law**
  - Wall tension = radius x pressure
  - Rupture = wall tension > strength of aortic wall

- **Diameter is greatest predictor of rupture risk**
  - Maximum wall-to-wall
  - Transverse or AP
  - *Independent* of length

Wall tension

Pressure
Abdominal Aortic Aneurysm

Rupture Risk

- Estimated risk of rupture/yr
  - 4.0-5.4 cm  0.6%
  - 5.5-6.4 cm  10%
  - 6.5-6.9 cm  19%
  - 7.0-7.9 cm  35%
  - >8.0 cm  51%

- Average rate of expansion/yr
  - < 4 cm  0.2-0.4 cm
  - 4-5 cm  0.2-0.5 cm
  - > 5 cm  0.3-0.7 cm
Abdominal Aortic Aneurysm Repair

Options for Repair
Abdominal Aortic Aneurysm
Endovascular Aortic Repair (EVAR)
Abdominal Aortic Aneurysm
Endovascular Aortic Repair (EVAR)
# Abdominal Aortic Aneurysm

## Morbidity/Mortality

<table>
<thead>
<tr>
<th>Elective Repair</th>
<th>Emergency Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Mortality 1-4%</td>
<td>- Mortality 30-70%</td>
</tr>
<tr>
<td>- Morbidity 10-15%</td>
<td>- Morbidity &gt;50%</td>
</tr>
</tbody>
</table>
Abdominal Aortic Aneurysm
Medicare Screening Benefit

- **SAAAVE** = Screening Abdominal Aortic Aneurysms Very Efficiently
- Effective January 1, 2007
- Provides one-time AAA screening to qualified Medicare beneficiaries
- Men age > 65 yrs who smoked >100 cigarettes during lifetime
- Women with family history of AAA
Abdominal Aortic Aneurysm
Medical Management

• CV risk factor modification
• **NO** physical activity limitations
• Educate patient about signs/symptoms of rupture (advise immediate ER evaluation)
• Imaging surveillance Q 6-12 months
  
  U/S vs. CT
Abdominal Aortic Aneurysm
Indications for Referral

• Absolute size: > 5.5 cm
• Annualized rate of growth: > 5 mm/yr.
• Aneurysm tenderness
• Pain associated with AAA and no obvious alternative explanation
• Patient education/ preference
Abdominal Aortic Aneurysm
Indications for **Urgent** Referral

- Suspicion of AAA leak/rupture
- Absolute size: $> 8 \text{ cm}$
Common Vascular Conditions

• Peripheral Artery Disease (PAD)
• Carotid Occlusive Disease
• Abdominal Aortic Aneurysms
• Chronic venous insufficiency/ varicose veins
Chronic Venous Insufficiency Demographics

- 4.5% (13.9 million people) in the USA are affected by varicose veins
- Incidence increases with age
- 40% of women in their 50’s suffering from some sort of venous disorder
- 4:1 female gender
Chronic Venous Insufficiency

Valvular Function

- Valve leaflets allow unidirectional flow, upward or inward
- Causes of incompetence:
  - Dilation of vein wall
  - Valvular fibrosis, thrombotic destruction
  - Congenital agenesis
Chronic Venous Insufficiency
Pathophysiology

REFLUX

- Dilatation of vein wall leads to valve insufficiency
- Monocytes may destroy vein valves
- Retrograde flow results in distal venous hypertension

OBSTRUCTION

- Thrombosis and subsequent fibrosis obstruct venous outflow
- Damage to vein valves may also cause reflux
- Both contribute to venous hypertension
Chronic Venous Insufficiency

Clinical Disease Spectrum

- Asymptomatic abnormality (including varicose veins)
- Symptomatic disease
  - Pain, Swelling, Pruritus
  - Superficial thrombophlebitis
  - External hemorrhage
  - Stasis pigmentation
  - Stasis ulceration
Chronic Venous Insufficiency
Clinical Disease Spectrum

telangiectasias

varicose veins

lipodermatosclerosis

superficial phlebitis

venous ulceration
Chronic Venous Insufficiency

Initial Clinical Evaluation

• History- including symptom details, impact on lifestyle/work activities, prior trauma, history of VTE, prior treatment

• Physical examination

• Size of varicosities, inflammation, palpable thrombus, pulse exam

• Skin/soft tissue quality
Chronic Venous Insufficiency
Non-invasive Vascular Evaluation

• Venous duplex scan
• Initial recumbent exam
    Assess for SVT/DVT
• Standing exam with rapid cuff inflation
    Assess superficial / deep valvular competence
    Abnormal threshold > 500 msec
Chronic Venous Insufficiency

Medical Management

• Lifestyle modification
  Avoid sitting/standing
  Exercise
  Weight control
• Intermittent leg elevation > heart level
• *Graduated* elastic compression stockings

Photo courtesy of Juzo
<table>
<thead>
<tr>
<th>Compression Strength</th>
<th>Indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-15mm</td>
<td>Leg fatigue, mild swelling, stylish</td>
</tr>
<tr>
<td>15-20mm</td>
<td>Mild aching, swelling, stylish</td>
</tr>
<tr>
<td>20-30mm</td>
<td>Aching, pain, swelling, mild varicose veins</td>
</tr>
<tr>
<td>30-40mm *</td>
<td>Aching, pain, swelling, varicose veins, post-ulcer</td>
</tr>
<tr>
<td>40-50, 50-60mm *</td>
<td>Recurrent ulceration, lymphedema</td>
</tr>
</tbody>
</table>

* Requires a prescription
Chronic Venous Insufficiency

Interventional Management

- Radiofrequency or laser ablation
  - Great saphenous vein
  - Short saphenous vein
  - Perforator veins
- Microphlebectomy - subcutaneous varicose veins
- Local anesthetic, conscious sedation, office-based
- Injection sclerotherapy - intradermal “spider” veins
Chronic Venous Insufficiency

Ultrasound-guided Access
Chronic Venous Insufficiency

Ultrasound-guided Access

[Image of ultrasound-guided access with labels such as skin, needle, and GSV]
Chronic Venous Insufficiency

Guidewire Placement

Tumescent Anesthetic
Chronic Venous Insufficiency

Indications For Referral

• Moderate-severe symptoms + varicose veins
• Stasis pigmentation
• Venous ulceration
• Patient education/ preference
Chronic Venous Insufficiency

Indications For Urgent Referral

• Uncontrolled external hemorrhage

(ER referral, suture ligation)
Common Vascular Conditions

• Peripheral Artery Disease (PAD)
• Carotid Occlusive Disease
• Abdominal Aortic Aneurysms
• Chronic venous insufficiency/ varicose veins
Peripheral Artery Disease (PAD)


References

Carotid Artery Disease


References

Abdominal Aortic Aneurysms


References

Chronic Venous Insufficiency  Varicose Veins