Etiology of CLI and the role of perfusion

Jim Reekers, MD, PhD, EBIR
University of Amsterdam teaching hospital. Netherlands
Disclosure

Speaker name: Jim Reekers

I have the following potential conflicts of interest to report:

Institutional research grant from philips.
2 patients with CLI

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male 72 years</td>
<td>Male 70 years</td>
</tr>
<tr>
<td>Diabetes type 2</td>
<td>Diabetes type 2</td>
</tr>
<tr>
<td>Non-healing ulcer with mild infection.</td>
<td>Non-healing ulcer dig 3 left foot</td>
</tr>
<tr>
<td>Polyneuropathy</td>
<td>Polyneuropathy</td>
</tr>
<tr>
<td>No osteomyelitis</td>
<td>No osteomyelitis</td>
</tr>
<tr>
<td>ABI 58%</td>
<td>ABI 62%</td>
</tr>
<tr>
<td>Toe pressure 32 mmHg</td>
<td>Toe pressure 34 mmHg</td>
</tr>
</tbody>
</table>
Follow-up

Patient 1

Patient 2

- Minor amputation dig 3
- Good wound healing
- No amputation at 12 months
Conclusion

• Visual information about the result of an intervention is **insufficient** to predict outcome.

• **CLI can exist with good flow in the foot.**

• We need **functional** information about the result of our intervention.
Perfusion angiography

- **Quantitative** information about the change in total flow through the whole foot.

- Could be a parameter for:
  - Endpoint of revascularization
  - Success
  - Outcome
Perfusion of the foot

• Macrovascular (conduit arteries)
• Microvascular (arterioles-capillaries–venules)

- The arterioles range in diameter from about 5 to 100 µm, have a thick smooth muscle layer, a thin adventitial layer, and an endothelial lining.

- The arterioles give rise directly to the capillaries (5 to 10 µm in diameter).
Perfusion angiography

Time-density
What makes the blood flow?

Cardiac output

Peripheral resistance

Blood pressure

Artery
Arteriole
Capillary

Circular muscle (Arteriolar pinchock)

Peripheral resistance
Under normal physiological circumstances blood flow is subject to some very basic rules.

- The **total blood volume** is constant
- The inflow and the return flow are in balance.
- The blood pressure is generated by cardiac output and the peripheral resistance
- The **local** blood volume rate is depending on the vessel diameter and the flow velocity
- The flow velocity is subject of cardiac output and peripheral resistance.
Increase in flow to the foot after revascularization

- The **local** blood volume rate is depending on the vessel diameter and the flow velocity

- The **total blood flow is constant**
  - Cardiac output
  - Peripheral resistance
Perfusion angiography of the foot pre and post intervention.

Instant information about

- Volume increase
- Velocity increase
- Flow (re-)distribution
Pre- and post pta of a stenosis at the bypass anastomosis to the peroneal artery
After opening of the tibiopeoneal trunc.
New outcome parameters

Angle increase 15°
Flow velocity

Peak: increase > 100%
Volume flow/time

Area under the curve: increase >80%
Total volume
3 new parameters to quantify the result of the intervention.

- Increase in Flow velocity
- Volume flow/time
- Increase in total volume
Redistribution of flow to the foot after revascularization
Crural vessels are communicating vessels

After opening crural vessels

– There is a redistribution of flow depending on the outflow.
Conclusion 1

• PA gives **Quantitative** information about the total **flow** in the foot after revascularization.

• PA gives instant information about the (**re-**)distribution of flow after revascularization.
Conclusion 2

• PA provides **new parameters** to guide the decision making during revascularization and to predict outcome.

• With PA we might get more information about the etiology of CLI.
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