Angiosome-based intervention is associated with Improved outcomes in BTK

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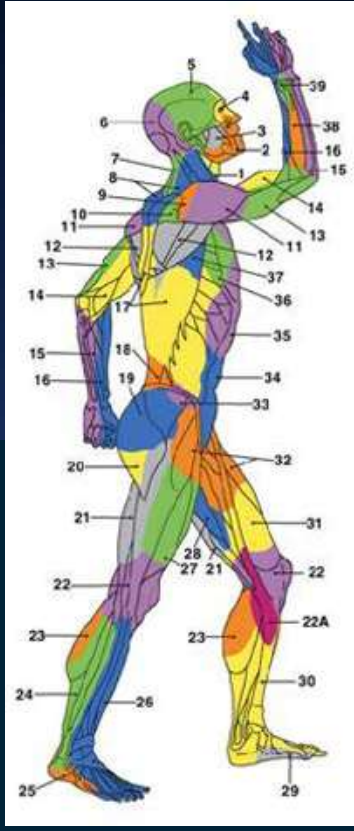
Angiosome ?

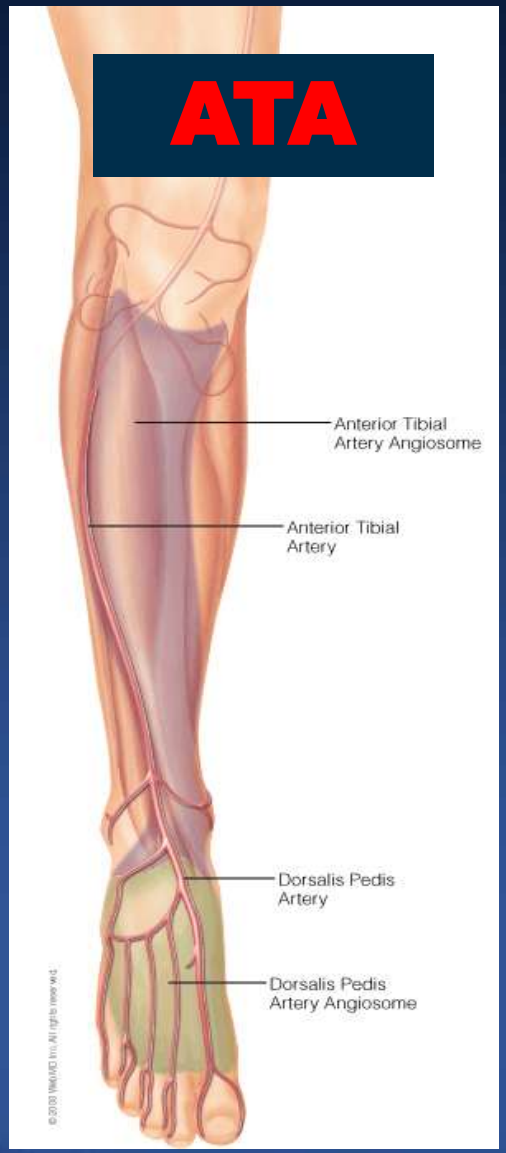
3D vascular territories

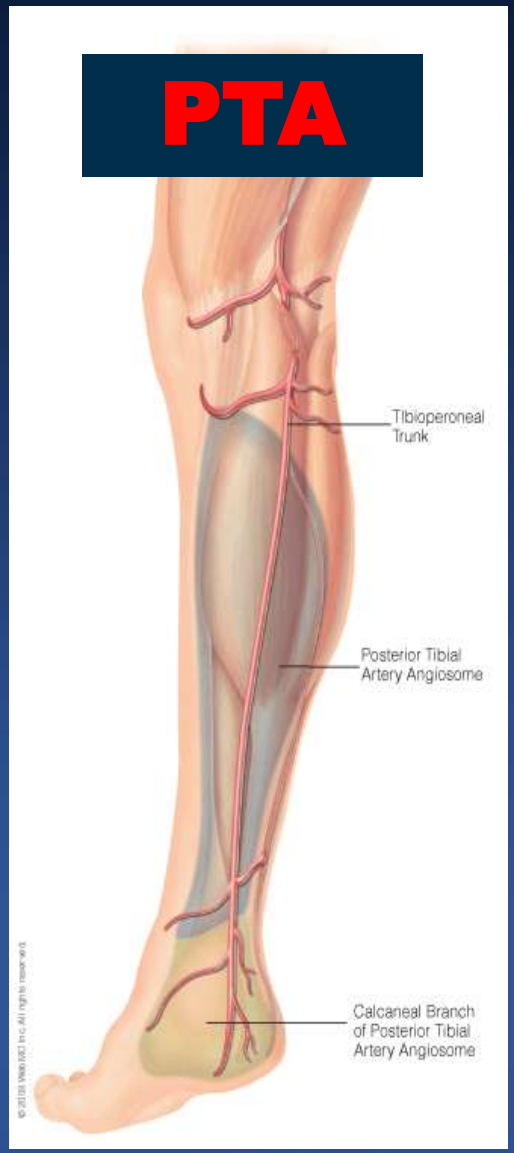


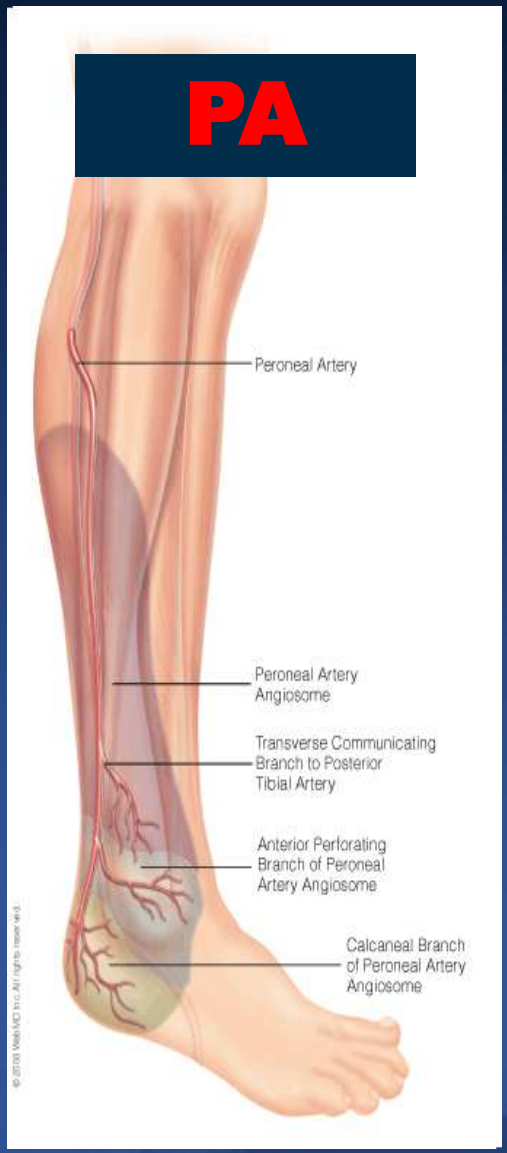
supplied by specific source arteries
drained by specific veins

Originally plastic and reconstructive surgery
Preserve blood flow for surgical wounds to heal

Angiosome Foot and Ankle







Angiosome Foot and Ankle

ATA

PTA

PA

Six angiosomes of the foot and ankle

The posterior tibial artery (3 angiosomes)

-medial calcaneal artery angiosome,
-medial plantar artery angiosome
-lateral plantar artery angiosome

PTA Angiosome

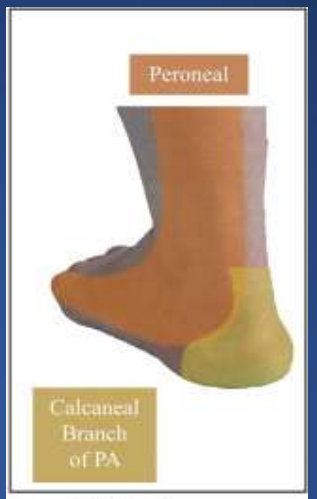
The anterior tibial artery (1 angiosome)

