An endovascular treatment option for end stage desert foot in the setting of rapidly progressing critical limb ischemia by way of deep venous arterialization

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Disclosure

Speaker name:
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I have the following potential conflicts of interest to report:

Consulting:
  Abbott Speaker Bureau
  Bard Speaker Bureau
**"No Option" CLI patient**

- Patient with no acceptable target vessels for percutaneous (PTA) or surgical revascularization
- May be considered for major limb amputation

**Major Limb Amputation**

- High perioperative mortality (5-10%)
- High major complication rate (20-37%)
- High Costs:
  - ~€40k in first month (45% is operating room cost)
  - 6th most expensive surgical procedure
  - US total annual cost: $11B
- Poor Outcomes:
  - Only 18-24% discharged home
  - 60-80% are unable to walk
  - 2 year mortality is 30-50%
43 year old male with a history of HTN, HLP, DM II, ESRD, PAD s/p R TMA presenting with L 2\textsuperscript{nd} toe wound
• ABI: Non compressible vessels

• US: L POP disease + 1 vessel via PT

• Revascularization:
  Angioplasty
    • POP + TPT + PT

    • Residual distal PT CTO with faint collaterals
Left popliteal angioplasty
5 x 60 mm DCB
Rapidly progressing wound

Post op day 3

Post op day 3

Post op day 11
Antegrade left CFA access: SFA+ POP mild disease
Single vessel run off via PT
Distal PT CTO with under-perfused collaterals inadequately supplying the foot combination of macro + microvascular disease

Unable to cross distal PT CTO
Antegrade L CFA access
Multiple guide wires

No option CLI

Heavily calcified
Desperation

Concept of deep venous arterialization

Pressurize the vein
Backfill the capillaries
Improve tissue perfusion
Trigger angiogenesis

0.18 angled CXI catheter + Astato 30 wire
Creation of fistula from PTA to PTV
Balloon angioplasty with 2.0 and 2.5 mm balloons
Goal: pressurize plantar veins
- TMA after revascularization
- Wound care + antibiotics
- TcPO2
  - Dorsum 2 to 11 mmHg
  - Medial 22 to 45 mmHg
  - Both > 50 mmHg with O2
Set back 8 weeks later:
non compliance with offloading
Debridement and wound vac placement

TcPO2:
Dorsum 11 improved to 40 + Medial 45 improved to 50 mmHg
5 months later
Percutaneous Deep Venous Arterialization

A brief technical overview of percutaneous deep venous arterialization for critical limb ischemia.

BY STEVEN KUM, MD
DIJKER SCHEINERT, MD

Critical limb ischemia is a condition in which the blood supply to the leg is insufficient, often due to atherosclerosis, diabetes, and other factors. The patient's demographics, comorbidities, and the presence of critical limb ischemia drive physician and vascular disease-drivers to adopt a percutaneous approach. Percutaneous techniques include percutaneous distal vessel angioplasty, angulated arterial strategies, and other percutaneous techniques.

However, patients are increasingly older, have more severe comorbidities, and often have had previous tissue infection and tissue loss, both of which can make an angiographic success very difficult. It is common to see a patient's foot without discernible blood flow. Many patients have already undergone multiple interventional procedures. This is where the "no-option" end-stage patient, stem cell therapy, or other local approaches offer some promise but is still in a relatively early phase of development and evaluation.

DEEP VENOUS ARTERIALIZATION

Deep venous arterialization (DVA) is not a new concept; it involves shunting arterial blood flow into the deep veins. Early surgical approaches involved bypassing the arteries, but these were often plagued by failure. Percutaneous approaches to DVA have been increasingly explored as better imaging and catheterization techniques have emerged.
Results
A total of 56 studies were selected for comprehensive review. 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 ischemia.
Venous Arterialisation for Salvage of Critically Ischaemic Limbs: A Systematic Review and Meta-Analysis

Conclusion: In this systematic review on venous arterialisation in patients with non-reconstructable critical limb ischaemia, the pooled proportion of limb salvage at 12 months was 75%. Venous arterialisation could be a valuable treatment option in patients facing amputation of the affected limb; however, the current evidence is of low quality.

Background: With high amputation rates associated with CLI, efforts to preserve extremity function with venous arterialisation have increased over the past decade. A recent study systematically reviewed for patients with CLI who underwent venous arterialisation and evaluated the outcomes of these procedures. Results: Fifteen studies were included, with patient demographics and procedural characteristics described. Of the 59 patients included in the study, the overall 1-year amputation rate was 75% (0.7 to 10%). The rate of limb salvage ranged from 0% to 90% and was associated with post-operative survival, patency, and amputation-free survival at one year. Conclusion: The evidence is associated with high levels of quality in terms of study design and reporting, with most studies reporting survival outcomes. However, the variability in outcome measures limits the ability to draw strong conclusions. Keywords: Critical limb ischaemia, Venous arterialisation, Limb salvage

Figure 3. Angiograms before (A) and after (B-D) the procedure (C is magnified lateral, D is magnified anteroposterior). Wound status preoperatively (E) and after forefoot amputation at day 12 (F), day 91 (G), and day 164 (H, fully healed).
Endovascular Distal Plantar Vein Arterialization in Dialysis Patients

Keywords
arteriovenous fistula, below-the-ankle revascularization, critical limb ischemia, desert foot, ischemic ulcer, limb salvage, no-option CLI, occlusion, plantar vein, posterior tibial artery, subintimal recanalization, vein arterialization
Thank you

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