Alternative approach to end stage critical limb ischemia

BTK revascularization: unresolved issues and outlook

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Disclosure

Speaker name: ROBERTO FERRARESI

I have the following potential conflicts of interest to report:

- Consulting: Medtronic, Abbott, Cook, LimFlow

No conflicts with this presentation

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BTK revascularization: unresolved issues and outlook

- BTK & BTA vessel disease and CLI
- Principle of venous arterialization
- Open questions
Obstructive disease distribution in a series of 1624 pts with CLI (RTF 5-6)

FOOT VESSEL CLASSIFICATION

We considered 4 big foot vessels:

1. retromalleolar posterior tibial artery
2. dorsalis pedis artery
3. lateral plantar artery
4. medial plantar artery

Plantar arch was considered separately, as the distal arch originating from lateral plantar artery, giving the forefoot distribution system and connecting to dorsalis pedis artery through the 1st perforating branch.

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Obstructive disease distribution in a series of 1624 pts with CLI (RTF 5-6)


Percentage of BTA diseased vessels (arch excluded) according to risk factors

- DM-/ESRD- (166 pts)
- DM+/ESRD- (993 pts)
- ESRD+/DM- (74 pts)
- DM+/ESRD+ (216 pts)

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Obstructive disease distribution in a series of 1624 pts with CLI (RTF 5-6)

- 65 yy old ale
- Type 1 DM
- ESRD in Hemodialysis
- Toes gangrene
Disease distribution in a series of 1915 with PAD and a complete angiographic study of BTA vessels

<table>
<thead>
<tr>
<th>PAD symptoms</th>
<th>N°</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic</td>
<td>6</td>
<td>0.3</td>
</tr>
<tr>
<td>Claudication</td>
<td>177</td>
<td>9.2</td>
</tr>
<tr>
<td>Ischemic Rest Pain</td>
<td>90</td>
<td>4.7</td>
</tr>
<tr>
<td>Ulceration or Gangrene</td>
<td>1642</td>
<td>85.7</td>
</tr>
<tr>
<td>Total</td>
<td>1915</td>
<td>100</td>
</tr>
</tbody>
</table>

“Below-the-ankle vessel disease in CLI patients: innocent bystander or leading actor?” Ferraresi R et Al, submitted for publication 2015
<table>
<thead>
<tr>
<th>Risk Factor for CLI</th>
<th>OR (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above the ankle vessel disease</td>
<td>1.20 (&lt;.05)</td>
</tr>
<tr>
<td>Foot vessel disease (arch excluded)</td>
<td>1.58 (&lt;.05)</td>
</tr>
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<td>Arch = small vessel disease</td>
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1. The disease of every above-the-ankle vessel segment has a weak association with CLI: we need many of them to get CLI

2. BTA vessel disease has the strongest association with CLI, particularly the small vessel disease of the arch *(the tiger of CLI!)*

**1° Conclusion:**
BTK & BTA vessel disease and CLI
BTK revascularization: unresolved issues and outlook

- BTK & BTA vessel disease and CLI
- Principle of venous arterialization
- Open questions
Meta-analysis of the Clinical Effectiveness of Venous Arterialization for Salvage of Critically Ischaemic Limbs

X.W. Lu,¹ M.M. Idu,¹ D.T. Ubbink¹² and D.A. Legemate¹*


Objective. The aim of this study is to assess the clinical effectiveness of venous arterialization in patients with critical limb ischaemia not reconstructable by conventional bypass.


Results. A total of 56 studies were selected. No RCTs were identified. Seven patient series, comprising 228 patients, matched the selection criteria. Overall 1-year foot preservation was 71% (95% CI: 64–77%) and 1-year secondary patency was 46% (95% CI: 39–53%). The large majority of patients in whom major amputation was avoided experienced successful wound healing, disappearance of rest pain and absence of serious complications.

Conclusion: on the basis of limited evidence, venous arterialization may be considered as a viable alternative before major amputation is undertaken in patients with ‘inoperable’ chronic critical leg ischaemia.
AV shunts

Arterial system

Capillary bed

Venules

Venous system
The natural blood flow is a “sequential” flow:

- Arteries
- Capillary bed
- Venules
- Veins
What can we do in patients with CLI in case of:

- Not reconstructable artery disease
- Global arterial system failure
- "No-option" patients
- "Inoperable" chronic critical leg ischaemia
- Etc. etc.
The arterialization of the venous system could be the only solution.
**Pathophysiology**

1. Venules have a very thin wall and can permit oxygen and metabolic exchange.
2. AV shunts (especially in diabetic neuropathy) could work reversely, improving blood flow to the capillary bed.
3. The global blood flow to the tissue is not sequential but “parallel”: some veins are afferent, some veins become efferent.

**Positive clinical effects**

1. Limb salvage 47-82% at 1y (mean 71%).
2. During follow-up of the patients without amputation, the large majority of the wounds healed successfully and rest pain had resolved. Patients also reported a significant increase in walking distance.

*Meta-analysis of the Clinical Effectiveness of Venous Arterialization for Salvage of Critically Ischaemic Limbs*

X.W. Lu, M.M. Isk; D.T. Ubbink and D.A. Legemate.

Negative effects

1. AV shunt increases cardiac output: high output cardiac failure

2. Venous hypertension: postoperative oedema was the most common complication, occurring in nearly all patients, but this generally disappeared after 5–30 days and persisted in a few patients only

Meta-analysis of the Clinical Effectiveness of Venous Arterialization for Salvage of Critically Ischaemic Limbs

X.W. Lu, M.M. Hsu, D.T. Ulbrink and D.A. Legemate

Patient 1
3.0 X 120 mm 14 atm

3.0 X 20 mm 26 atm
Courtesy Dr. Cesare Massa Saluzzo
Pavia - Italy
BTK & BTA vessel disease and CLI

Principle of venous arterialization

Open questions
Open questions

1. Where to do the AFV?
   - Proximal = shunt without tissue feeding
   - Distal = wound feeding, less shunt

2. The success of the procedure is the same in diabetics and non diabetics? Have AV-shunts a role in retrograde microcirculation?

3. Can we treat Rutherford 4-5-6 patients in the same way?
   - Can we save toes and rays?
   - Must we treat every patient with trans-metatarsal amputation?

4. What is the role of vein valves? Is valvulotomy always necessary? Are valves the true obstacle to retrograde tissue perfusion?

5. What is the fate of the arterialized veins? Failure after 3-6-12-24-XXX months?

Arterialization of the venous system is a new, great opportunity in “no-option” patients with CLI
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