-anterior tibial artery and dorsalis pedis angiosome

ATA Angiosome

The peroneal artery (2 angiosome)

-lateral calcaneal artery angiosome
-anterior perforator artery angiosome



PA Angiosome

Angiosome-Based approach

Direct vs. Indirect revascularization

In the real practice, angiosome-based direct revascularization for ischemic wounds is not always successful because of lesion complexity: 40-50%

Angiosome-Based approach

PA

Direct vs. Indirect revascularization

Vs.

PTA

ATA

Angiosome-Based approach

Retrospective analysis of 201 diabetic CLI-BTK leisons

Results	**Direct EVT (N = 167)**	**Indirect EVT (N = 34)**	P
Major amputation	16 (9.6%)	3 (8.8%)	
Limb salvage	151 (90.4%)	31 (91.2%)	0.92
Mean TcPO2	42	38.2	0.21

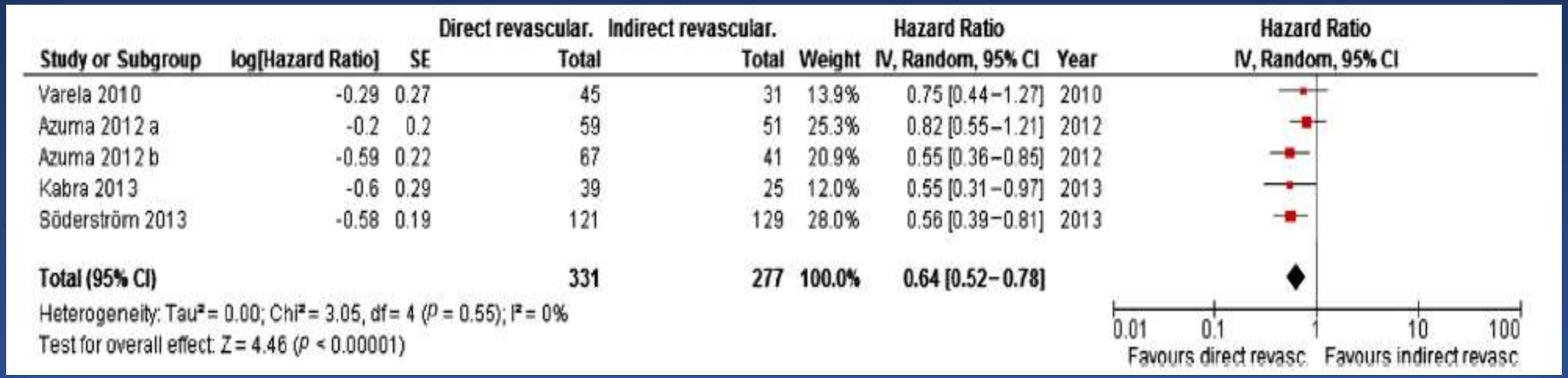
The DR technique is the first treatment option; however, that IR is similarly effective over time.

