

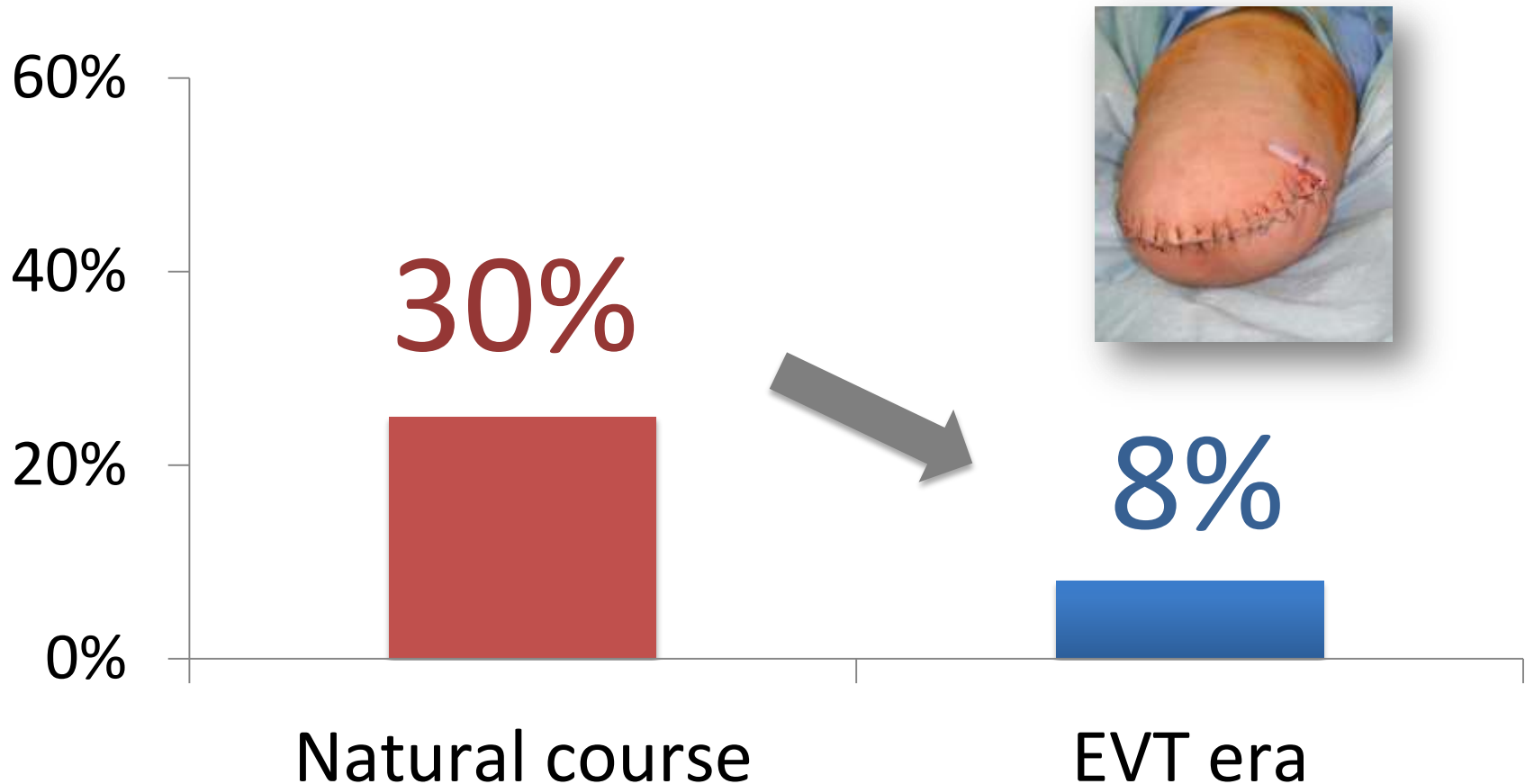
# What is the Best Angiographic Endpoint for Revascularization ? **Angiosome or "Straight-Line" Flow**

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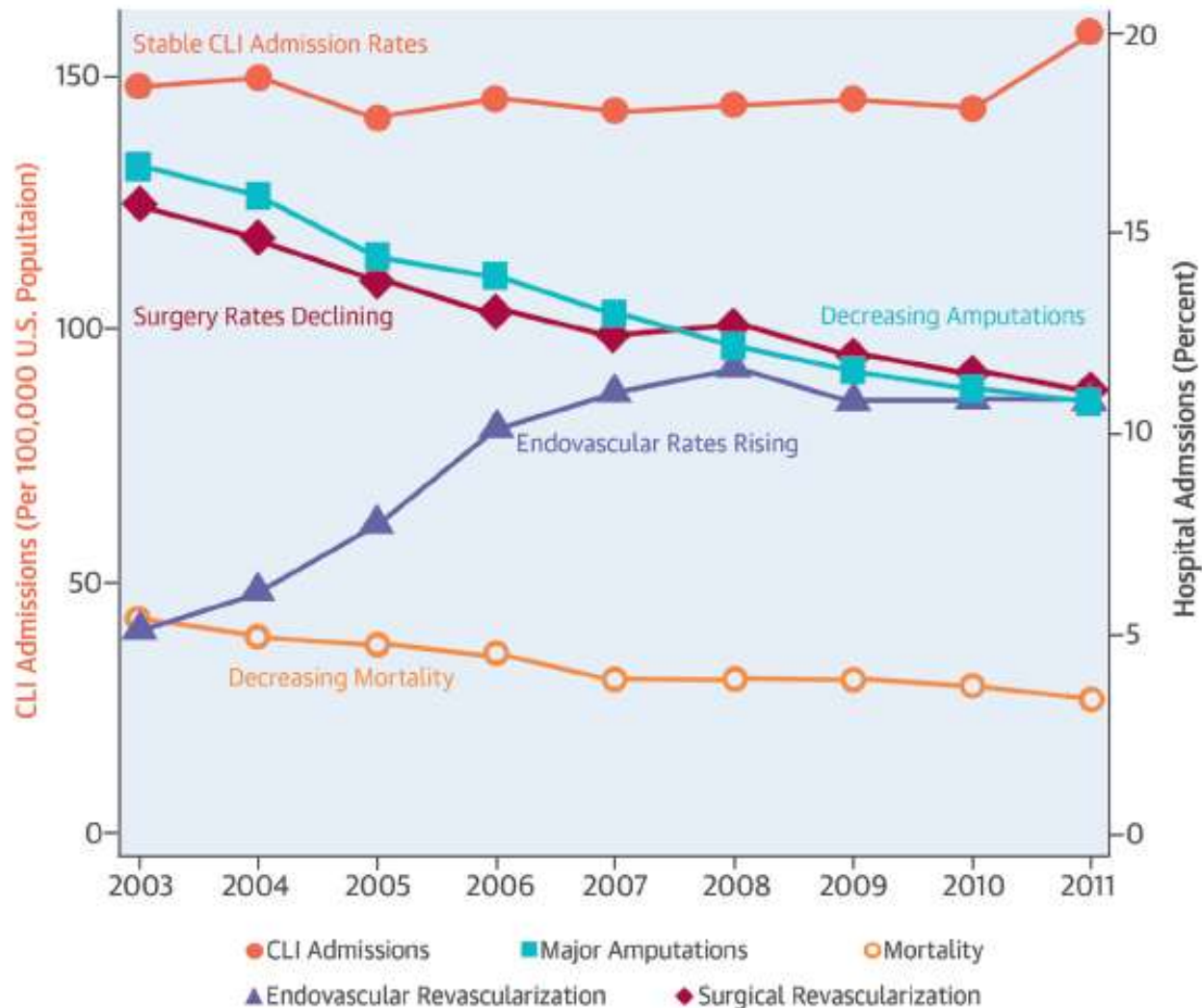
Amagasaki, Hyogo, Japan

