Pedal-Plantar Loop Access for Complex BTK CTO Lesion

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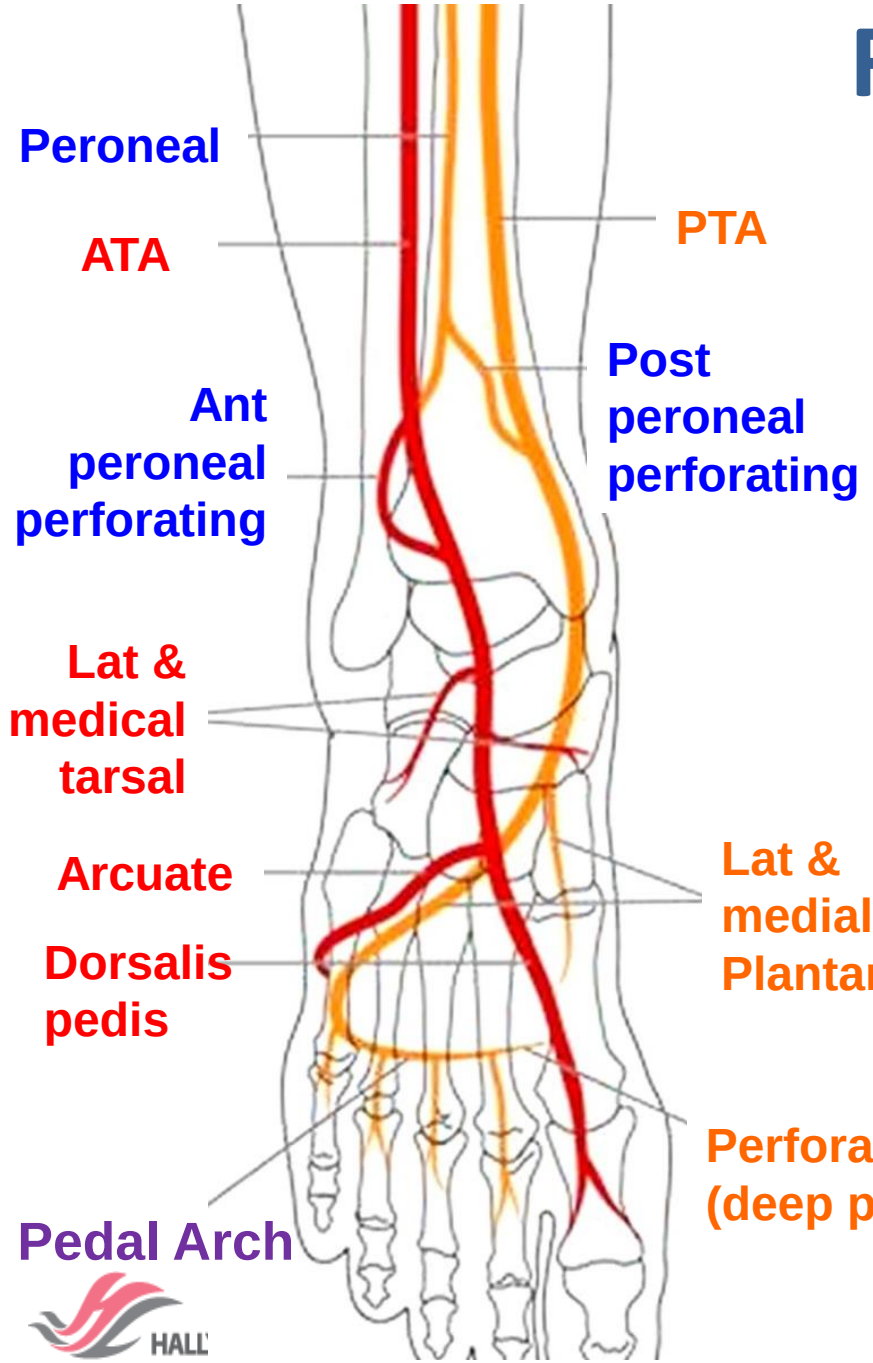
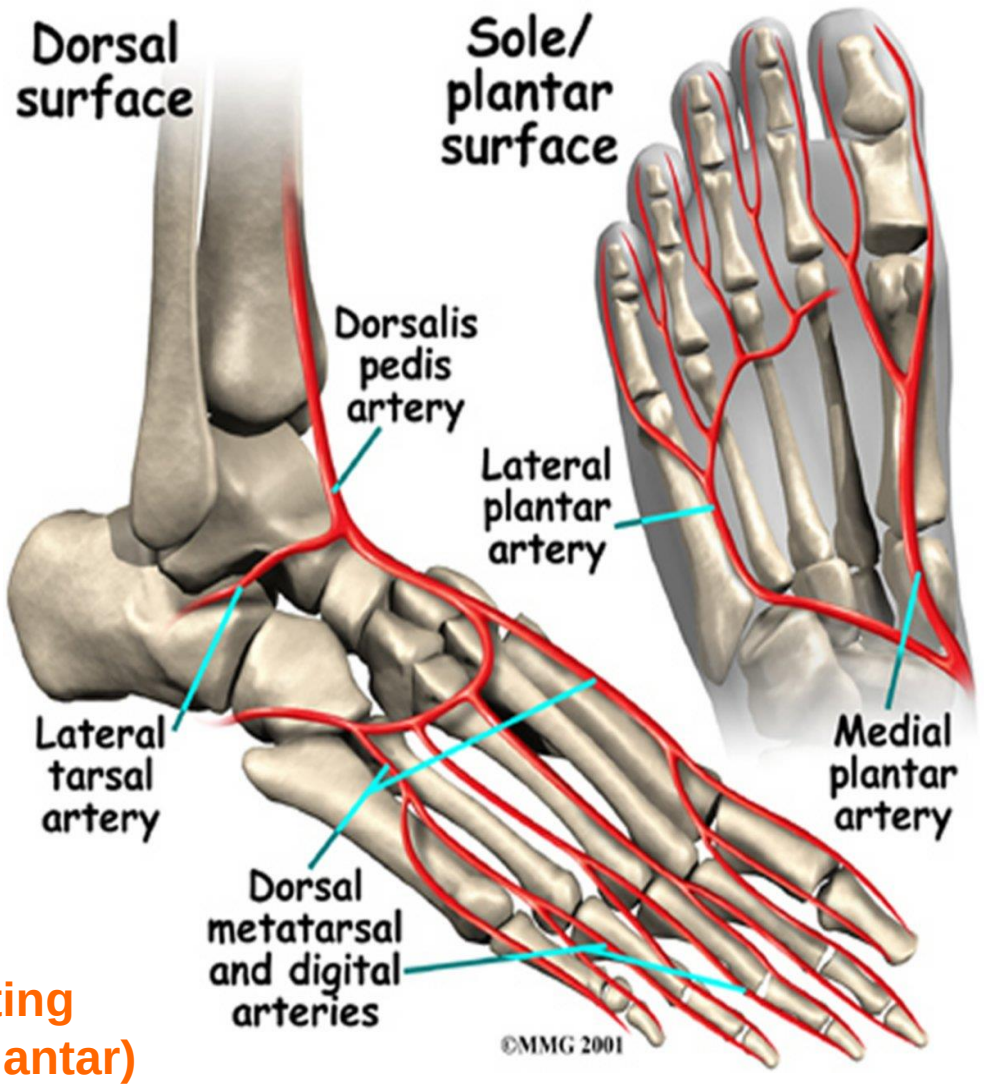
Foot Circulation