Cardiovasc Intervent Radiol (2013) 36:637–644

Angiosome-based revascularization

Meta-analysis

Wound healing



Study or Subgroup	log[Hazard Ratio]	SE	Direct revascular. Total	Indirect revascular. Total	Weight	Hazard Ratio IV, Random, 95% CI	Year
Varela 2010	-0.29	0.27	45	31	13.9%	0.75 [0.44–1.27]	2010
Azuma 2012 a	-0.2	0.2	59	51	25.3%	0.82 [0.55–1.21]	2012
Azuma 2012 b	-0.59	0.22	67	41	20.9%	0.55 [0.36–0.85]	2012
Kabra 2013	-0.6	0.29	39	25	12.0%	0.55 [0.31–0.97]	2013
Söderström 2013	-0.58	0.19	121	129	28.0%	0.56 [0.39–0.81]	2013
Total (95% CI)			**331**	**277**	**100.0%**	**0.64 [0.52–0.78]**	

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 3.05$, $df = 4$ ($p = 0.55$); $I^2 = 0\%$

Test for overall effect: $Z = 4.46$ ($p < 0.00001$)

HR 0.64, 95% CI: 0.52-0.78

Eur J Vasc Endovasc Surg 2014;47:517-22

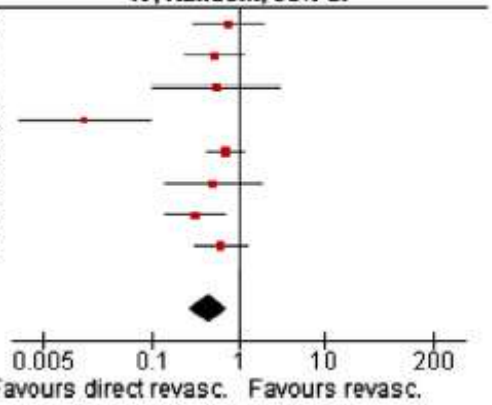
Angiosome-based revascularization

Meta-analysis

Limb salvage

Study or Subgroup	log[Hazard Ratio]	SE	Direct revascular. Total	Indirect revascular. Total	Weight	Hazard Ratio IV, Random, 95% CI	Year
Varela 2010	-0.28	0.5	45	31	12.7%	0.76 [0.28–2.01]	2010
Alexandrescu 2011	-0.65	0.4	134	98	15.1%	0.52 [0.24–1.14]	2011
Blanes Ortí 2011	-0.59	0.88	18	16	6.6%	0.55 [0.10–3.11]	2011
Ferrufino-Mérida 2012	-4.16	0.92	23	9	6.2%	0.02 [0.00–0.09]	2012
Iida 2012	-0.36	0.25	200	169	19.0%	0.70 [0.43–1.14]	2012
Kabra 2013	-0.69	0.67	39	25	9.4%	0.50 [0.13–1.86]	2013
Lejay 2013	-1.17	0.42	36	22	14.6%	0.31 [0.14–0.71]	2013
Söderström 2013	-0.48	0.36	121	129	16.2%	0.62 [0.31–1.25]	2013
Total (95% CI)			**616**	**499**	**100.0%**	**0.44 [0.26– 0.75]**	

Heterogeneity: Tau² = 0.32; Chi² = 18.21, df = 7 (*P* = 0.01); I² = 62%
Test for overall effect: Z = 3.02 (*P* = 0.002)



HR 0.44, 95% CI: 0.26-0.75

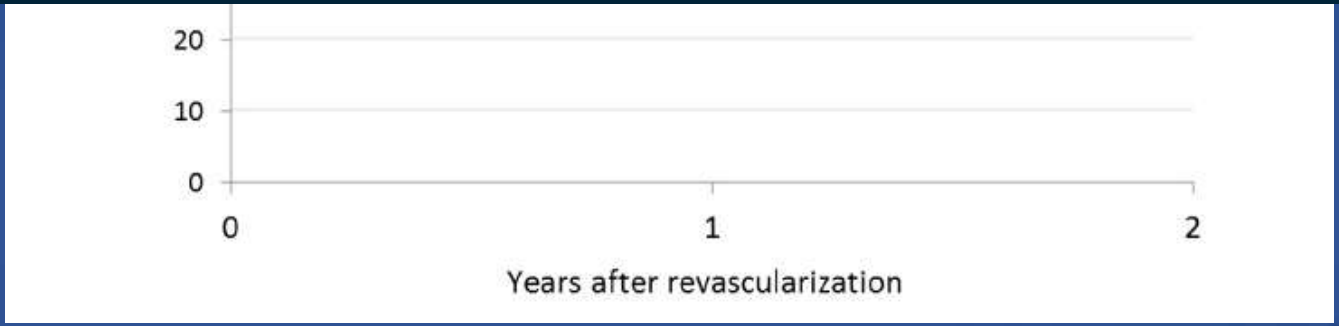
Eur J Vasc Endovasc Surg 2014;47:517-22

Angiosome-based revascularization

Meta-analysis

Limb salvage

When feasible, direct revascularization of the foot angiosome affected by ischemic tissue lesions may improve wound healing and limb salvage rates compared with indirect revascularization



