Update On The Angiosome Concept: It’s Not All It’s Cracked Up To Be; What Other Factors Are More Important

Hisham Rashid
Consultant Vascular Surgeon
King’s College Hospital, London, UK
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Disclosure

- I do not have any potential conflict of interest

The Angiosome Concept

Taylor & Palmer (Br J of Plastic Surgery, 1987)
- 2000 anatomical studies
- Each angiosome is a “composite anatomical territory supplied by a named artery”
- “Choke vessels” and true anastomoses linking angiosomes

The foot and ankle angiosomes

Angiosome revascularization concept
“Revascularization of a specific angiosome for limb salvage: does the target artery matter?”
- 52 non-healing leg ulcers in 48 patients
- Distal bypass only
- 51% (n=27) direct revascularization
- 49% (n=25) indirect revascularization
- Healing and amputation rates significantly better in direct group (p=0.03)
- Time-to-healing was not significantly different [162.4 days Vs 159.8 days] (p=0.95)

*Neville & Attinger, Ann Vasc Surg, 2009*

“Importance of the angiosome concept for endovascular therapy in patients with critical limb ischemia”
- 203 limbs in 177 consecutive patients
- Rutherford class 5 or 6
- Angioplasty: direct group and indirect group revascularisation
- Limb salvage rate significantly higher in the direct group (P = 0.03)

*Iida et al, Cathet Cardiovasc Interv. 2010*

“Outcomes of angiosome and non-angiosome targeted revascularization in critical lower limb ischemia”
- 64 patient with critical limb ischemia
- Direct revascularization (DR) of the ischemic angiosome performed in 61% (n = 39), indirect revascularization (IR) in 39% (n = 25)
- Open surgery in 60.9% and endovascular in 39.1%
- Rate of ulcer healing between DR and IR groups was statistically significant (P = 0.021)
- Limb salvage in the DR group (84%) and IR group (75%) was not statistically significant (P = 0.06)

*Kabra et al, JVS, 2012*

“Factors influencing wound healing of critical ischemic foot after bypass surgery: is the angiosome important in selecting bypass target artery?”
- 249 distal bypasses; 81% were diabetic, 49% ESRD
- Healing rate in indirect revascularisation was slower than in direct revascularisation, especially in ESRD patients (p < 0.001)
- No difference after propensity scoring (p=0.185)
- Conclusion:
  “The angiosome concept seems unimportant, at least in non-ESRD cases”

*Azuma, Eur J Vasc Endovasc Surg, 2012*

Aim of the Study
Evaluate the impact of direct angiosome revascularization on the time-to-healing of foot tissue loss and the outcome of infra-popliteal bypass surgery in patient with CLI

*Rashid et al, JVS, 2013*

Results
- 142 patients, 152 distal/ultra-distal bypasses
- Ulcers in 97(64%) and gangrene in 55(36%)
- Venous conduit in 148(97%), PTFE in 4(3%)
- 68(45%) in DAR group
- 84(55%) in Non-DAR group
- 4 Non-DAR patients were lost to follow-up
### Demographic data & risk factors

<table>
<thead>
<tr>
<th></th>
<th>DAR (n=68)</th>
<th>Non-DAR (n=80)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>53 (78%)</td>
<td>60 (75%)</td>
<td>0.7024</td>
</tr>
<tr>
<td>Median age (range)</td>
<td>75yr (47-88)</td>
<td>76yr (51-96)</td>
<td></td>
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<tr>
<td>Diabetes mellitus</td>
<td>56 (82%)</td>
<td>67 (84%)</td>
<td>0.8296</td>
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<tr>
<td>Chronic renal failure</td>
<td>20 (29%)</td>
<td>27 (34%)</td>
<td>0.5994</td>
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<tr>
<td>Ischaemic heart disease</td>
<td>33 (49%)</td>
<td>37 (46%)</td>
<td>0.8691</td>
</tr>
<tr>
<td>Hypertension</td>
<td>61 (90%)</td>
<td>66 (83%)</td>
<td>0.2439</td>
</tr>
<tr>
<td>Smokers/Ex-smokers</td>
<td>48 (71%)</td>
<td>62 (78%)</td>
<td>0.3521</td>
</tr>
</tbody>
</table>

### Time-to-healing

- **DAR (89%)**
- **Non-DAR (79%)**

### Aim of the Study

The impact of direct angiosome revascularization on the healing of the foot in relation to the quality of the arterial pedal arch in patients undergoing infra-popliteal bypass for CLI

*Rashid et al, JVS, 2013*

### Arterial Pedal Arch Classification

- **Complete Pedal Arch (CPA)**
- **Incomplete Pedal Arch (IPA)**
- **No Pedal Arch (NPA)**

*Gray’s Anatomy, 1858*
Pedal Arch Classification

- Incomplete pedal arch
- No pedal arch

Results

- 148 distal bypasses
- Ischemic ulcers in 95(64%) and gangrene in 53(36%)
- Wagner’s grade 2-5
- CPA (22%), IPA (62%), NPA (16%)
- 68(46%) in DAR group
- 80(54%) in Non-DAR group

Conclusions

- Healing and time-to-healing of foot tissue loss were significantly influenced by the quality of the pedal arch rather than the angiosome revascularized
- Wound healing could be achieved even in the presence of poor quality pedal arch

“Clinical implications of the angiosome model in peripheral vascular disease”

- “The dearth of convincing evidence in the form of prospective trials and large patient populations, and the lack of a consistent, comparable vocabulary to contrast study findings, prevent recommendation of the conceptual model at a wider level for guidance of revascularization attempts”

Sumpio et al, JVS, 2013
Is it the time for a randomized trial?

- Endovascular or open study
- Wound healing is multi-factorial
- Recruiting will be challenging
- Quality of pedal arch should be documented!

“Clinical implications of the angiosome model in peripheral vascular disease”

“Unfortunately, the gold standard of a randomized controlled trial may not be ethical in these patients, as the selection of a distal target in surgical bypass and endovascular therapy must be dictated by best surgical principles, and not by a research directive that would command an inferior intervention”

Sumpio et al, IVS, 2013