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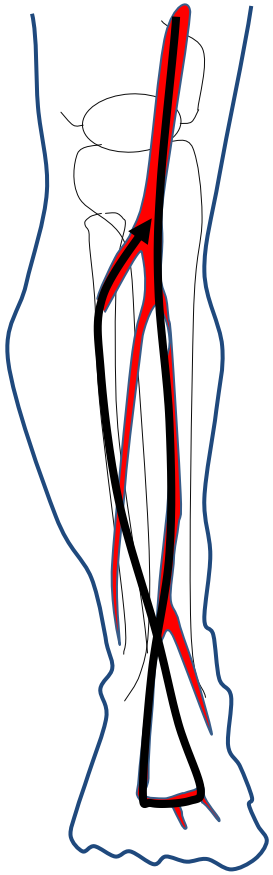
Step-by-step approach in CTOs crossing strategy

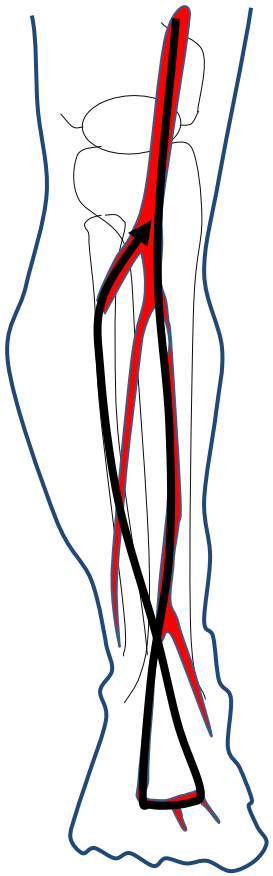
- **Antegrade approach**
  1. Endoluminal
  2. Subintimal

Failure

- **Retrograde puncture**
- **Transcollateral**
  1. **Pedal-plantar loop technique**
  2. Peroneal artery branches PTA



