All Patients With CLTI Should Have An Attempt At Revascularization: The Angiosome Concept Is Not Usually Helpful: Tips And Tricks For Success And Who Should Have A Primary BTK Amputation

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Disclosure

- I do not have any potential conflict of interest

"Fate of the contralateral limb after lower extremity amputation"

- Review all lower extremity amputation (1998-2010)
- 1,715 patients (average age; 67.2 years, 77%, diabetic)
- 34% underwent an initial major amputation
- After major amputation, 5.7% and 11.5% had contralateral major amputation at 1 and 5 years
- After minor amputation, 3.2% and 8.4% had contralateral major amputation at 1 and 5 years while 10.5% and 14.2% have an ipsilateral major amputation at 1 and 5 years

Glaser et al, JVS 2013

Quality and Outcome Framework, 2012
Lower Limb Amputation: Working Together. NCEPOD (2014)

| Treatment Strategy                        | Cost-effectiveness
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Barshes et al. JVS, 2012

Cost-effectiveness in the contemporary management of critical limb ischemia with tissue loss

- Markov model used to analyse 6 different treatment strategies
- Surgical bypass with subsequent endovascular revision(s) most cost-effective alternative to wound care alone
- Endovascular-first management strategies achieved comparable clinical outcomes but at higher cost
- Endovascular management did become cost-effective when the initial foot wound closure rate was >37% or when procedural costs were decreased by >42%
- Primary amputation least cost-effective, more costly than wound care alone


Mortality After Nontraumatic Major Amputation Among Patients With Diabetes and Peripheral Vascular Disease: A Systematic Review

Mortality: 5-years mortality

- Infra-inguinal bypass is associated with lower peri-operative mortality than major amputation in high-risk surgical candidates

Barshes et al. JVS, 2011

A decade of experience with dorsalis pedis artery bypass: analysis of outcome in more than 1000 cases

- 1032 dorsalis pedis bypass in 865 patients
- Mortality rate at 1 month was 0.9%
- Average of 23.6 months; primary patency, secondary patency, limb salvage, and patient survival rates of 56.8%, 67.7%, 78.3%, and 88.3%
- Conclusion: DP bypass is durable with high limb salvage. Results justify routine use of pedal arterial reconstruction for patients with diabetes with ischemic foot complications

Pomposelli et al. JVS, 2003
"Distal versus ultra-distal bypass grafts: amputation-free survival and patency rates in patients with critical leg ischaemia"

- 230 bypasses, 179 (78%) distal and 51 (22%) ultra-distal
- 30-day mortality rate was 1.7% (4/230)
- Amputation-free survival at 12 months was 82.9% in distal group compared to 83.0% in ultra-distal

Slim, Rashid et al, EJVES 2011

"Effectiveness of revascularization of the ulcerated foot in patients with diabetes and peripheral artery disease: a systematic review"

- 56 articles were suitable for analysis
- Outcomes following endovascular or bypass surgery were similar
- 1-year limb salvage: bypass 85%, endovascular 78%
- 60% or more of the ulcers healed
- Studies showed improved rates of limb salvage associated with revascularization compared with conservative treatment


"No-option for treatment" CLTI; quality of foot imaging

- Digital subtraction angiography (DSA)
- Magnetic resonance angiography (MRA) (non-contrast)
- Computed tomography angiography (CTA)
- Duplex ultrasound

Hybrid revascularization strategy

**Definition:** planned combined angioplasty and bypass performed in stages or synchronously

**Rational:** Ideal for CLTI with multilevel extensive disease unsuitable for one modality
- Reduce length of graft, fewer joints crossed, better outcome

**Classification:**
- Hybrid-I: inflow angioplasty + bypass
- Hybrid-II: bypass + outflow angioplasty
- Hybrid-III: angioplasty + bypass + angioplasty
King's CLTI revascularization strategies

- Angioplasty: 70%
- Bypass: 30%
- Hybrid: 15%

Clinical results of below-the knee intervention using pedal-plantar loop technique for the revascularization of foot arteries

- 1331 CLI patients treated using BK PTA
- 135 (10.1%) treated with pedal-plantar loop technique
- Immediate success was 85%
- Significant improvement of TcPO$_2$ after 15 days (59±16 mmHg)

Manzi et al. J Cardiovasc Surg (Rome), 2009

“Ultra-hybrid” on-table revascularization

Deep Veins Arterialization

- Factors Influencing Wound Healing of Critical Ischaemic Foot after Bypass Surgery: Is the Angiosome Important in Selecting Bypass Target Artery?
  - 249 CLI with tissue loss underwent distal bypasses
  - Complete healing wounds achieved in 211 limbs (84.7%)
  - ESRD (odds ratio (OR) 0.127, $p < 0.001$)
  - Diabetes (OR 0.216, $p = 0.030$)
  - Rutherford category 6 with heal ulcer/gangrene (OR 0.134, $p < 0.001$)
  - Hypo-albuminaemia (OR 0.387, $p = 0.049$)
  - Healing rates in the indirect revascularisation group was slower than in the direct group, especially in ESRD ($p < 0.001$)
  - Healing rates were similar with propensity score ($p = 0.183$)

Azuma et al, EJVES, 2012

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Azuma et al, EJVES, 2012

“The impact of arterial pedal arch quality and angiosome revascularization on foot tissue loss healing and infrapopliteal bypass outcome”

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Azuma et al, EJVES, 2012
Who requires a major amputation?

- Fulminant severe leg/foot sepsis
- Extensive dorsal and planter foot tissue loss/necrosis
- Failed attempts of pedal-planter bypass and angioplasty

Tips And Tricks For Success

- Short bypasses using different revascularization strategies including hybrid techniques
- Pre-operative duplex US for pedal arteries as a reliable imaging technique prior to pedal-plantar bypasses
- Specialized anaesthetic support
- Aggressive wound care post-revascularization
- Graft surveillance program is essential

“No-option for treatment” CLTI

Proposed definition:
“CLTI not suitable for or failed pedal-plantar bypass and angioplasty”
- Genuine “no-option” for treatment is uncommon
- Fore-foot “no-option” CLTI is the true challenge

Conclusions

- Major amputation; poor outcomes, not cost-effective
- All medically fit CLTI patients should have an attempt at revascularization
- Complex CLTI should be managed in specialized centres
- Hybrid techniques needed in complex cases
- Direct angiosome revascularization improves outcome in patients with poor quality arterial pedal arch