Angiosome directed revascularization improves wound healing with CLI: when does it matter?

Richard F. Neville, MD

Associate Director, INOVA Heart and Vascular Institute
Vice-Chairman, Department of Surgery
Director of Vascular Services
Falls Church, Virginia

Disclosures

• Nothing related to disclose

Angiosome concept

- Angiosome: 3D anatomic unit of tissue (skin, muscle, bone, nerve) fed by a single source artery
- Defined 40 in the body

Angiosomes of the lower leg and foot

Six distinct angiosomes:
- Anterior tibial artery (1)
- Dorsalis pedis
- Peroneal artery (2)
- Lateral calcaneal
- Anterior perforator
- Posterior tibial artery (3)
- Calcaneal
- Medical plantar
- Lateral plantar

Cadaveric dissection with colored latex injections


Angiosome revascularization

Healing more complete with direct revascularization of the wound's angiosome by surgical bypass

Direct revascularization

Indirect revascularization

Healing faster with direct revascularization of the wound's angiosome by surgical bypass

Annals of Vascular Surgery

Angiosome theory: does it matter?

Indirect connections
• Arterial-arterial connection: “Choke vessels”
• Pedal arch

Wounds not confined to strict borders

Angiosome concept: does it matter

Surgical bypass
• Oregon Health Sciences University
• n=106 bypasses
• More complete healing in the DR group ($p<.001$)
  – DR 78% vs IR 46%
• More rapid time to healing in the DR group ($p=.002$)
  – DR 99 days vs IR 195 days
• Only 36% of wounds in a single angiosome


Angiosome concept: does it matter

Surgical bypass
• n=106 tibial bypasses for tissue loss
  – 36 DR
  – 22 IR
• More rapid healing in the DR group
  – 56 days vs 112 days
• Limb salvage higher in DR group
  – 1 year: 91% vs. 66%
  – 5 years: 58% vs. 18%


Angiosome concept: does it matter

Endovascular
• Healing of diabetic ischemic ulcers after endovascular revascularization
  DR 83% healed
  IR 59% healed

“An angiosome model of perfusion, helps the treatment of diabetic foot ulcers”


Angiosome concept: does it matter

Endovascular
• 203 ischemic ulcers
• Procedures
  – Iliac PTA 17%
  – SFA stenting 54%
  – Tibial PTA 82%
• Healing improved with DR
  – Direct R 86%
  – Indirect R 69%


Angiosome concept: does it matter

Endovascular
• Ischemic diabetic foot ulcers (n=250)
• Improved healing (12 m) with DR
  – Direct R 72%
  – Indirect R 45%

“Important for ulcer healing in diabetic patients”

Angiosome concept; does it matter

- Universities of Poitiers and Bologna
- Peroneal bypass (n=120)
- Amputation free survival (3 years)
  - DR vs IR made no difference
- Patency of both peroneal collateral branches
- Patency of pedal arch
- 46% of wounds in a peroneal angiosome


Angiosome concept; clinical results

<table>
<thead>
<tr>
<th></th>
<th>Direct revasc</th>
<th>Indirect revasc</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neville</td>
<td>91</td>
<td>62</td>
<td>Bypass</td>
</tr>
<tr>
<td>Lejay</td>
<td>91</td>
<td>66</td>
<td>Bypass</td>
</tr>
<tr>
<td>Alexandrescu</td>
<td>83</td>
<td>59</td>
<td>Endovascular</td>
</tr>
<tr>
<td>Iida</td>
<td>86</td>
<td>69</td>
<td>Endovascular</td>
</tr>
<tr>
<td>Kret</td>
<td>78</td>
<td>46</td>
<td>Bypass</td>
</tr>
<tr>
<td>Kaba</td>
<td>96</td>
<td>83</td>
<td>Bypass/Endo</td>
</tr>
<tr>
<td>Soderstrom</td>
<td>72</td>
<td>43</td>
<td>Endovascular</td>
</tr>
</tbody>
</table>

Over 700 limbs studied

Angiosome meta-analysis

- 9 studies from 2001-2012
- 1290 limbs
  - 715 DR
  - 575 IR
- Bypass & Endovascular revascularization
- Direct R lowers the risk of an unhealed wound
- Direct R lowers risk of major amputation

Angiosome meta-analysis

- 15 studies
- 1868 limbs
- Direct R greater wound healing
- Direct R greater limb preservation
- Maintained for bypass and endovascular analysis

Angiosome: Societal guidelines

- Direct Revascularization of the appropriate angiosome does result in increased healing
- The angiosome concept should be considered in planning revascularization for healing
- May be most important for:
  - Endovascular therapy may be more i than bypass
  - Diabetic revascularization
  - Wound in a single angiosome

- The angiosome concept matters when it can be utilized without sacrifice of other key principles of revascularization
Thank you