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NON-INVASIVE VASCULAR TESTING FOR CARDIOLOGISTS

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Comorbidity of Atherosclerotic Disease

Patients with one manifestation often have coexistent disease in other vascular beds.

Coronary Artery Disease
- 33%

Cerebrovascular Disease
- 15%

PAD
- 12%

Intersection:
- 13%

- 8%

- 14%

- 5%
what test to do?
NON-INVASIVE TESTING IN THE OFFICE

Ankle/Brachial Index

Arterial Doppler Duplex

Segmental Pressures

Pulse Volume Recording
ANKLE / BRACHIAL INDEX (ABI)

Systolic ankle pressure / Systolic arm pressure

Systolic Brachial pressure

Dorsalis Pedis pressure

Posterior Tibial pressure

Ankle mmHg / Brachial mmHg = ABI
Conclusions:
The LAP ABI has better sensitivity and overall accuracy in comparison to the HAP ABI to diagnose PAD.
What to do with ABI
Arterial insufficiency

ABI*

< 0.7

MRA/CTA/duplex

0.7 – 1.3

Exercise ABI

> 1.3

Non-diagnostic

Arterial duplex

0.7 – 0.8

Mod/severe pain &/or limitation

Mild pain &/or no limitation

>0.8 & <1.0

Repeat in a year

Arterial duplex/MRA/CTA

* Look at arterial waveforms
Segmental pressures
Diagnosis of PAD

Pulse volume recordings (PVRs)

Normal
- rises rapidly
- falls slowly
- dicrotic notch
Segmental pressures

HT  >30 mmHg  Brachial systolic
AK  
BK  
Ankle

Between two adjacent cuffs  <20 mmHg
Corresponding segments  <20 mmHg
Toe-Brachial index

- Normal > 0.70
- Helpful when ABI > 1.30
PULSE VOLUME RECORDING

NORMAL
- rises rapidly
- falls slowly
- dicrotic notch

SEVERE
- loss of dicrotic notch
- systolic rise slower
- peak delayed
- flat/rounded
Noninvasive Physiologic Methods

Doppler US – no images of arteries
CWD

Duplex US – images of arteries
PWD
Arterial waveform - Normal

Three phases – Triphasic
Forward flow – systole
Reverse flow – early diastole
Forward flow – late diastole
Duplex scanning

- Anatomic
- Physiologic

Spectral waveform analysis remains the primary source of duplex diagnostic information
<table>
<thead>
<tr>
<th>Artery Type</th>
<th>Normal Peak Systolic Velocities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ext Iliac/CFA</td>
<td>100-140 cm/sec</td>
</tr>
<tr>
<td>Femoral arteries</td>
<td>80-100 cm/sec</td>
</tr>
<tr>
<td>Popliteal arteries</td>
<td>60-80 cm/sec</td>
</tr>
<tr>
<td>Tibial arteries</td>
<td>40-60 cm/sec</td>
</tr>
</tbody>
</table>
Peripheral Arterial Stenosis
by Duplex

- Waveform shape
- PSV
- Spectral window
- Peak velocity ratio
Peripheral Arterial Stenosis by Duplex

Mild disease – < 20% stenosis

Moderate – 20-49% stenosis

Significant – 50-99% stenosis

Occluded
Mild disease – < 20% stenosis

- Mild spectral broadening
- <30% increase in PSV
- Normal waveform
Moderate – 20-49% stenosis

- Spectral broadening
- 30-100% increase in PSV
- Reverse flow component present
Significant – 50-99% stenosis

- Loss of reverse flow component
- Marked spectral broadening
- >100% increase in PSV
- Monophasic waveform
- Post stenotic turbulence
Occluded

- Absence of flow
- Damped proximal and distal waveforms
- Collateral flow
Arterial waveform - distal to stenosis

- spectral broadening
- single forward component
- no reversal – above baseline
- PSV is lower
- flat and rounded
Peripheral Arterial Stenosis by Duplex

- Strong correlation with peak velocity ratio

- $PVR \geq 2.4 \implies \geq 50\%$ stenosis
- $PVR \geq 4.0 \implies \geq 80\%$ stenosis
- $PVR \geq 7.0 \implies \geq 90\%$ stenosis

Ranke et al: 1992
Common sites of disease involvement

- SFA – adductor canal
- Aorto-iliac disease
- Trifurcation vessels (crural)
MRA
Thank you