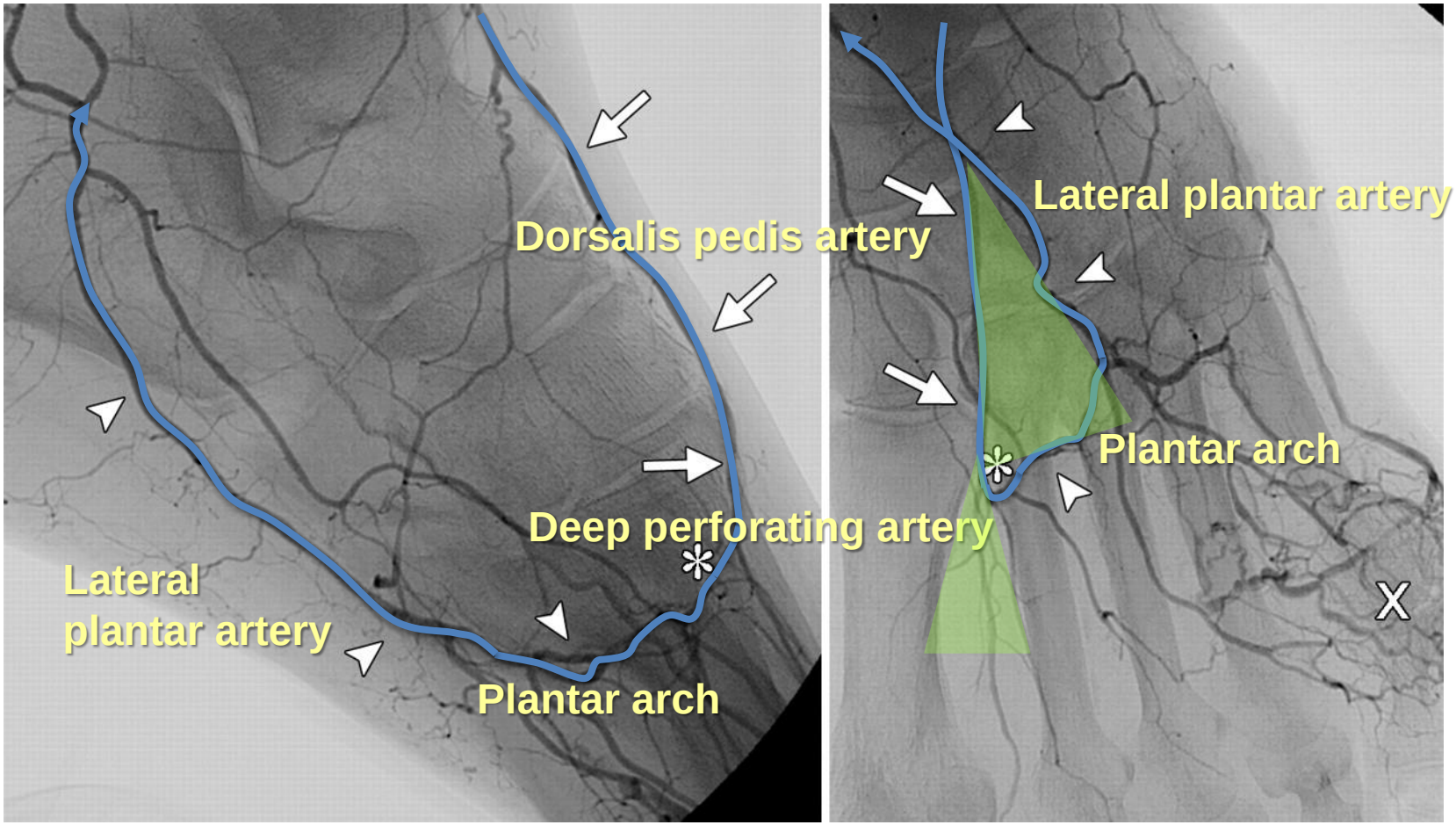
Pedal – Plantar Loop Technique



Pre-existing collateral channel = pedal arch

Pedal – Plantar Loop

Lateral Oblique & AP Projections with DSA



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Manzi M et al. Radiographics 2011;31:1623-36

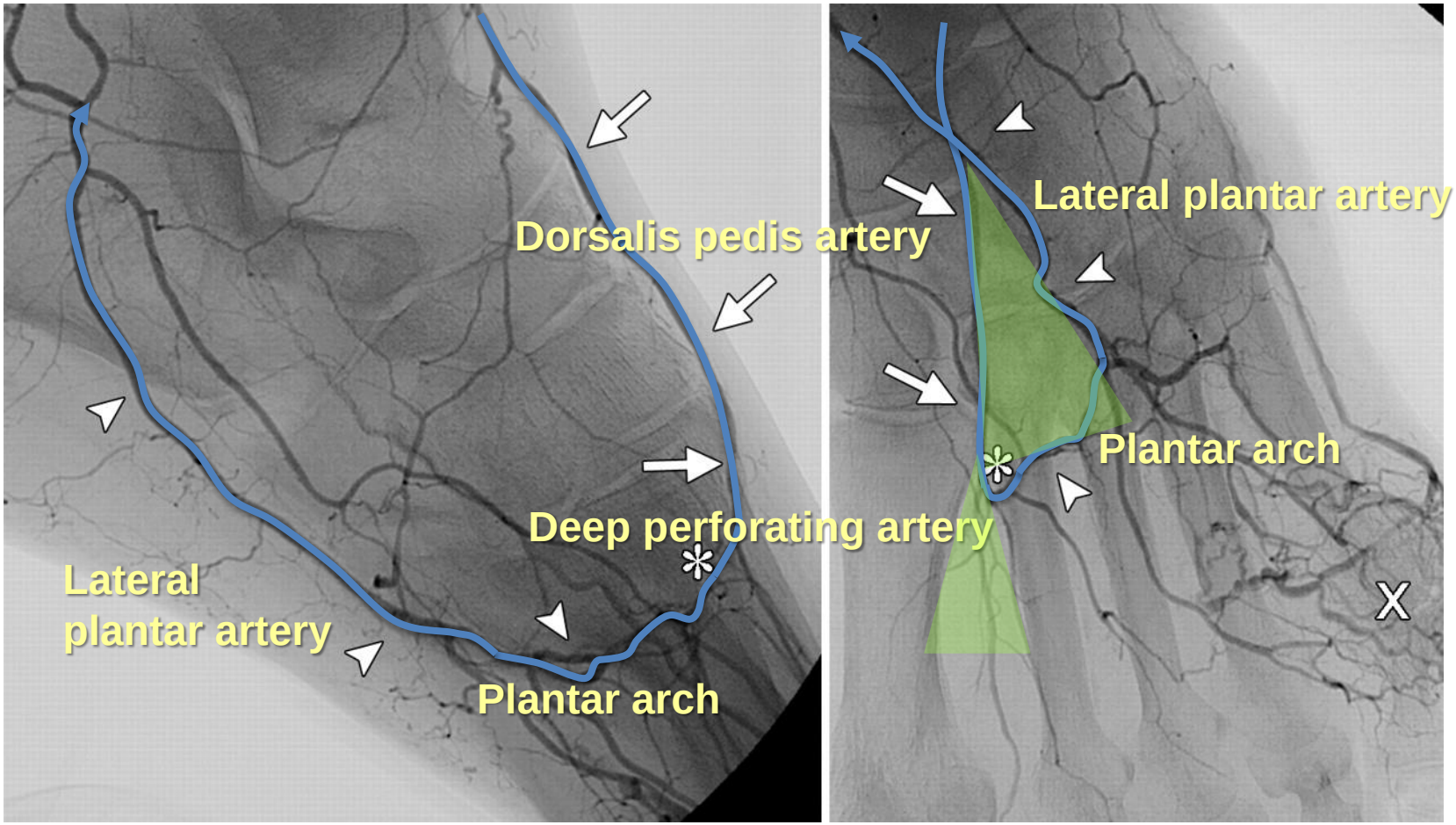
Most Important Thing of Successful BTK/BTA CTO Intervention