Eur J Vasc Endovasc Surg 2014;47:517-22

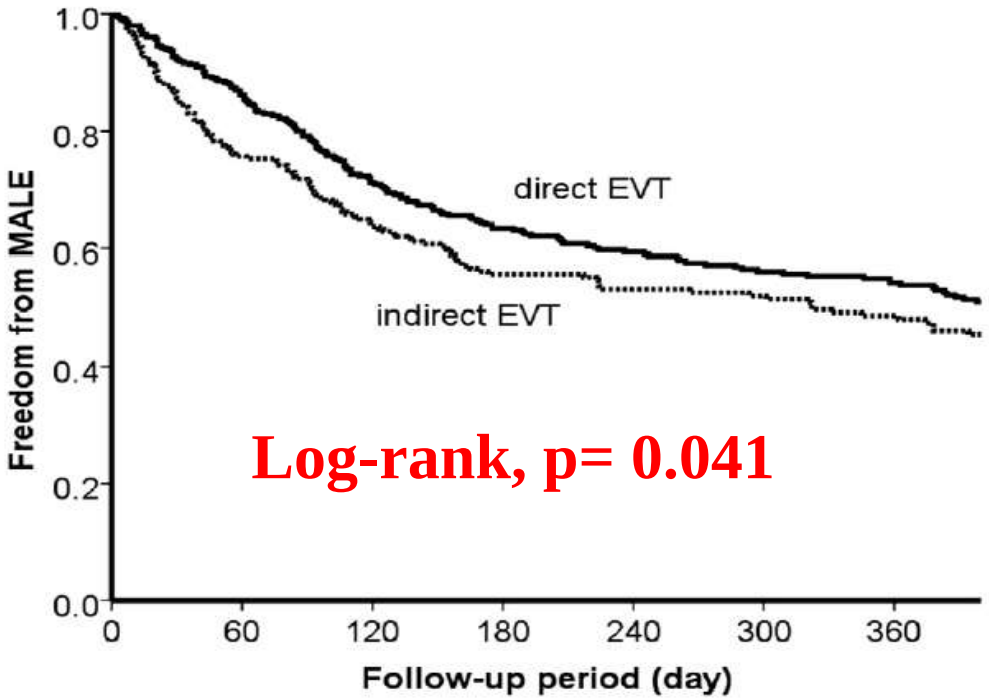
Angiosome
Indirect revascularization

In the real practice, angiosome-based direct revascularization for ischemic wounds is not always successful because of lesion complexity: 40-50%

So, to find benefit population of inevitable indirect revascularization is also clinically important !!!

Angiosome-based revascularization

718 consecutive CLI patients, with ischemic tissue loss

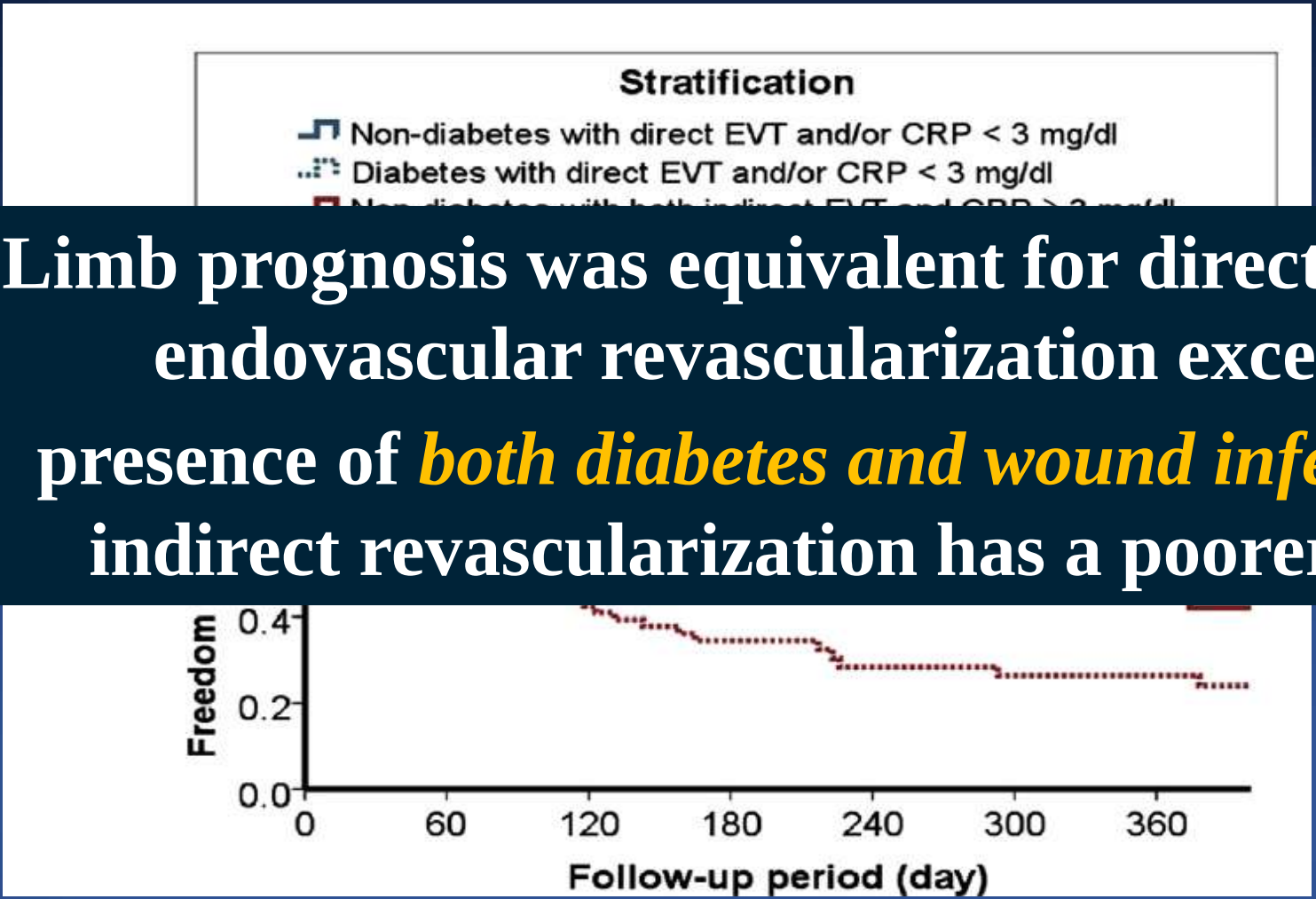


No. at risk							
direct EVT	411	325	242	202	172	152	137
indirect EVT	307	200	152	118	101	93	80

O Iida, et al. Eur J Vasc Endovasc Surg 2013;46:575-82

Angiosome-based revascularization

718 consecutive CLI patients, with ischemic tissue loss



Limb prognosis was equivalent for direct and indirect endovascular revascularization except in the presence of *both diabetes and wound infection*, when indirect revascularization has a poorer outcome.