# Major amputation @1-year



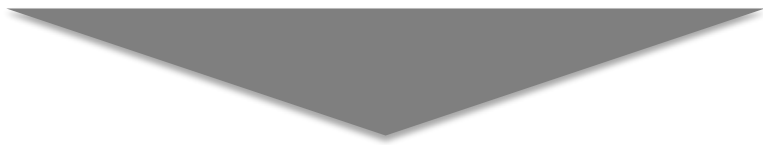
Hirsch AT. J Am Coll Cardiol. 2006;47:1239-1312  
Iida O. J Am Coll Cardiol Interv 2015;8:1493-503

# U.S. Trends of Hospital Admission and Outcomes among CLI Patients



# Goal for CLI management

Major amputation



Wound healing



# J beat III

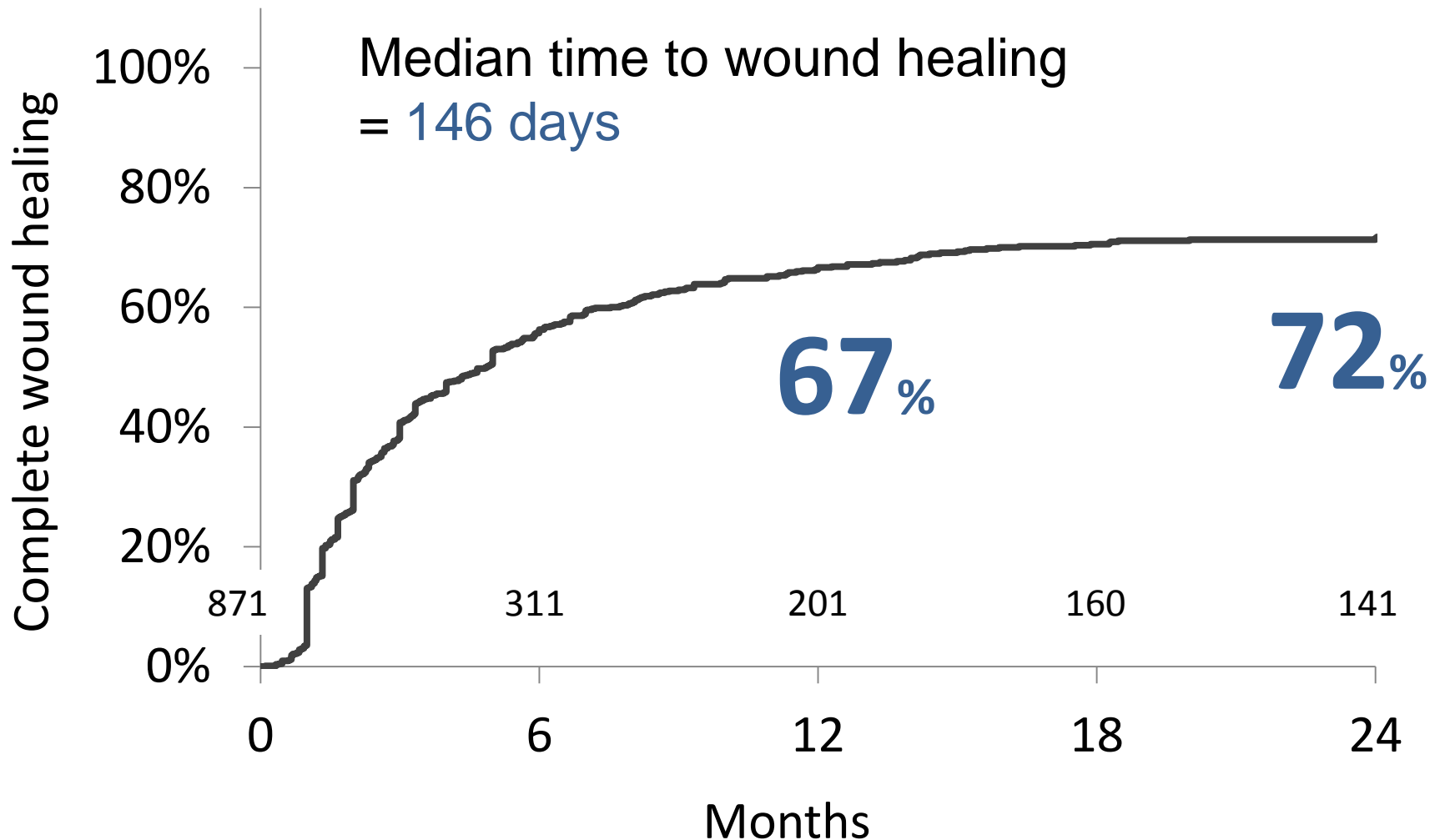
Japanese **BE**low-the-knee **Ar**tery **T**reatment trial III