Clear and Proper Image

From Anatomic Concepts

Pedal – Plantar Loop

Lateral Oblique & AP Projections with DSA



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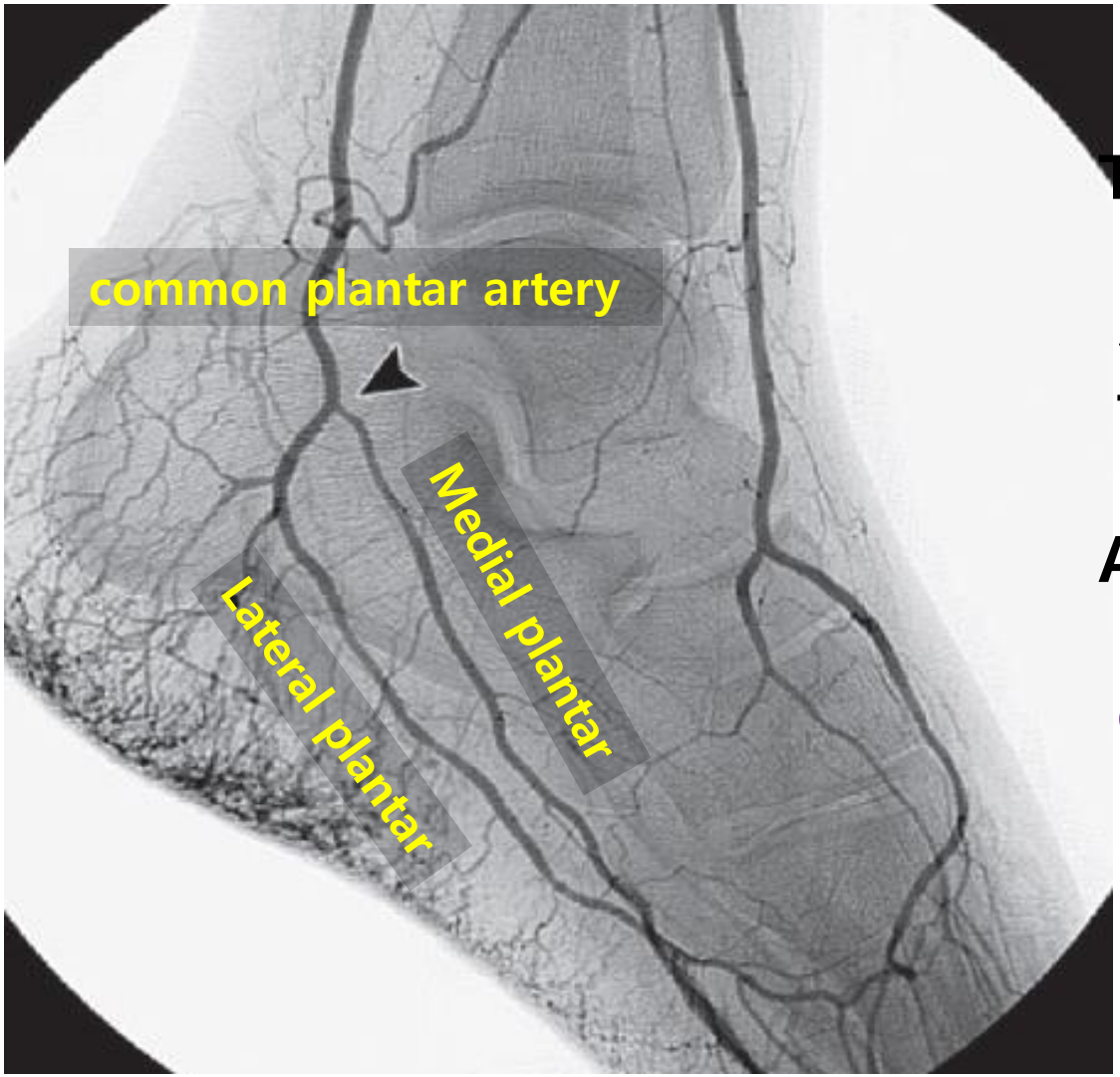
Manzi M et al. Radiographics 2011;31:1623-36