0.88 (0.67 to 1.15)
1.05 (0.54 to 2.04)
2.17 (1.54 to 3.06)

O Iida, et al. Eur J Vasc Endovasc Surg 2013;46:575-82

Role of Indirect revascularization

Why different ?

DM vs. non-DM

Indirect revascularization

DM vs. non-DM

The usefulness of indirect revasc in a population of patients with diabetes has potential limitations. It follows that the obliteration of collaterals typical of a patient with diabetes would likely render indirect revasc less useful than direct revasc

Indirect revascularization

Role of collaterals

P=NS

P=0.008

P=NS

P=0.02

No difference of direct revasc vs. indirect revasc with good collaterals function in ulcer healing and limb salvage

Vasc Endovascular Surg. 2010;44:654-60

Angiosome
Indirect revascularization

Role of Indirect revascularization depends on collateral function to ulcer healing artery

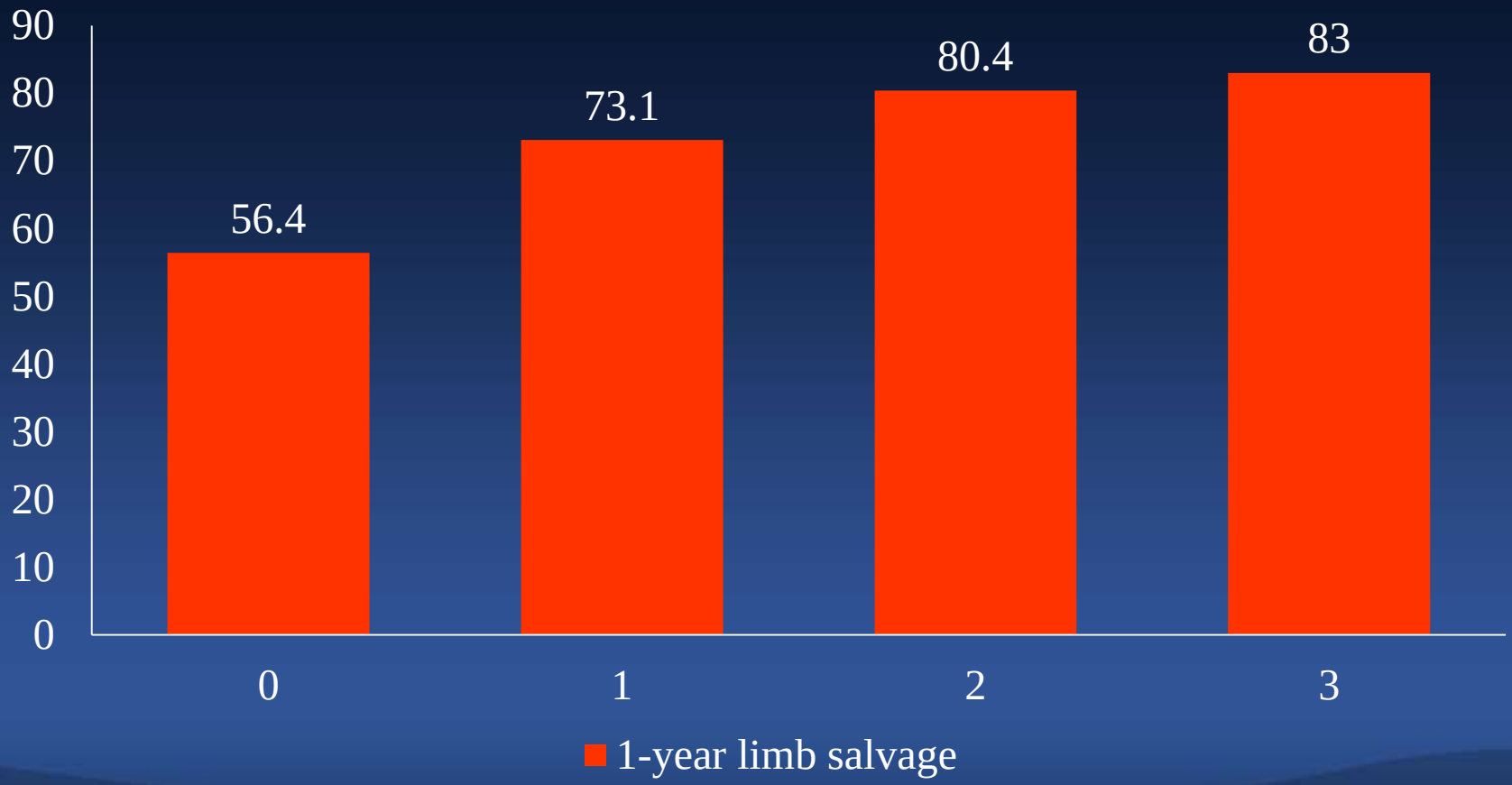
Role of multi-vessel EVT
Angiosome-based

Direct vs. indirect

Angiosome-concept enough ?

