How to Differentiate with Certainty Ischemic Buttock Claudication from Spinal Stenosis

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Disclosure

I have no relevant financial relationships to disclose

Prevalence of Proximal Vascular Claudication

- 5 to 14% of patients with mild to moderate PAD 1,2
- 28% of patients post aortobifemoral bypass 3
- 35% of patients post EVAR with prior internal iliac artery embolization* 4

Prevalence in the general population is unknown

1 Picquet et al., Eur J Int Med, 2005
2 Jaquinandi et al., Vasc Med, 2004
3 Jaquinandi et al., Ann Surg, 2007
4 Rayt et al., Cardiovasc Intervent Radiol, 2008

Pelvic Blood Flow

Evaluation of Proximal Claudication

Standard Non-Invasive Evaluation
- Ankle brachial index
- Segmental pressures
- Pulse volume recording
- Doppler signals
- Duplex ultrasound

Problematic
AXIAL not PARALLEL / Collateral

Hip and Buttock Pain
Evaluation of Proximal Claudication

- Resting and Exercise Ankle-Brachial Index
- Duplex Ultrasound
- Penile brachial Index
- Near Infra-Red Spectroscopy (muscle O2 sat)
- Exercise transcutaneous pO2 (in mmHg)
  noted as Exercise O2 or Ex-O2

Exercise O2

1980’s
- Pulmonary: Studied as an alternative to arterial O2 measurement in the pediatric and adult population
- Noted drop in TcpO2 in chronic lung disease

1990’s
- Studied during exercise in peripheral arterial disease

2000 to date
- Protocol developed Dr. Abraham, Angers, France
- Automated correction of peripheral tcpO2 values to central changes during exercise by software

2013 Dr. Guillame Mahe 6 month at Mayo

Exercise O2 Study Protocol

DROP = (PreL-PreLu)-(PreChest-PreChests) (From 0 to -20)
DROP > -15 mm Hg ↔cut-off Ischemia

Detection of >75% stenosis in arteries towards internal iliac circulation

PASS

Sensitivity = 80%
Specificity = 72%
PPV = 43%
NPV = 93%
Accuracy = 74%
Exercise O2 Study Protocol

- Place TcpO2 probes and ECG on the patient
- Stand 10 minutes for probe stabilization
- 2 minute baseline values standing
- Walk on treadmill (10% grade, 2 mph)
  - Time to 12 minutes or until pain forces stop
  - 10 minutes recovery standing
- Raw data recorded directly into Perimed software
- Drop index corrected data recorded into separate program and displayed on monitor for technician

Reproducibility good at both the proximal and distal levels

*Bouye et al., Int Angiol, 2004

Exercise O2 Study

- All patients undergo standard non-invasive testing
  - Resting ABI
  - Resting Doppler waveforms at common femoral, superficial femoral, popliteal, PT and DP levels
  - Treadmill exercise 2 mph at 10% grade for 5 minutes
  - Post-exercise ABI’s and Doppler waveforms at common femoral level
  - ECG monitoring
  - CT angiography or other imaging as clinically indicated

Patient Demographics

N=68 pts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of PAD</td>
<td>54 (78)</td>
</tr>
<tr>
<td>Current or former smoking</td>
<td>55 (81)</td>
</tr>
<tr>
<td>CAD</td>
<td>31 (46)</td>
</tr>
<tr>
<td>History of Stroke</td>
<td>8 (12)</td>
</tr>
<tr>
<td>AAA</td>
<td>4 (6)</td>
</tr>
<tr>
<td>Lumbar spine stenosis</td>
<td>10 (15)</td>
</tr>
<tr>
<td>Hip arthritis</td>
<td>13 (19)</td>
</tr>
</tbody>
</table>

Results

N=68 pts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RLE Resting ABI</td>
<td>0.94 ± 0.29</td>
</tr>
<tr>
<td>LLE Resting ABI</td>
<td>0.99 ± 0.32</td>
</tr>
<tr>
<td>Maximal walking distance (meters)</td>
<td>359 ± 209</td>
</tr>
</tbody>
</table>

Exercise O2 Study

- Positive 28 (42)
- Negative 25 (34)
- Indeterminate 15 (22)

71 yr M with L buttock and R calf claudication

a/p L CIA stenting, unsuccessful R popliteal intervention
Conclusions

- Non-invasive evaluation of buttock claudication with exercise TcPO2 is safe and cost effective with ability to reserve imaging for patients with positive studies.

- A high negative predictive value promises good ability to differentiate from other non-vascular causes of buttock and hip discomfort.

- The study is time consuming, automation is essential, current software is proprietary.

Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abraham</th>
<th>Mahe</th>
<th>Mayo Study</th>
</tr>
</thead>
<tbody>
<tr>
<td># of patients</td>
<td>207</td>
<td>34</td>
<td>68</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>80%</td>
<td>79%</td>
<td>94%</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>72%</td>
<td>86%</td>
<td>68%</td>
</tr>
<tr>
<td>PPV</td>
<td>43%</td>
<td>84%</td>
<td>74%</td>
</tr>
<tr>
<td>NPV</td>
<td>93%</td>
<td>81%</td>
<td>93%</td>
</tr>
</tbody>
</table>

137 patients studied thus far
Blinded comparison to CTA / Angio / US ongoing