Lateral oblique projection

The base of the 5th metatarsal bone should be seen projecting outward from the base of the foot to obtain the correct lateral oblique inclination

Manzi M et al. Radiographics 2011;31:1623-36

Lateral oblique projection

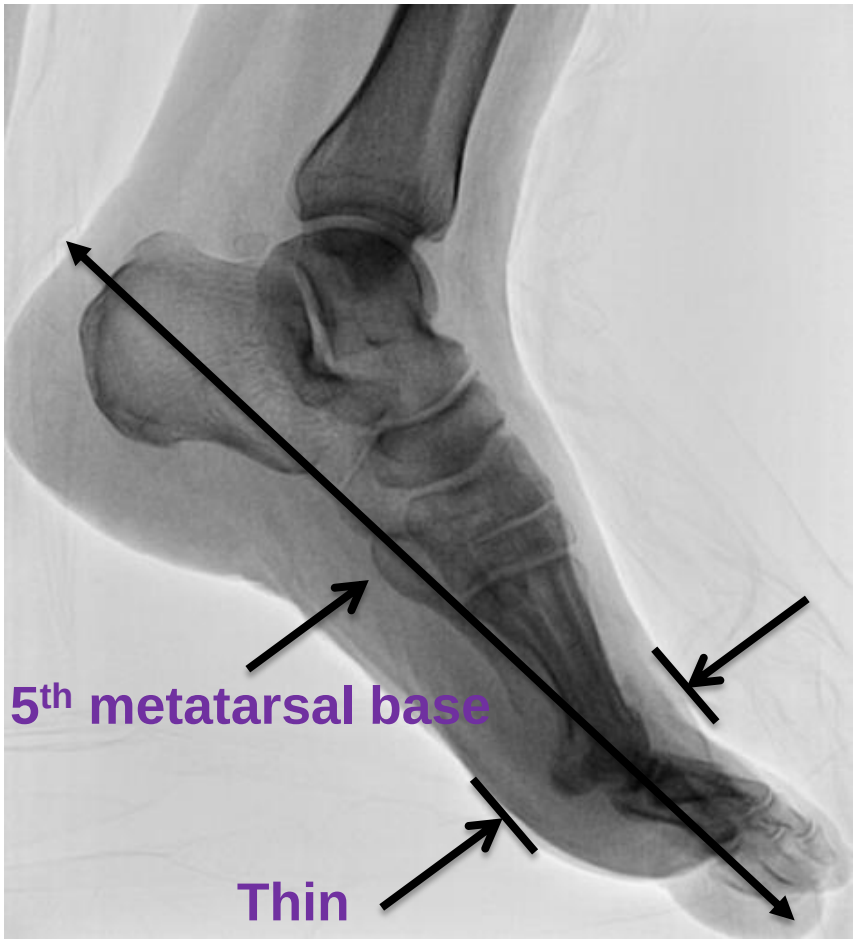


The heel and proximal part of the forefoot should be included in the projection area.

Angiogram shows the bifurcation of the common plantar artery (arrowhead) into the medial and lateral plantar arteries