Retrospective analysis of 1268 CLI-patients and PTA BTK

Number of patent arteries post-PTA



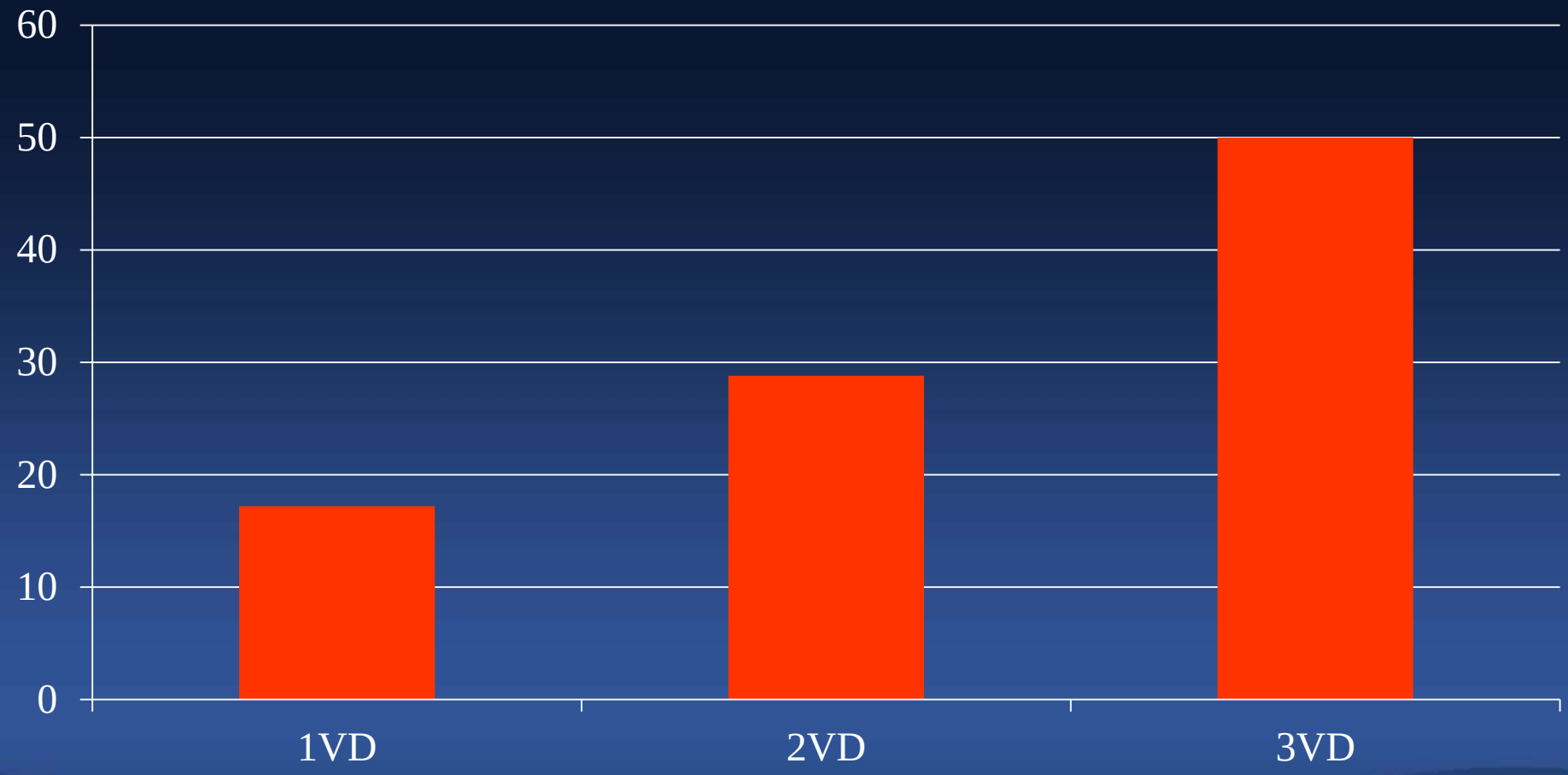
Peregrin et al., Cardiovasc Intervent Radiol 2010;33:720-725