**J-BEAT III registry: Japanese BElow-the-knee Artery Treatment registry III**

Subjects: CLI due to isolated BTK lesions (**734** patients with **871** tissue loss)

# Wound healing rate (N=871)



# Predictors of **delayed wound healing**

## Patient

- Albumin level
- Non-ambulatory status

## Limb

- Rutherford 6
- Wound infection

## EVT

- **Indirect EVT**
- **Poor below-the-ankle Run-off**

Predictors of **delayed wound healing**

**Quality of EVT**

**was associated with  
clinical outcomes**

**EVT**

- Indirect EVT**
- Poor below-the-ankle Run-off**



1) Keep in mind is "Limitation of intrapopliteal  
elastasy"

1 year

40%

Restenosis

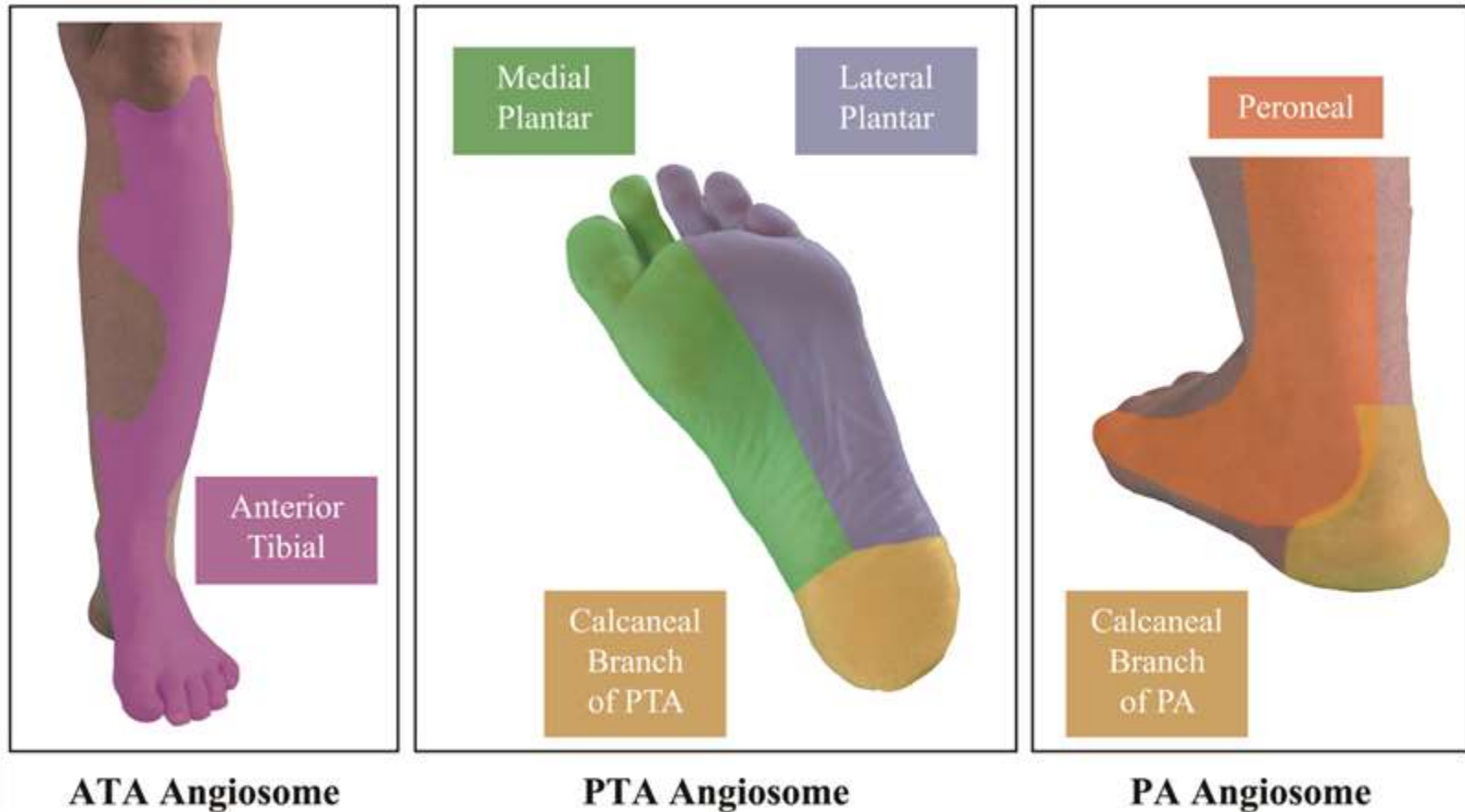
70%

2:44:425-31.

Early Recoil @ 15 min.

