Can wound healing and limb salvage be improved by better vessel patency

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Disclosure

Speaker name:

Frank Vermassen

I have the following potential conflicts of interest to report:

☑ Consulting: Medtronic, Abbott Vascular, Gore, Terumo, Silkroad, Bard, Cordis.

☐ Employment in industry

☐ Stockholder of a healthcare company

☐ Owner of a healthcare company

☐ Other(s)

☐ I do not have any potential conflict of interest
CLI – Need for revascularisation

Chronic ischemic rest pain, ulcers or gangrene attributable to objectively proven arterial occlusive disease

1 million
one mil. major amputations ww p/y

Dick JVS 2007
Influence on survival

Figure 1—Kaplan-Meier major amputation (A) and survival (B) estimates in nonrevascularized (NO REV) or revascularized with PTA or BPG patients.

Long-Term Prognosis of Diabetic Patients With Critical Limb Ischemia

A population-based cohort study
Is sustained patency important?

**Meta-analysis of infrapopliteal angioplasty for chronic claudication**

Marcello Romiti, MD
Anai Espinelli S. Duarte Santos and Sao Paulo

<table>
<thead>
<tr>
<th>Result</th>
<th>0 Months</th>
<th>12 Months</th>
<th>24 Months</th>
<th>36 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary patency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTA</td>
<td>95.1 ± 1.2</td>
<td>90.9 ± 1.9</td>
<td>88.5 ± 2.2</td>
<td>85.2 ± 2.5</td>
</tr>
<tr>
<td>Bypass</td>
<td>69.6 ± 2.0</td>
<td>63.4 ± 1.8</td>
<td>61.8 ± 2.3</td>
<td>60.4 ± 2.5</td>
</tr>
<tr>
<td>Secondary patency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTA</td>
<td>98.3 ± 0.7</td>
<td>92.3 ± 5.5</td>
<td>87.0 ± 2.1</td>
<td>74.3 ± 3.7</td>
</tr>
<tr>
<td>Bypass</td>
<td>86.1 ± 1.8</td>
<td>80.9 ± 1.9</td>
<td>78.6 ± 2.2</td>
<td>75.3 ± 2.7</td>
</tr>
<tr>
<td>Limb salvage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTA</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Bypass</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Patient survival</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Bypass</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

NA, Estimates not available; PTA, percutaneous transluminal angioplasty.

*Values are pooled estimate and standard error.

JVS 2008
Is sustained patency important?

Destiny Study

12-month Primary Patency

**MultiLink Vision vs Xience V**

- **P<0.001**
- 85.2%
- 54.4%

Clinical results:
Evolution in Rutherford

- No difference in Rutherford evolution

12-month freedom from amputation

**MultiLink Vision vs Xience V**

- **P=0.53**
- 98.7%
- 97.1%

Bosiers – Linc 2011
Is sustained patency important?

Optimal vascularization

Vascularization

Metabolic need

Trauma

Revascularisation

Restenosis

Time needed for healing

Patent

Restenosis

New trauma
Is sustained patency important?

Destiny Study

Number of re-interventions

MultiLink Vision vs Xience V

P = 0.001

Bosiers – Linc 2011
Primary vs secondary patency in CLI

- Limb Salvage correlates best with secondary patency, Continued clinical improvement with primary patency
- Primary Patency reduces TLR and cost, and improves QoL

Is sustained patency necessary?

- Albers (JVS 2006)

Meta-analysis of popliteal-to-distal vein bypass grafts for critical ischemia

![Graph showing patency rates over time]

Fig. 1. Random-effects meta-analysis of popliteal-to-distal bypass grafts for primary patency (gray line), secondary patency (black line), and foot preservation (red line).

Majority of patients with occlusion also lose their limb in the long term
Influence of restenosis

- O.lida (EJVES 2012)
  - 68 CLI-limbs in 63 patients
  - Restenosis impedes healing and independent walking

![Chart showing Ulcer healing and Ambulatory status with statistical significance](image)
DEBATE BTK – 1-year Results

Restenosis and Occlusion Rates

- Restenosis (>50%)
  - DEB: 27%
  - PTA: 74.3%
  - Relative Risk Reduction (RRR): 64%
  - P = 0.001

- Occlusion
  - DEB: 17.6%
  - PTA: 55.4%
  - RRR: 68%
  - P = 0.001

TLR

- 12-month TLR
  - DEB vs. PTA: 18.5% vs. 43.3% (p = 0.003)