AMC data

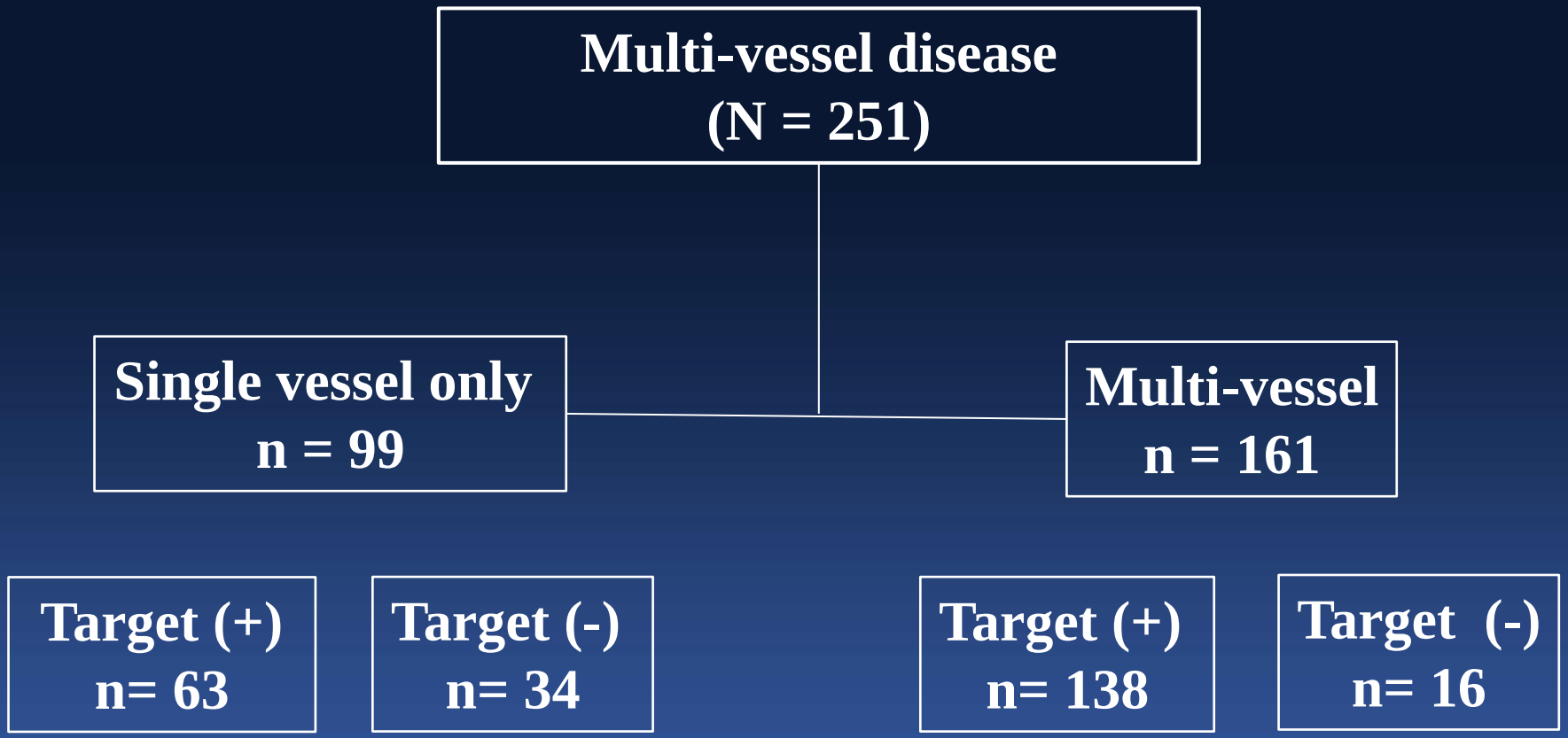
- January 2008 ~ September 2013
- Total 303 CLI patients (Rutherford 5 or 6)
- Procedure success in 284 patients (93.7%)

Multi-vessel Disease in BTK CLI

AMC data (304 limbs)