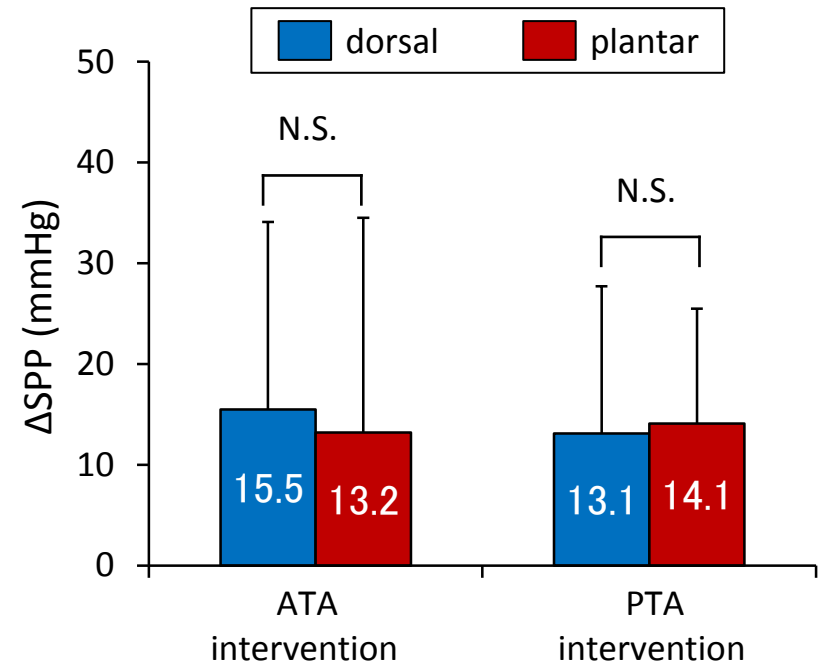
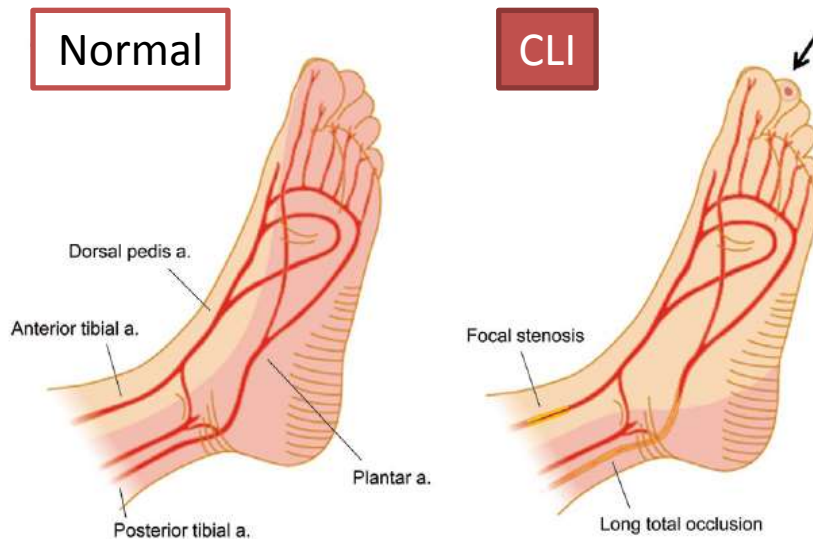
results

# Angiosome based revascularization



How should revascularization of a wound be efficiently implemented with "uncertain plain old balloon angioplasty?" the answer for concept on the goal of revascularization seems to be clear, if endovascular therapy is selected instead of bypass surgery.

# Controversy over the angiosome theory



“Angiosome” is not 2D but 3D.

Single tibial artery revascularization, whether of the ATA or PTA, yielded comparable improvements in microcirculation of the dorsal and plantar foot based on skin perfusion pressure (SPP).

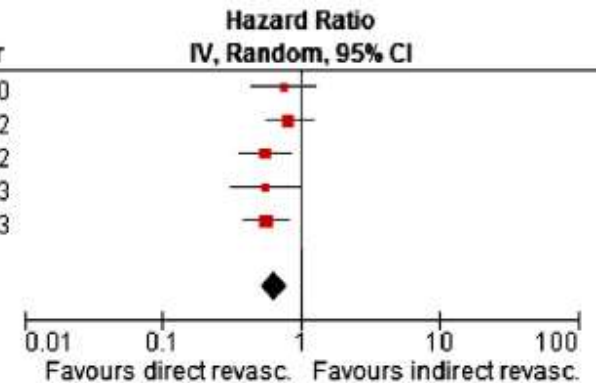
Kawarada O, et al. *Circ J.* 2014;78:1540-1549.

Kawarada O, et al. *Circ Cardiovasc Interv.* 2014;7:684-91.

## 2) Keep in mind is “evidence level of angisome”

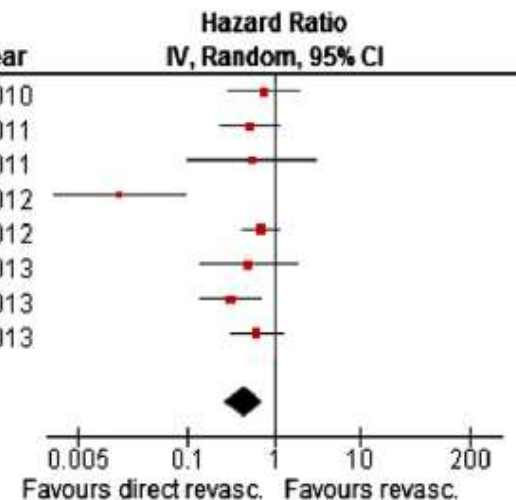
### Forest plot for effectiveness in **wound healing**

Study or Subgroup	log[Hazard Ratio]	SE	Weight	Hazard Ratio		Year
				IV, Random, 95% CI	95% CI	
Varela 2010	-0.29	0.27	13.9%	0.75	[0.44–1.27]	2010
Azuma 2012 a	-0.2	0.2	25.3%	0.82	[0.55–1.21]	2012
Azuma 2012 b	-0.59	0.22	20.9%	0.55	[0.36–0.85]	2012
Kabra 2013	-0.6	0.29	12.0%	0.55	[0.31–0.97]	2013
Söderström 2013	-0.58	0.19	28.0%	0.56	[0.39–0.81]	2013
<b>Total (95% CI)</b>			<b>100.0%</b>	<b>0.64</b>	<b>[0.52–0.78]</b>	

