Compression in concomitant arterial occlusive disease

Hugo Partsch

London, May 14, 2015
Concomitant PAOD is a frequent condition

- Framingham Study:
  - ABPI<0,9: ~10 % in adult population
  - ~20% in age >70y

16% of venous ulcers are „mixed“

1416 leg ulcers with venous reflux

- ABPI >1
- 0.85-0.5
- <0.5

Humphreys ML et al. Br J Surg. 2007 Sep;94(9):1104-7
Vascular Ulcers

27% PAOD in 330 ulcers

COMPRESSION

• First choice when extremity is swollen, painful, inflamed, open

• Contraindiated in every case of arterial occlusive disease (20-30%)
Patient in horizontal position

Cuff over the ankle area: Ankle pressure AP

<table>
<thead>
<tr>
<th>ABPI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;1.3</td>
<td>Mediasclerosis</td>
</tr>
<tr>
<td>&gt;1.0 - 1.3</td>
<td>No PAOD</td>
</tr>
<tr>
<td>0.81 - 1.00</td>
<td>Mild PAOD ?</td>
</tr>
<tr>
<td>0.51 - 0.8</td>
<td>Moderate PAOD</td>
</tr>
<tr>
<td>&lt;0.5</td>
<td>Critical ischaemia</td>
</tr>
</tbody>
</table>
CONSENSUS RECOMMENDATIONS

SIMPLIFYING VENOUS LEG ULCER MANAGEMENT

Recommendations from an expert working group

2015
## What to do if ABPI is abnormal?

<table>
<thead>
<tr>
<th>ABPI &lt;0,8 or &gt;1,3</th>
<th>Refer to specialist for further investigations and care</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABPI &gt; 1,3</td>
<td>Refer to specialist MODIFIED COMPRESSION using a stiff system may be applied with frequent reassessment and monitoring for ischemia and pressure damage</td>
</tr>
<tr>
<td>ABPI 0,5-&lt;0,8</td>
<td>Refer to vascular surgeon for possible revascularisation Consider IPC</td>
</tr>
<tr>
<td>ABPI &lt; 0,5</td>
<td>Refer to specialist for further investigations and care</td>
</tr>
<tr>
<td>ABPI 0.5-&lt;0.8</td>
<td>MODIFIED COMPRESSSION using a stiff system may be applied with frequent reassessment and monitoring for ischemia and pressure damage</td>
</tr>
</tbody>
</table>
25 patients with mixed ulcers
(ABPI 0.42-0.8)

• 1. Flat Laser Doppler under the bandage
• 2. Standard Laser Doppler on first toe (plantar)
• 3. TcPO2 dorsum of the foot
• 4. Toe pressure

• without bandage
• Inelastic bandages
  – 20-30 31-40 41-50 mm Hg
  (measured by Picopress)
Inelastic bandages -40 mmHg

INCREASE of LDF
NO distal flow reduction

25 patients with mixed ulcers (ABPI 0,6-0,8)

Inelastic compression in mixed ulceration (n=25)

- ABPI 0.5-0.8, ankle pressure > 60 mmHg:
- Inelastic bandages with pressures <40mmHg
  - Increase arterial perfusion
  - Increase venous pump (Ejection fraction)

„MODIFIED compression“ if ABPI 0,5-0,8

- Inelastic material not exceeding 40 mmHg
- Padding of sharp curvatures (bones and tendons)
- Frequent bandage change (initially daily)
- Check for pressure marks on the skin
- Walking exercises
- Combine with IPC
Increase of blood flow under light compression

Shown:

- In normals –
- In venous patients
- In purely arterial patients
before compression

during compression

values in ml/min

before compression

48

45

47

36

20

during compression

85

77

58

44

35

modified from:

Mayrovitz HN, Larsen PB.
Effects of compression bandaging on leg pulsatile blood flow.
Clin Physiol 1997; 17: 105-117.
Laser Doppler Flux
Effect of compression in venous patients (sitting)


Courtesy Ph. Coleridge Smith
Compression in arterial patients

• 15 patients with PAOD (ABPI 0.5-0.8):
  – inelastic bandages,
  – standing pressure 25-30 mmHg
  – up to 2 weeks:

• Improvement of microcirculation, no skin damage

Compression effects on arterial circulation

• Sustained compression
  – light pressure enhances arterial flow
  – strong pressure reduces arterial flow

• Intermittent compression
  - enhances arterial flow

Mayrovitz HN et al. Ostomy Wound Manage 1998;44:56-60

Mayrovitz HN et al. Adv Skin Wound Care 2003;16:198
Dai G et al. AJP-Heart and Circ Physiol2002;282:2066
Increase of blood flow under light compression:
Some possible explanations

- Myogenic relaxation in arterial wall
- Release of vasodilating mediators
- Reduction of arterio-venous pressure gradient by improvement of venous return
Fig. 1. Mechanical effects of pneumatic compression on a vein or artery. The pneumatic compression increases intravascular flow, shear and compressive strain on endothelial cells with the resulting release of biochemical mediators. tPA: tissue plasminogen activator; NO: nitric oxide; TFPI: tissue factor pathway inhibitor.
Pressure induced vasodilation

- Compression triggers an arteriolar vasodilatory axon reflex response, mediated by nervous and biomechanical signals (Fromy B et al.)
- Increase of skin blood flow under compression stockings (Mayrovitz HN 2013, Grenier et al. 2014)
Increase of capillary density

Bollinger A, Fagrell B. Clinical capillaroscopy, Hofgreve & Huber 1990
Sustained bandage pressure should never exceed the arterial perfusion pressure (= ankle pressure)!

Persisting or increasing pain: Remove the bandage!

Consider neuropathy!

Warning!!!
Ankle pressure < 50 = Critical ischemia = Contraindication sustained compression
Hazards of compression treatment of the leg: an estimate from Scottish surgeons

Callam MJ, Ruckley V et al.

- 38 cases of skin necrosis after antiembolism stockings
- 36 cases after compression stockings
- 73 cases after compression bandages
Avoid sustained compression

- Elastic material provides sustained compression.

- Inelastic compression produces high pressures intermittently during walking only, loses pressure immediately.
Sustained compression: elastic stockings

- Elastic fibers: maintain pressure
- Inelastic bandage: immediate pressure loss
Sustained compression pressure should never exceed the ankle pressure.
High sustained pressure in a patient with unrecognized AOD
Conclusions

• Sustained compression pressure should never exceed the intraarterial pressure (ankle pressure)
• Stiff, light pressure bandages (<40 mmHg) reduce venous oedema, improve nutritional flow and venous pumping function
• Intermittent pressure waves (pumps, stiff bandages + movement) enhance arterial inflow
• „Modified inelastic bandages“ are the basic treatment in mixed arterial-venous-lymphatic disease
ICC Bari: Cinderella indications

- Oct 9, 2015