Manzi M et al. Radiographics 2011;31:1623-36

Lateral oblique projection



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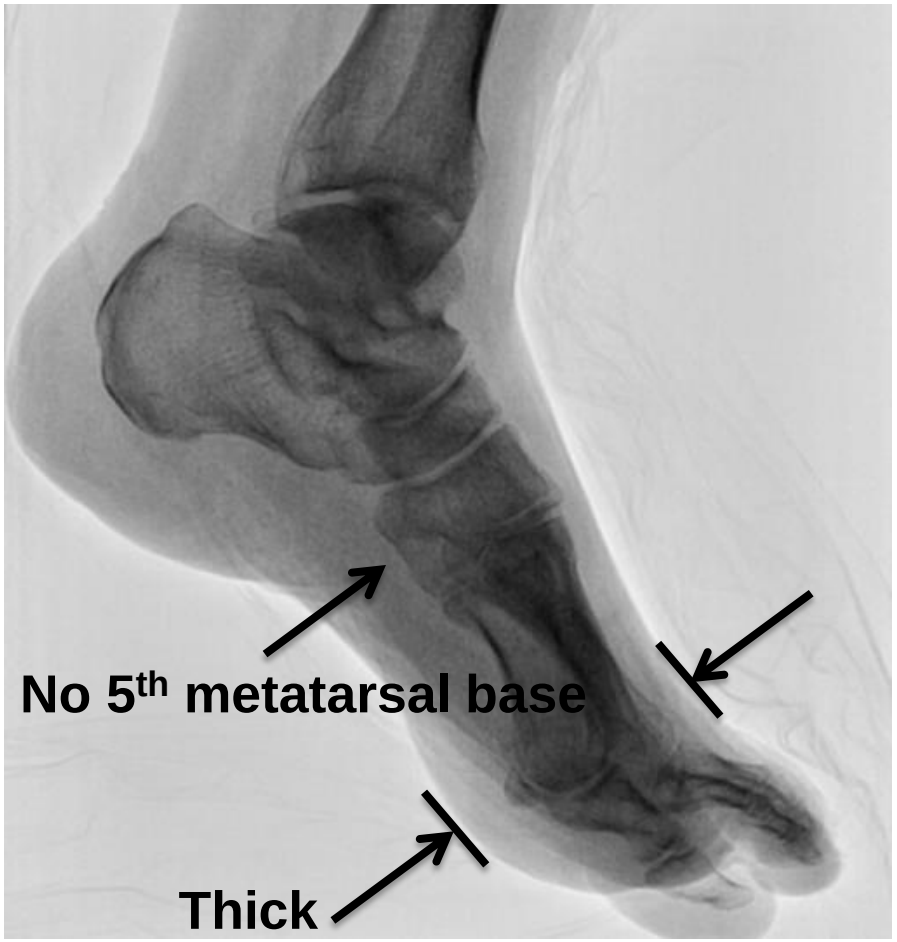

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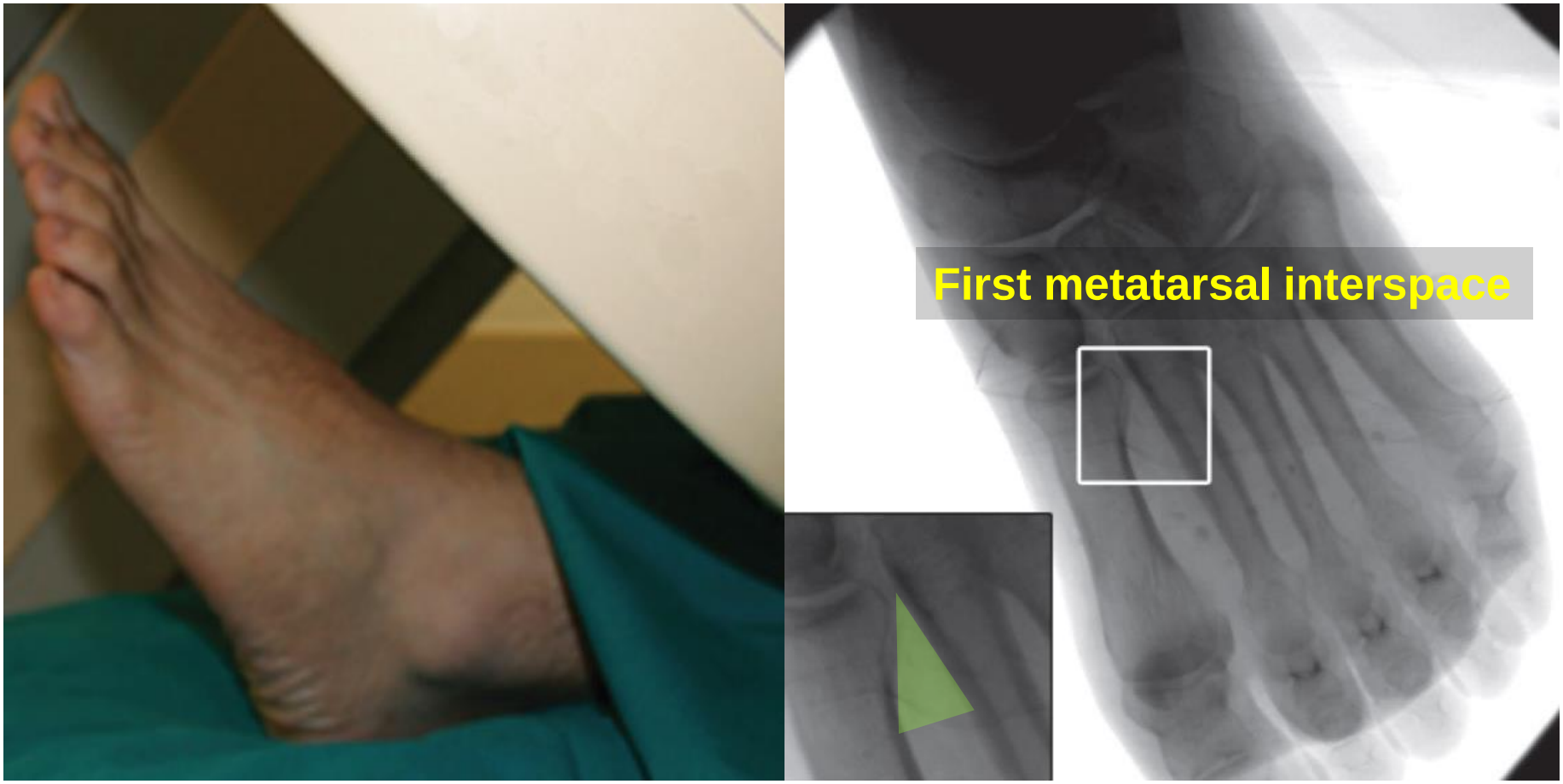
AP Cranial Projection



The 1st metatarsal interspace should be visualized.