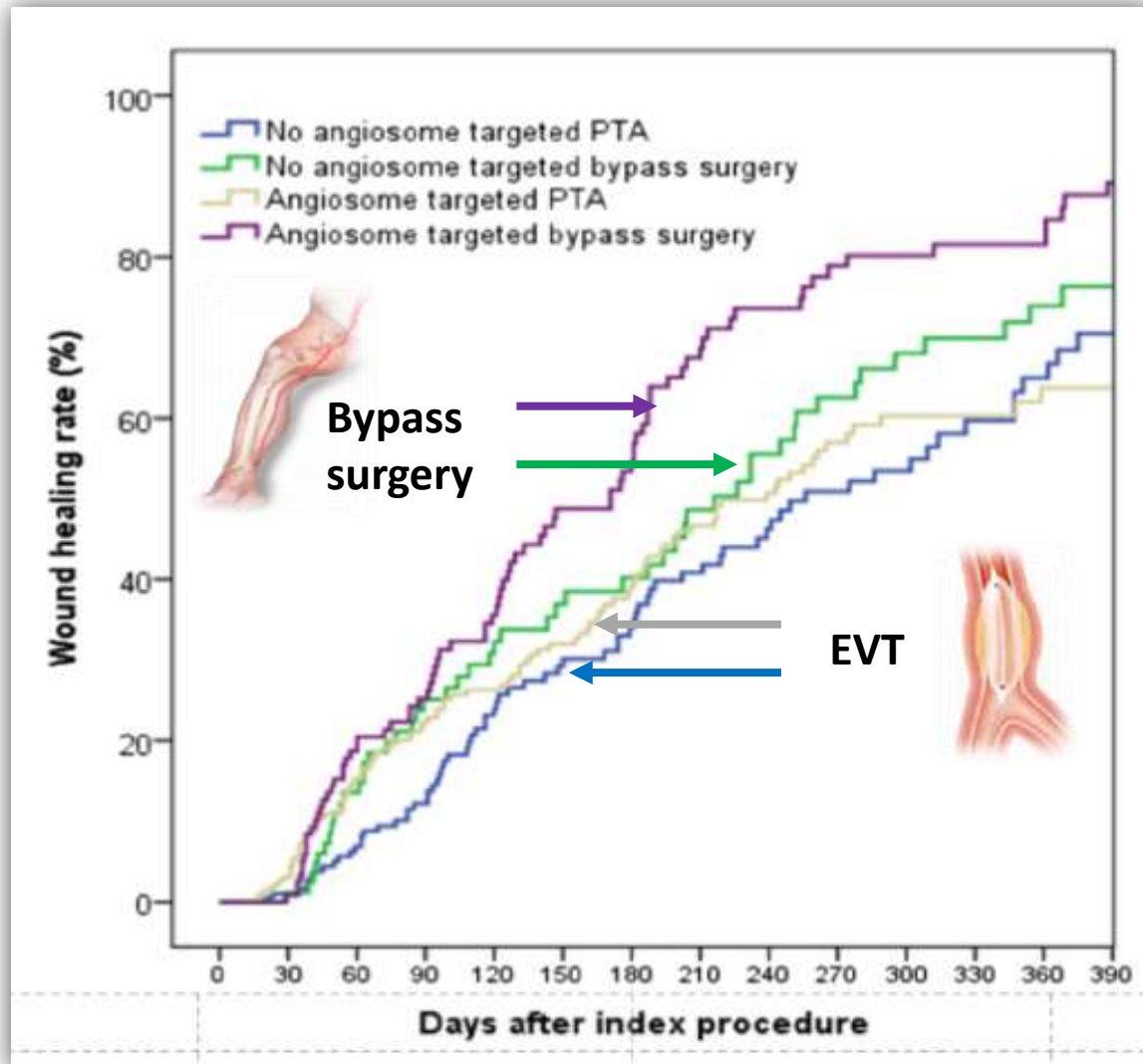


### Forest plot for effectiveness in **limb salvage**

Study or Subgroup	log[Hazard Ratio]	SE	Weight	Hazard Ratio		Year
				IV, Random, 95% CI	95% CI	
Varela 2010	-0.28	0.5	12.7%	0.76	[0.28–2.01]	2010
Alexandrescu 2011	-0.65	0.4	15.1%	0.52	[0.24–1.14]	2011
Blanes Ortí 2011	-0.59	0.88	6.6%	0.55	[0.10–3.11]	2011
Ferrufino-Mérida 2012	-4.18	0.92	6.2%	0.02	[0.00–0.09]	2012
Iida 2012	-0.36	0.25	19.0%	0.70	[0.43–1.14]	2012
Kabra 2013	-0.69	0.67	9.4%	0.50	[0.13–1.86]	2013
Lejay 2013	-1.17	0.42	14.6%	0.31	[0.14–0.71]	2013
Söderström 2013	-0.48	0.36	16.2%	0.62	[0.31–1.25]	2013
<b>Total (95% CI)</b>			<b>100.0%</b>	<b>0.44</b>	<b>[0.26–0.75]</b>	