Major Adverse Events

- Death
  - DEB: 7.7%
  - PTA: 4.5%
  - P = 0.4

- Major Amp.
  - DEB: 0.0%
  - PTA: 4.5%
  - P = 0.9

- TLR
  - DEB: 18.5%
  - PTA: 43.3%
  - P = 0.003

- AMI
  - DEB: 4.6%
  - PTA: 4.5%
  - P = 0.9

- CVA
  - DEB: 3.1%
  - PTA: 4.5%
  - P = 0.9

- Cumulative
  - DEB: 29.2%
  - PTA: 45.3%
  - P = 0.05

Complete Wound Healing

- DEB: 86.0%
  - P = 0.01

- PTA: 67.0%
Risc factors for amputation after PTA

Table 4 Univariate logistic regression analysis of variables potentially associated with above-the-ankle amputation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds ratio</th>
<th>95% confidence interval</th>
<th><strong>P</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (1 year)</td>
<td>0.95</td>
<td>0.88–1.01</td>
<td>0.099</td>
</tr>
<tr>
<td>Gender</td>
<td>1.82</td>
<td>0.49–6.74</td>
<td>0.367</td>
</tr>
<tr>
<td>Insulin therapy</td>
<td>7.20</td>
<td>0.98–52.69</td>
<td>0.052</td>
</tr>
<tr>
<td>Diabetes duration (1 year)</td>
<td>1.01</td>
<td>0.95–1.06</td>
<td>0.837</td>
</tr>
<tr>
<td>Body mass index (1 unit)</td>
<td>0.83</td>
<td>0.76–10.3</td>
<td>0.124</td>
</tr>
<tr>
<td>Glycated haemoglobin (0.1%)</td>
<td>1.07</td>
<td>0.82–1.42</td>
<td>0.49</td>
</tr>
<tr>
<td>Neuropathy</td>
<td>1.48</td>
<td>0.36–6.09</td>
<td>0.584</td>
</tr>
<tr>
<td>Retinopathy</td>
<td>0.52</td>
<td>0.14–1.94</td>
<td>0.334</td>
</tr>
<tr>
<td>Arterial hypertension</td>
<td>0.45</td>
<td>0.15–1.38</td>
<td>0.164</td>
</tr>
<tr>
<td>History of coronary artery disease</td>
<td>2.79</td>
<td>0.76–10.3</td>
<td>0.124</td>
</tr>
<tr>
<td>History of stroke</td>
<td>1.37</td>
<td>0.48–3.69</td>
<td>0.579</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.81</td>
<td>0.42–1.56</td>
<td>0.528</td>
</tr>
<tr>
<td>Urine albumin concentration (1 mg/l)</td>
<td>0.99</td>
<td>0.99–1.00</td>
<td>0.918</td>
</tr>
<tr>
<td>Serum creatinine &gt; 97 μmol/l</td>
<td>1.33</td>
<td>0.49–3.64</td>
<td>0.574</td>
</tr>
<tr>
<td>Dialysis</td>
<td>13.5</td>
<td>4.00–45.32</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Ulcer Wagner grade</td>
<td>3.29</td>
<td>1.16–9.35</td>
<td>0.026</td>
</tr>
<tr>
<td>Ulcer infection</td>
<td>2.79</td>
<td>0.76–10.28</td>
<td>0.124</td>
</tr>
<tr>
<td>TcPO₂ before PTA (1 mmHg)</td>
<td>0.99</td>
<td>0.89–1.01</td>
<td>0.092</td>
</tr>
<tr>
<td>TcPO₂ after PTA (1 mmHg)</td>
<td>0.82</td>
<td>0.76–0.88</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>ΔTcPO₂ (1 mmHg)</td>
<td>0.69</td>
<td>0.59–0.82</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>All crural arteries occluded</td>
<td>20.20</td>
<td>6.40–63.77</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
How long is patency needed?

- Wound healing time ~ 6 months
- Complete 6m healing rate < 50%

1. Xcell Trial – Rocha Sing 2011

Healing rates after infra-inguinal bypass surgery according to ulcer locations
GEAR: Ghent Experience on Angiosome Revascularisation

- Retrospective analysis of 201 femorocrural bypasses for non-healing wounds at Ghent University Hospital

Healing rate: DR ~ IR
85% vs. 79% at 12 months (P = 0.481)
Mean healing time: 7 months

Grafts with best patency also yield best healing rates
- 38 patients developed new wounds
- 64% in same angiosome
- 81% related to restenosis or occlusion
- Mean healing time: 7.2 mths

Best patency with autologous GSV
No difference between direct and indirect revascularisation
Sustained patency: The patient’s perspective

- What does a patient expect from a medical intervention?
  - Prolong life
    - Not achieved by peripheral revascularisation
  - Improve quality of life
    - In CLI patients this means
      - Freedom from amputation
      - Freedom from ischemic ulcers and rest pain
      - Freedom from re-interventions
Conclusion

- Restoration of blood flow to the foot is important for limb salvage and influences survival
- Sustained vessel patency is important to enhance wound healing, avoid repeat intervention and improve QOL and should be the goal of modern revascularization therapy
- Vessel patency alone is insufficient and has to go hand in hand with appropriate wound care
Can wound healing and limb salvage be improved by better vessel patency

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