Inclusion of the entire forefoot in the projection area.

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Manzi M et al. Radiographics 2011;31:1623-1636

AP Cranial Projection

The AP projection is best for visualizing the pedal-plantar loop and the origins of the tarsal and metatarsal arteries.

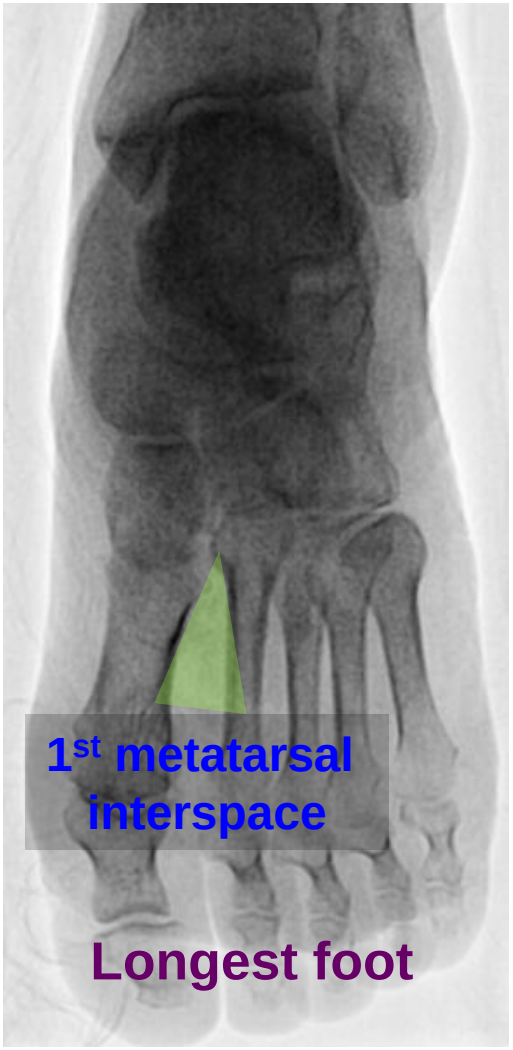
Angiogram shows the pedal-plantar loop passing from the dorsal portion to the plantar portion of the foot in the 1st metatarsal interspace.

Manzi M et al. Radiographics 2011;31:1623-1636

AP Cranial Projection

(X)

(X)



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Vascular Imaging of the foot

The 1st step toward endovascular recanalization

- **Use of digital subtraction with a large matrix**
- **Prolonged filming to record delayed enhance-ment of pedal vessels**
- **A single projection is inadequate for complete depiction of vasculature**
- **The pedal-plantar loop should be adequately imaged**

Access Routes for BTK Intervention

Contralateral femoral

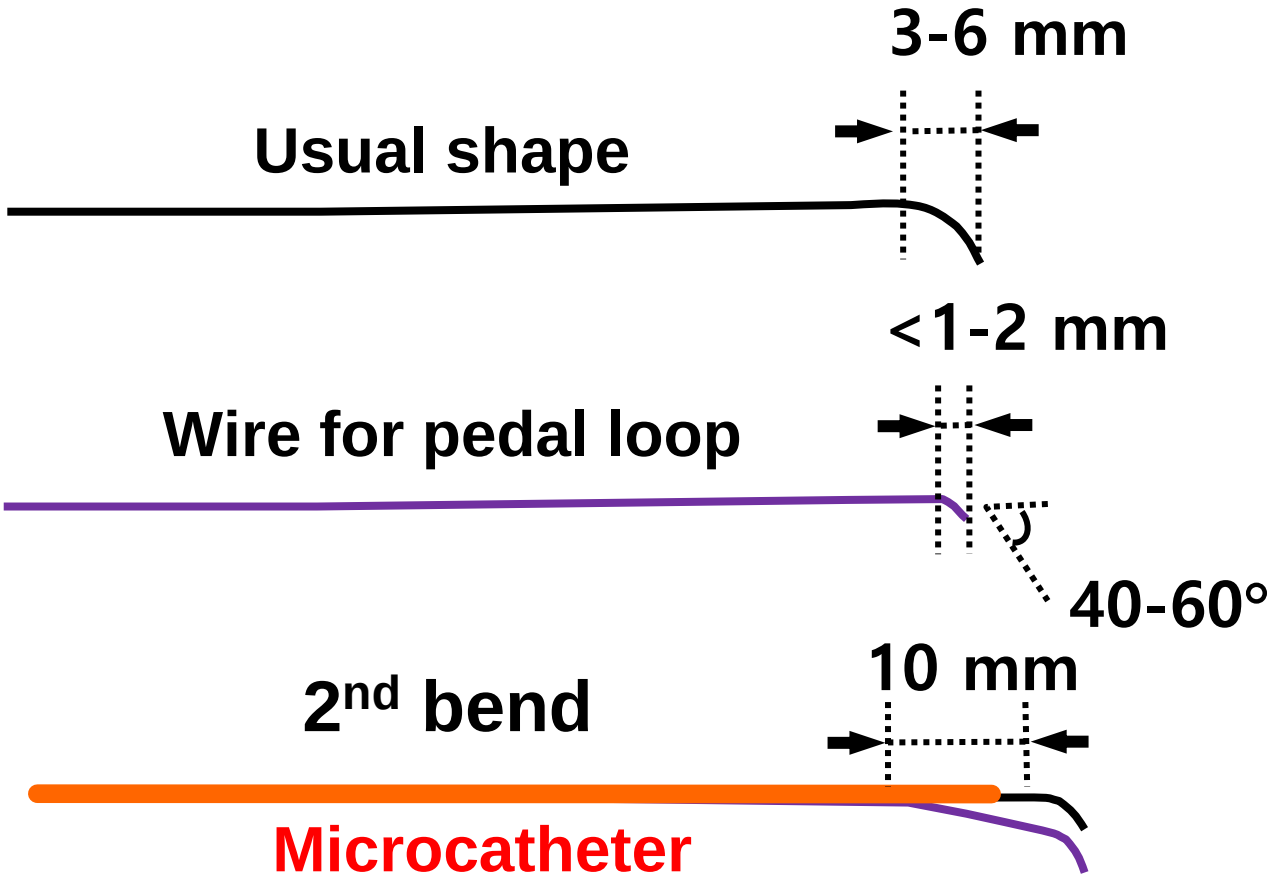
- evaluate whole L/E
- Too long to reach BTA
- Need for additional route for pedal-loop access