# Differential Impact of Bypass Surgery and EVT on Angiosome-Targeted Infrapopliteal Revascularization



# 3) Keep in mind is “not all the same”

R5 without infection



Dent



1) at short time, 2) low cost, 3) with less work



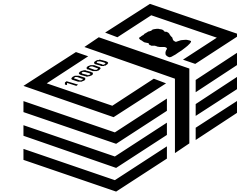
R5 with infection or R6



Damage



1) at long time, 2) high cost, 3) with hard work



Unsalvageable



Large damage



Unrepairable



-Not all the same-



Rutherford 5  
**with** infection

**CRP: 22**



Versus



Rutherford 5  
**without** infection

**CRP: 0.2**

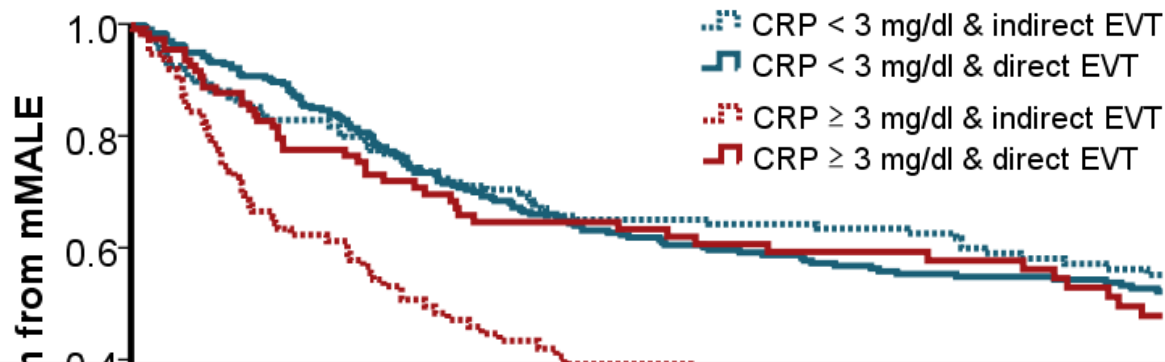
# Discrepancy from theory to practice

We should seek determinants of patients with CLI who derive the most clinical benefit from **direct revascularization (DR)**.

- ✓ In clinical practice, moderate limb salvage rates (**68-76%**) were obtained by **indirect revascularization (IR)** in earlier studies.
- ✓ However, it remains unclear which patients derive the most clinical benefit from **direct revascularization (DR)**.



Worse limb prognosis for IR vs. DR only in patients with CLI complicated **with** wound infection and DM (N=718)

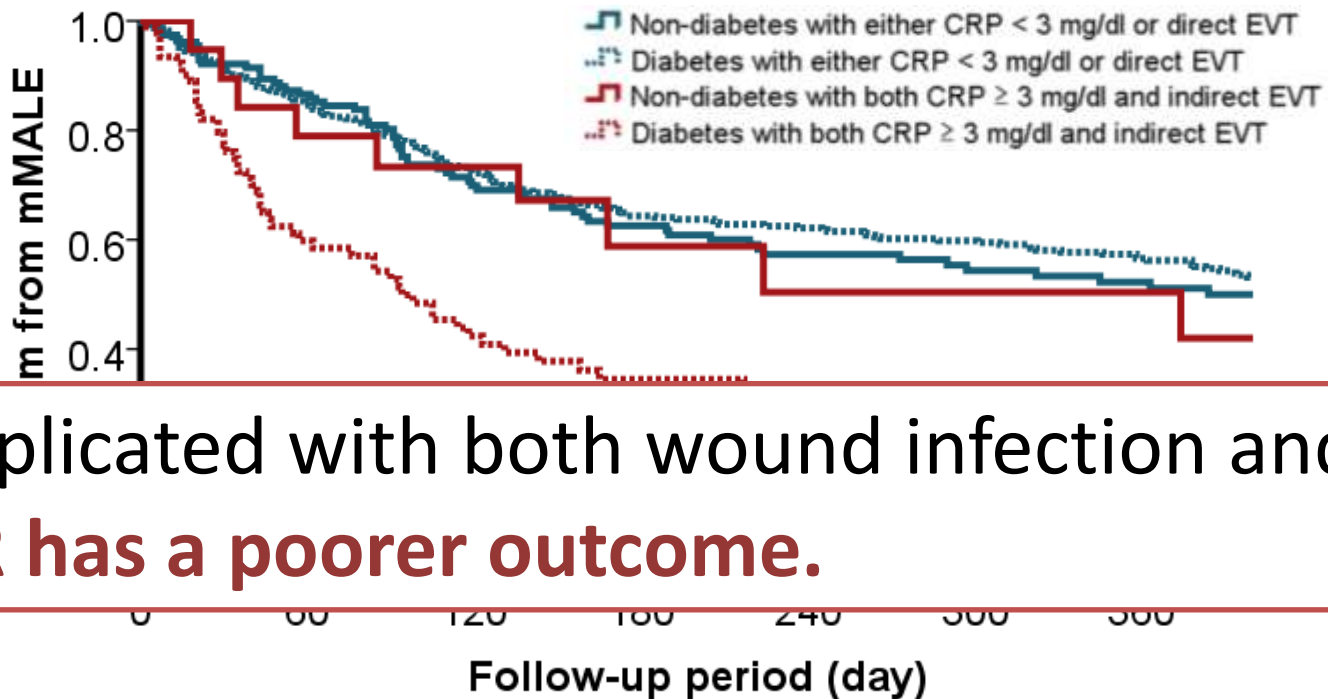


**Indirect EVT** increased risk for MALE only in patients with **CRP ≥ 3 mg/dL**

Follow-up period (day)

Indirect EVT	CRP ≥ 3 mg/dL	n	Hazard ratio for MALE
—	—	297	1.00 (Ref)
—	●	114	1.11 [0.80, 1.53]
●	—	191	0.96 [0.73, 1.27]
●	●	116	2.08 [1.56, 2.78]**

