DVA pathophysiology and mechanism of action

Vincenzo Foppa, 1462
“The miracle of the salvaged foot”
Cappella Portinari, S. Eustorgio Church
Milan, Italy
Disclosure

Roberto Ferraresi, MD

In the last 2 years I have the following potential conflicts of interest to report:

**Consultant:** Medtronic, Abbott, Boston Scientific, Contract Medical International, Cook, Asahi, Ivascular, Biotronik, Limflow, Spectranetics, Shire, Kardia, Astra Zeneca, Orbus, Bard, Philips, Volcano, Novena, Angiodroid, M&L Healthcare

**Virtual shareholder:** Limflow
4 vein foot systems

1. V. Saph. Int.
2. V. Plant. Ext. Sup.
3. V. Pédieuse
4. V. P. du Gros orteil

- Arc Dors. Sup.
- Arc Plant. Prof.
- V. Plant. Prof.
4 vein foot systems

The foot vein fortress
Jailed inside the fortress!
If arterial blood does not reach venulae in microcirculation, DVA is only AVF, not DVA

Sasajima T, Koyama T. Oxygen Transport to Tissue 34: Springer, NY. pp245-250; 2012

We estimate each venula with a diameter of 30μm is surrounded by tissue cylinder with a radius of 268μm.

When retrograde arterial blood flow reaches 30μm venulae, oxygen diffusion front reaches 587μm at rest, which exceeds tissue cylinder radius, so sufficient oxygen is transported to resting ischemic skeletal muscle.
If I cannot see, by angio, blood flow escaping from fortress and going into the tissues I cannot believe in FVA!
Mechanical hypothesis: direct tissue nutrition by reverse blood flow due to valve incompetence

1° In a minority of pts we can see blood flow escaping from the fortress and going into metatarsal & plantar vein systems

- Hydrostatic pressure could play a role

- Distal veins recruitment due to mechanical fatigue leading to progressive valve failure
Mechanical hypothesis: direct tissue nutrition by reverse blood flow due to valve incompetence

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No pressure calf

Pressure calf inflated at the ankle
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Baseline angio & foot picture
Final result of the FVA procedure after embolization of proximal stealing branches
Final result of the FVA procedure after embolization of proximal stealing branches
One month later
Angio study before TMT amputation + connective tissue substitute
3 months later, before skin graft
Angio-study
3 months later, waiting for the final orthopedic shoe
Time 0 Post-embolization

+1 month Pre-TMT

+3 months Before skin graft
Let “buds” grow up
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Biological hypothesis: remodeling and/or neoangiogenesis creating a new foot distribution system

- Recruitment of the old hidden & survived arterial fragments
- FVA promotes angiogenesis creating a new arterial distribution system
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- **Jun 2017**
- **April 2018**
- **2018 Nov**
Comparison with the baseline angiography made 2 years before.

I am injecting dye inside the venous graft!
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Biological hypothesis: remodeling and/or neoangiogenesis creating a new foot distribution system

- Recruitment of the old hidden & survived arterial fragments
- FVA promotes angiogenesis creating a new arterial distribution system
- 5 month after PDVA
- 3.5 month after TMT amputation
### Mechanical hypothesis: direct tissue nutrition by reverse blood flow due to valve incompetence

#### Timing
- Fast? Could we use FVA in acute limb ischemia?
- Slow? Weeks or months? We cannot use it in acute limb ischemia

#### Technical targets
- Small vein devalvulation – microvalvulotomes
- Plantar vein network?
- Less important to pursue small vein devalvulation or plantar vein network, the vascular remodeling will grow up a new vascular distribution system

#### Wound
- No wound necessary: we could use FVA in RTF 4 & 5
- Maybe a big wound is an essential factor to start vascular remodeling, and we cannot use FVA in RTF 4 (and 5?) pts

#### Patency
- Long term patency needed! Occlusion means redo CLI
- A temporary patency is sufficient

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