Peripheral Artery Disease Interventions Utilizing the Angiosomal Approach to the Complex Wound

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No Disclosures
**Angiosome Concept:** Introduced by Taylor and Palmer in 1987 which divides the body into 3-dimensional vascular territories supplied by specific source arteries and drained by specific veins.
• Taylor and Palmer: 3D anatomic unit of tissue fed by a source artery

• Adjacent angiosomes bordered by choke vessels (indirect connections among angiosomes)

• Understanding the angiosome principal allows the interventionalist to perform the procedure that maximizes
  – Ischemic ulceration healing
  – Surgical incision/amputation healing
Anterior Tibial Artery Angiosome

Peroneal Artery Angiosome

Posterior Tibial Artery Angiosomes

Foot Angiosomes
Direct vs Indirect Revasc in BK interventions for CLI (360 pts)

**Limb Salvage**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Total</th>
<th>Total</th>
<th>IV, Random, 95% CI</th>
<th>Year</th>
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<tbody>
<tr>
<td>Varela 2010</td>
<td>45</td>
<td>31</td>
<td>0.76 [0.28–2.01]</td>
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<tr>
<td>Alexandrescu 2011</td>
<td>134</td>
<td>98</td>
<td>0.52 [0.24–1.14]</td>
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<td>Blanes Ortí 2011</td>
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<td>16</td>
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<td>Iida 2012</td>
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<tr>
<td>Kabra 2013</td>
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<tr>
<td>Lejay 2013</td>
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<tr>
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<td>129</td>
<td>0.62 [0.31–1.25]</td>
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<table>
<thead>
<tr>
<th>Hazard Ratio</th>
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<tr>
<td>IV, Random, 95% CI</td>
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<tr>
<td>0.44 [0.26–0.75]</td>
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Wound Healing

<table>
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<th>Hazard Ratio IV, Random, 95% CI</th>
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<td>0.75 [0.44 – 1.27]</td>
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<tr>
<td>Azuma 2012 a</td>
<td>59</td>
<td>51</td>
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<td>67</td>
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<td>39</td>
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<td>121</td>
<td>129</td>
<td>0.56 [0.39 – 0.81]</td>
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<td><strong>Total</strong></td>
<td><strong>331</strong></td>
<td><strong>277</strong></td>
<td><strong>0.64 [0.52 – 0.78]</strong></td>
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</tbody>
</table>
**Systematic Review and Meta-analysis of Direct Versus Indirect Angiosomal Revascularisation of Infrapopliteal Arteries**

D.C. Bosanquet a, b, J.C.D. Glasbey b, I.M. Williams a, C.P. Twine c

a South East Wales Regional Vascular Network, University Hospital of Wales, Cardiff, UK
b Cardiff University School of Medicine, Cardiff, UK
c South East Wales Regional Vascular Network, Royal Gwent Hospital, Newport, UK

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Favours DR Events</th>
<th>Total</th>
<th>IR Events</th>
<th>Total</th>
<th>Weight</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
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<td>Acin</td>
<td>14</td>
<td>44</td>
<td>23</td>
<td>39</td>
<td>11.5%</td>
<td>0.32 [0.13, 0.80]</td>
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<td>17</td>
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<td>48</td>
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<td>0.32 [0.03, 3.18]</td>
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<td>Kret</td>
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<td>54</td>
<td>41</td>
<td>52</td>
<td>12.1%</td>
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<td>Noville</td>
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<td>8</td>
<td>21</td>
<td>3.2%</td>
<td>0.16 [0.03, 0.89]</td>
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<tr>
<td>Osawa</td>
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<td>29</td>
<td>6</td>
<td>22</td>
<td>1.9%</td>
<td>0.10 [0.01, 0.86]</td>
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<tr>
<td>Rashid</td>
<td>9</td>
<td>66</td>
<td>16</td>
<td>75</td>
<td>11.7%</td>
<td>0.58 [0.24, 1.42]</td>
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<tr>
<td>Soderstrom</td>
<td>28</td>
<td>84</td>
<td>45</td>
<td>84</td>
<td>23.5%</td>
<td>0.39 [0.21, 0.73]</td>
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<tr>
<td>Valera</td>
<td>4</td>
<td>45</td>
<td>8</td>
<td>31</td>
<td>5.5%</td>
<td>0.28 [0.08, 1.03]</td>
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<tr>
<td>Subtotal (95% CI)</td>
<td>683</td>
<td>438</td>
<td>100.0%</td>
<td></td>
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<td>0.40 [0.29, 0.54]</td>
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<tr>
<td>Total events</td>
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<td>186</td>
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</table>

Heterogeneity: Tau² = 0.00; Chi² = 7.29, df = 10 (P = 0.70); I² = 0%
Test for overall effect: Z = 5.91 (P < 0.00001)
Goals of Revascularization

- Direct Flow to the foot
- Angiosome Concept (Direct flow to ischemic zone when possible. Indirect perfusion may suffice when excellent collateral vessels present.)
- Achieve at $\text{TcPO}_2 > 20 \text{ mm Hg}$, ideally $> 40 \text{ mm Hg}$
- SPP $> 50 \text{ mm Hg}$

ACHIEVE ENOUGH BLOOD FLOW TO THE WOUND TO ACHIEVE HEALING
Patient with a medio-lateral heel non healing ulcer, Absent pedal pulses, PT with faint monophasic flow by Doppler. Tibio-pedal Ultrasound mapping showed patent hibernating PT

- Access should be antegrade with preparation to obtain PT tibial access

- Also be prepared to do antegrade/retrograde crossing and treatment
Angiosomes directed therapy

Posterior Tibial artery w/ diffuse disease, (a single diseased tibial vessel runoff via Peroneal),

Critical heel ulcer
With global calcaneal hypoperfusion

10 weeks later
Angiosomes directed therapy. Initial Angio - right Peroneal and PT.

Keep in mind, when you have heel ulcers
Look for both calcaneal branches. Medial And lateral
Understanding tibiopedal anatomy gives you the upper hand and additional therapeutic options.

Interventional wire in the antegrade/retrograde approach during CLI angiosome directed therapy.

Balloon angioplasty in an antegrade/retrograde angiosome directed therapy.
Angiosome Directed Therapy
A multi-disciplinary post-therapy approach is critical to Success.
Ulcer on the Medial Aspect of the Left Ankle

Which Artery is Affected?
Ulcer on the Medial Aspect of the Left Ankle
What’s wrong?

Happy?
Ulcer on the Medial Aspect of the Left Ankle – Post Intervention

Adams, GL 2011
Ulcers on the Lateral Aspect of the Right Lower Leg and Dorsum of the Foot

Which Artery is Affected?
Ulcers on the Lateral Aspect of the Right Lower Leg and Dorsum of the Foot

Angiogram

Intervention
Ulcers on the Lateral Aspect of the Right Lower Leg and Dorsum of the Foot

Post-Intervention
Ideally which artery should we revascularize?
Advanced Techniques for Limb Salvage

- Distal and multi-vessel intervention
- Pedal and Tibial Access
- CTO Techniques
- Recanalization via collaterals
- Pedal Arch recanalization
Challenges of Direct Angiosome Perfusion

- Long lesions
- Heavy calcifications
- Sub-optimal Equipment
- Limited treatment options
- Poor long term patency

**ACHIEVING LIMB SALVAGE PERFUSION IS NOT EASY AND OCCASIONALLY REQUIRES MORE THAN ONE INTERVENTION.**
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