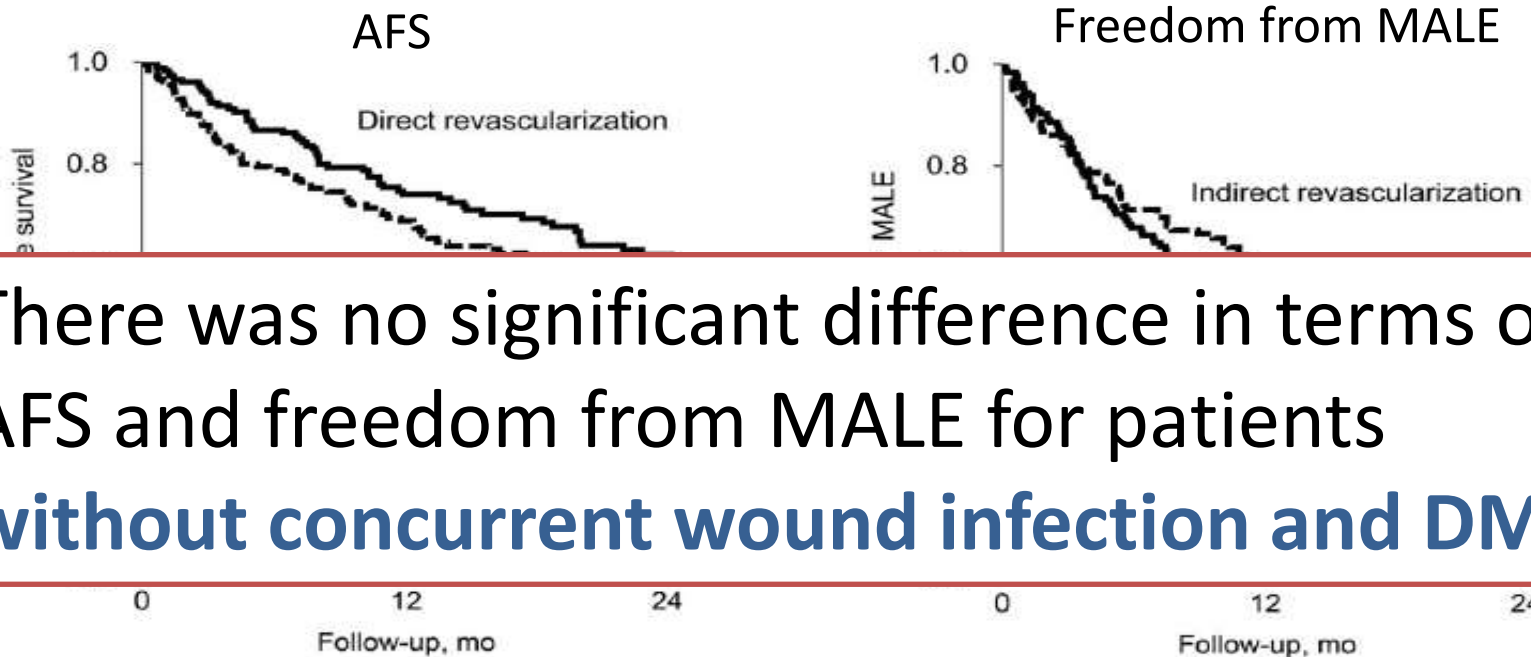
Worse limb prognosis for IR vs. DR only in patients with CLI complicated **with** wound infection and DM (N=718)



CLI complicated with both wound infection and DM, when **IR has a poorer outcome.**

Indirect EVT & CRP $\geq$ 3 mg/dl	DM	n	Hazard ratio for MALE
—	—	159	1.00 (Ref)
—	●	443	0.88 [0.67, 1.15]
●	—	21	1.05 [0.54, 2.04]
●	●	95	2.17 [1.54, 3.06]**

# The angiosome-oriented revascularization for CLI patients **without** concurrent wound infection and DM



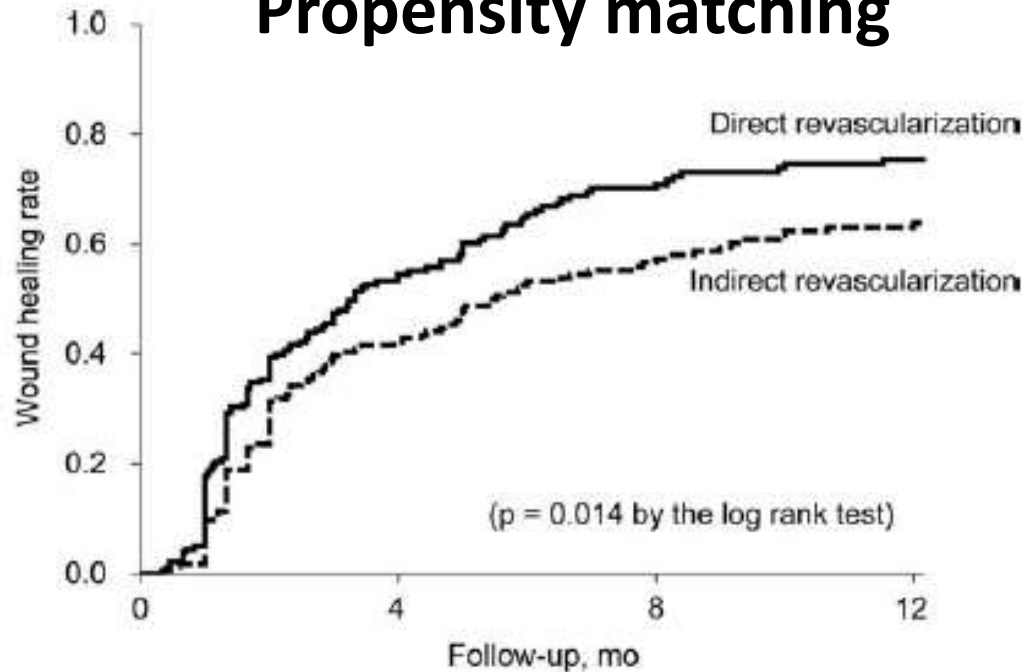
There was no significant difference in terms of AFS and freedom from MALE for patients **without concurrent wound infection and DM.**

		0	12	24
Direct	No. at risk	182	106	59
	Rate	100%	74%	60%
	SE	0%	3%	4%
Indirect	No. at risk	182	104	60
	Rate	100%	69%	57%
	SE	0%	4%	4%

		0	12	24
Direct	No. at risk	182	65	32
	Rate	100%	60%	55%
	SE	0%	4%	4%
Indirect	No. at risk	182	66	33
	Rate	100%	60%	54%
	SE	0%	4%	4%