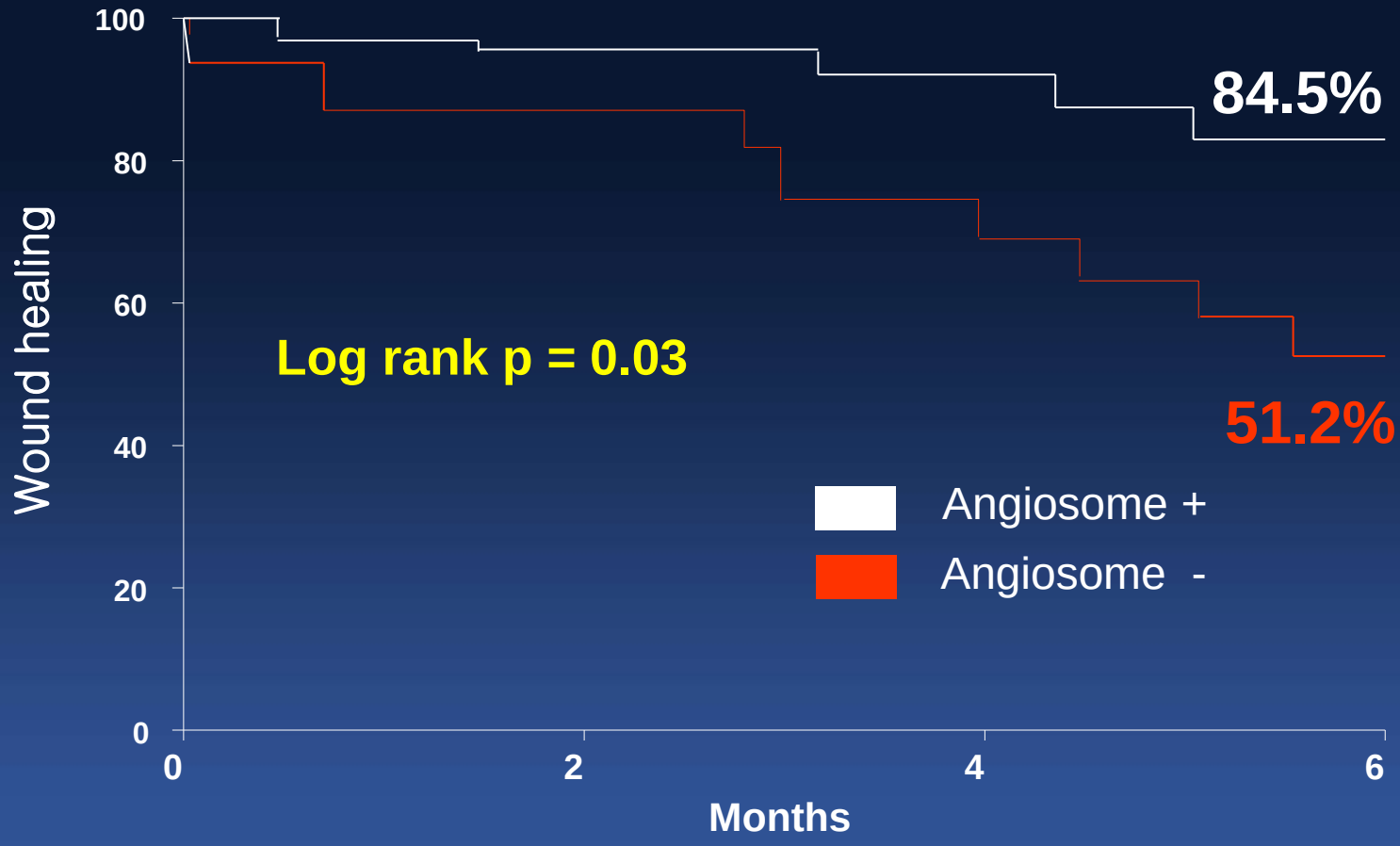


Treatment Strategy in BTK CLI

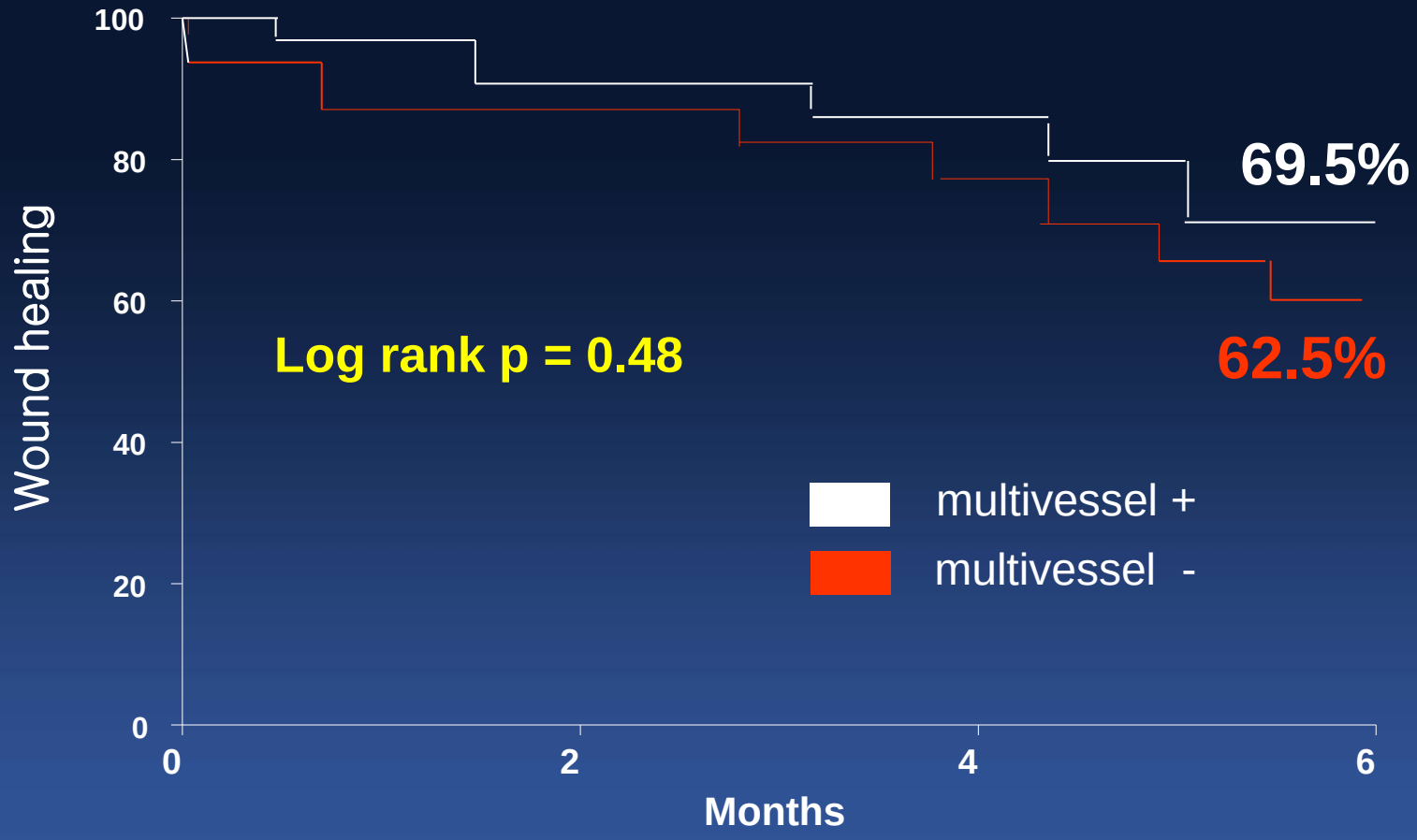


Direct revascularization : 80%
Indirect revascularization: 20%

Angiosome-guided EVT in BTK CLI



Multivessel-guided EVT in BTK CLI



Treatment strategy in BTK CLI

Results	**Angiosome (+) N=201**	**Angiosome (-) N=50**	P
Major amputation	4 (1.9)	1 (2.0)	0.88
Limb salvage	197 (98.1)	49 (98.0)	

Conclusions

- Angiosome-based revascularization is a reliable and practical strategy in CLI patients, yielding better clinical success including limb salvage and wound healing.

- if Indirect revascularization is feasible, try to open artery with good collaterals to affected angiosome

- Despite controversy, for limb salvage, the more, the better, but angiosome-targeted artery should be reestablished.