Exercise ABI adds important prognostic information on long-term outcome in patients with normal resting ABI.

I. de Liefde, H. Verhagen, R. van Domburg, D. Poldermans
Peripheral arterial disease (PAD) is associated with an increased risk of cardiovascular morbidity and mortality.

ABI is used to diagnose PAD.

A resting ABI < 0.90 is defined as PAD.

ABI ≥ 0.90 is considered as a normal ABI.
Introduction

- Resting ABI 0.90 - 1.10 are associated with a higher mortality and arthrosclerosis.

- 31% with resting ABI > 0.90, had an ABI < 0.90 after a treadmill exercise test.

- The prognostic value of this exercise ABI is still not completely clear, especially not in patients with normal resting ABI.
Objective

- To investigate the association between exercise ABI and long-term mortality in patients with normal resting ABI and PAD.
Study design: population

• 2164 consecutive patients with known or suspected PAD

• Referred to the Erasmus Medical Centre, the Netherlands

• Between 1993 and 2005

• Treadmill walking test to diagnose or evaluate PAD
Study design: Exercise test

- Systolic blood pressure at both arms
- Systolic blood pressure ADP and ATP
- After 15 minutes of rest
- Immediately after the exercise test
Study design: Exercise test

- The ABI:
  The highest systolic blood pressure at the anterior tibial or the posterior tibial arteries / the highest systolic blood pressure at the arm

- ABI was calculated at rest and after the exercise test
Study design: End point

• Long-term mortality
  ➢ civil registries and medical records
• Completed in 99%
Study design: groups

- Patients were divided into
  - normal ABI defined as resting ABI $\geq 0.90$
  - PAD defined as resting ABI $< 0.90$
Results

- 67% men
- Age 63 years
- Mean follow-up: 5 years (0.5-14 years)
- Patients with PAD: older, more often men, more often hypertension.
### Results

<table>
<thead>
<tr>
<th></th>
<th>PAD HR (95% CI)</th>
<th>p-value</th>
<th>Normal resting ABI HR (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting ABI</strong></td>
<td>0.99 (0.98 -1.00)</td>
<td>0.02</td>
<td>0.98 (0.96 - 1.01)</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Exercised ABI</strong></td>
<td>1.00 (1.00 - 1.01)</td>
<td>0.8</td>
<td>0.99 (0.98 - .99)</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Chi-square</strong></td>
<td><strong>0.05</strong></td>
<td>0.8</td>
<td><strong>6.02</strong></td>
<td><strong>0.01</strong></td>
</tr>
</tbody>
</table>
### Results

- **Patients with resting ABI ≥ 0.90**

<table>
<thead>
<tr>
<th></th>
<th>Normal resting ABI + Exercise ABI &lt;1.10 (OR, 95% CI)</th>
<th>Normal resting ABI + Exercise ABI &lt; 0.90 (OR, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age: ≥ 50 years</td>
<td>1.76 (1.12-2.76)</td>
<td>2.93 (1.65-5.20)</td>
</tr>
<tr>
<td>Systolic blood pressure &gt;140</td>
<td>1.64 (1.06-2.54)</td>
<td>2.18 (1.35-3.55)</td>
</tr>
<tr>
<td>Current Smoking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>-</td>
<td>1.76 (1.03 - 3.06)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.62 (1.00-2.65)</td>
</tr>
</tbody>
</table>
Results

- Patient groups:
  I  Resting ABI > 0.90 and exercise ABI 1.10-1.29
  II Resting ABI > 0.90 and exercise ABI 1.00-1.09
  III Resting ABI > 0.90 and exercise ABI 0.90-0.99
  IV Resting ABI > 0.90 and exercise ABI < 0.90
  V  PAD (resting ABI < 0.90)
## Results

<table>
<thead>
<tr>
<th></th>
<th>Exercise ABI 1.10-1.30</th>
<th>Exercise ABI 1.00-1.09</th>
<th>Exercise ABI 0.90-0.99</th>
<th>Exercise ABI &lt; 0.90</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resting ABI</strong></td>
<td><strong>47%</strong></td>
<td><strong>30%</strong></td>
<td><strong>12%</strong></td>
<td><strong>11%</strong></td>
</tr>
<tr>
<td>1.10-1.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.00-1.09</td>
<td><strong>13%</strong></td>
<td><strong>37%</strong></td>
<td><strong>27%</strong></td>
<td><strong>23%</strong></td>
</tr>
<tr>
<td>0.90-0.99</td>
<td><strong>2%</strong></td>
<td><strong>10%</strong></td>
<td><strong>20%</strong></td>
<td><strong>68%</strong></td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>14%</strong></td>
<td><strong>28%</strong></td>
<td><strong>23%</strong></td>
<td><strong>35%</strong></td>
</tr>
</tbody>
</table>
Results

P trend 0.0001

ABI rest \( \geq 0.90 \)  
ABI ex. 1.10-1.29

ABI rest \( \geq 0.90 \)  
ABI ex. 1.00-1.09

ABI rest \( \geq 0.90 \)  
ABI ex. 0.90-0.99

ABI rest \( \geq 0.90 \)  
ABI ex. < 0.90

PAD
Results

- After adjustment for potential cardiovascular risk factors and medication use.

<table>
<thead>
<tr>
<th>Long-term mortality</th>
<th>Model II (HR, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Resting ABI</td>
<td>ref</td>
</tr>
<tr>
<td>Exercise ABI 1.10-1.29</td>
<td>1.31 (0.54 - 3.17)</td>
</tr>
<tr>
<td>Exercise ABI 1.00-1.09</td>
<td>1.95 (0.82 - 4.64)</td>
</tr>
<tr>
<td>Exercise ABI 0.90-0.99</td>
<td>2.56 (1.11 - 5.91)</td>
</tr>
<tr>
<td>Exercise ABI &lt; 0.90</td>
<td>2.73 (1.22 - 6.14)</td>
</tr>
</tbody>
</table>

PAD
Conclusion

• Treadmill exercise ABI adds important prognostic information on long-term mortality, in patients with a normal resting ABI.

• Based on our results we recommend that at least patients suspected for PAD, with a resting ABI ≥ 0.90, who are 50 years or older and having hypertension should undergo treadmill exercise testing.
DISCLOSURE INFORMATION: The following relationships exist related to this presentation: NONE

UNLABELED/UNAPPROVED USE: The following products are not labeled for the use under discussion or are still investigational: NONE