# The angiosome-oriented revascularization for CLI patients **without** concurrent wound infection and DM

## Propensity matching



		0	4	8	12
Direct	No. at risk	182	76	43	30
	Rate	0%	54%	71%	75%
	SE	0%	4%	4%	3%
Indirect	No. at risk	182	92	62	49
	Rate	0%	42%	57%	64%
	SE	0%	4%	4%	4%

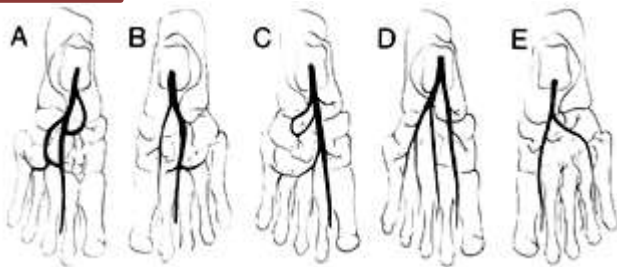
# Limitaion of Angiosome concept

- The angiosome has been investigated in cadaver specimens.

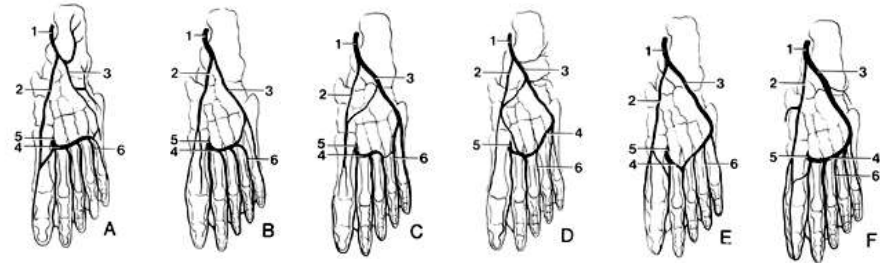


- The arterial anatomy of the foot differs from patient to patient.

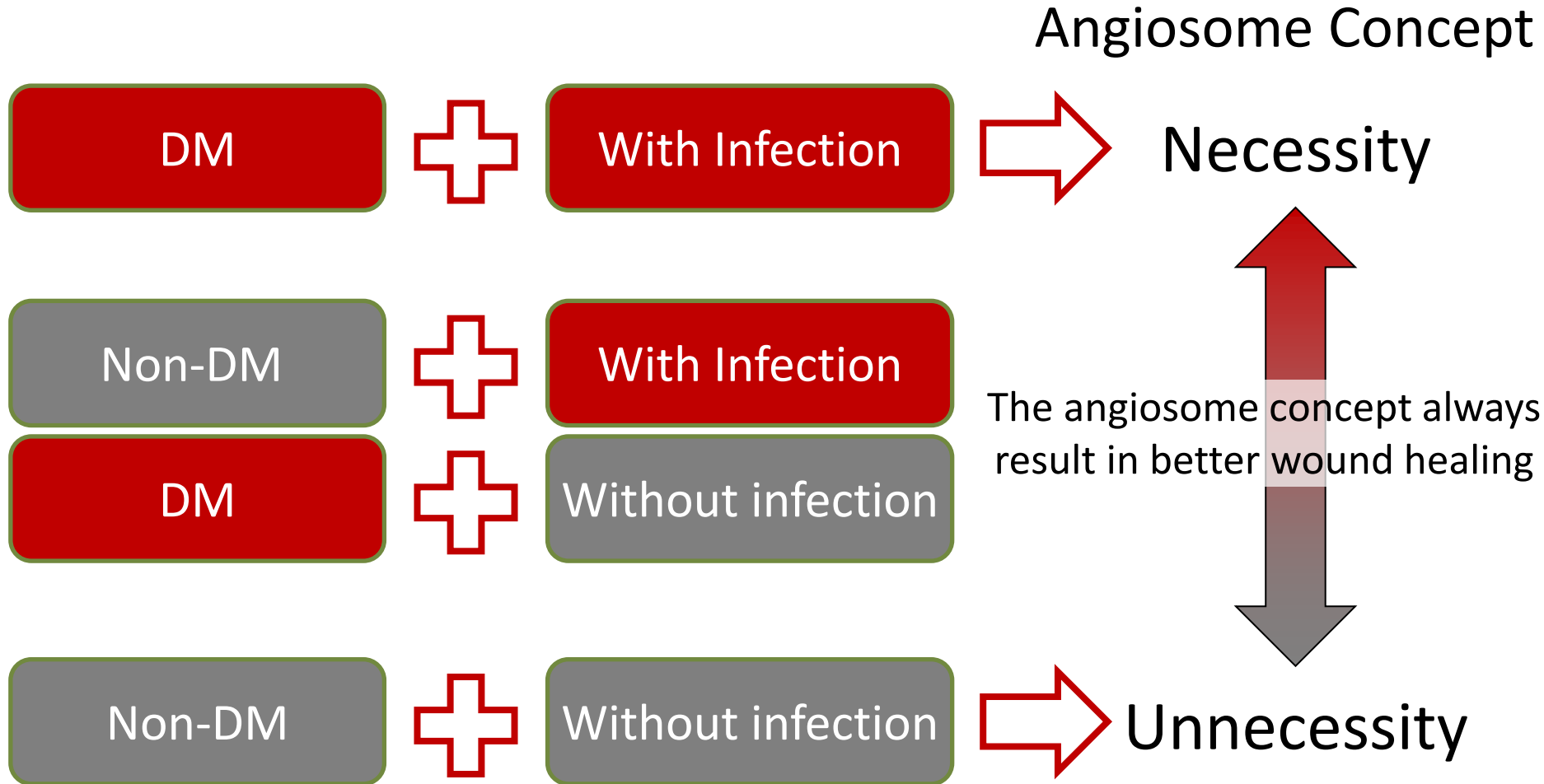
Dorsal



Plantar



# Think about “the Angiosome Concept”



Based on our analysis, revascularization for wound-related artery is best way to achieve better wound healing rate.