Ipsilateral femoral

- Difficult puncture for CFA or pSFA disease
- More bleeding Cx (esp. in obese pt)
- Short to reach BTA
- More complex BTK ds
: calcified, thrombus+
: needs atherectomy
: needs pedal-loop access

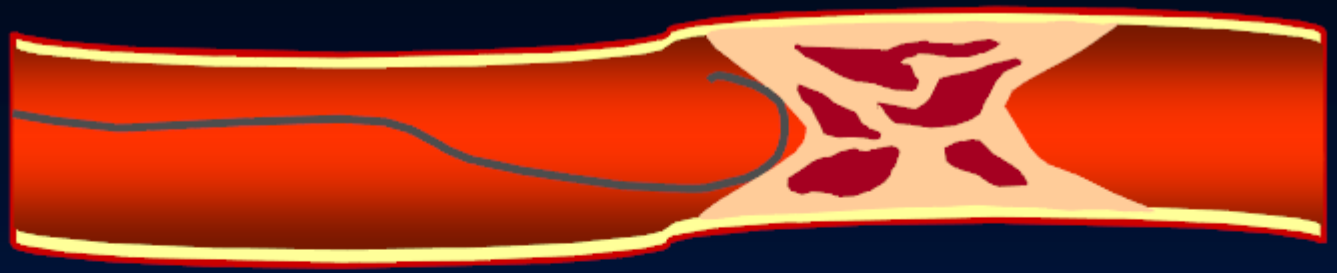
Ipsilateral antegrade access is the usual route for pedal-plantar loop intervention

Guidewire Tip for CLI CTO Intervention



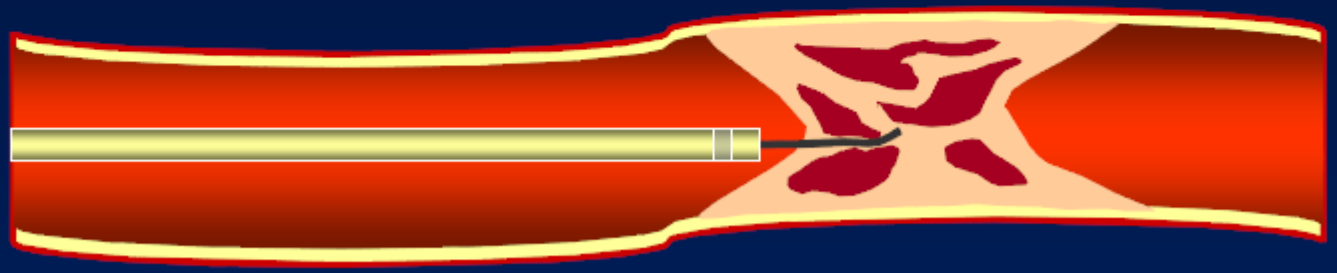
Microcatheter back-up is mandatory

Wire only



The tip of the guidewire often curves back at the proximal fibrous cap due to poor backup support.

Wire with Micro-catheter



Micro-catheter reinforces torque transmission of guidewire and creates better backup support for penetration of the complex lesion.

Microcatheter back-up is mandatory

- For rapid wire exchange, wire reshaping, or superselective angiography
- Can increase tip load
- I prefer to use **0.014” guide wire**
  → better tracking for angulated pedal loop
- **1.2-1.5x20mm Armada XT OTW balloon**
  or **150 cm long CXI microcatheter**
- 1.2~1.5mm OTW balloon is very helpful for
  - progressive dilatation for calcified lesion
  - balloon anchoring to increase GW power

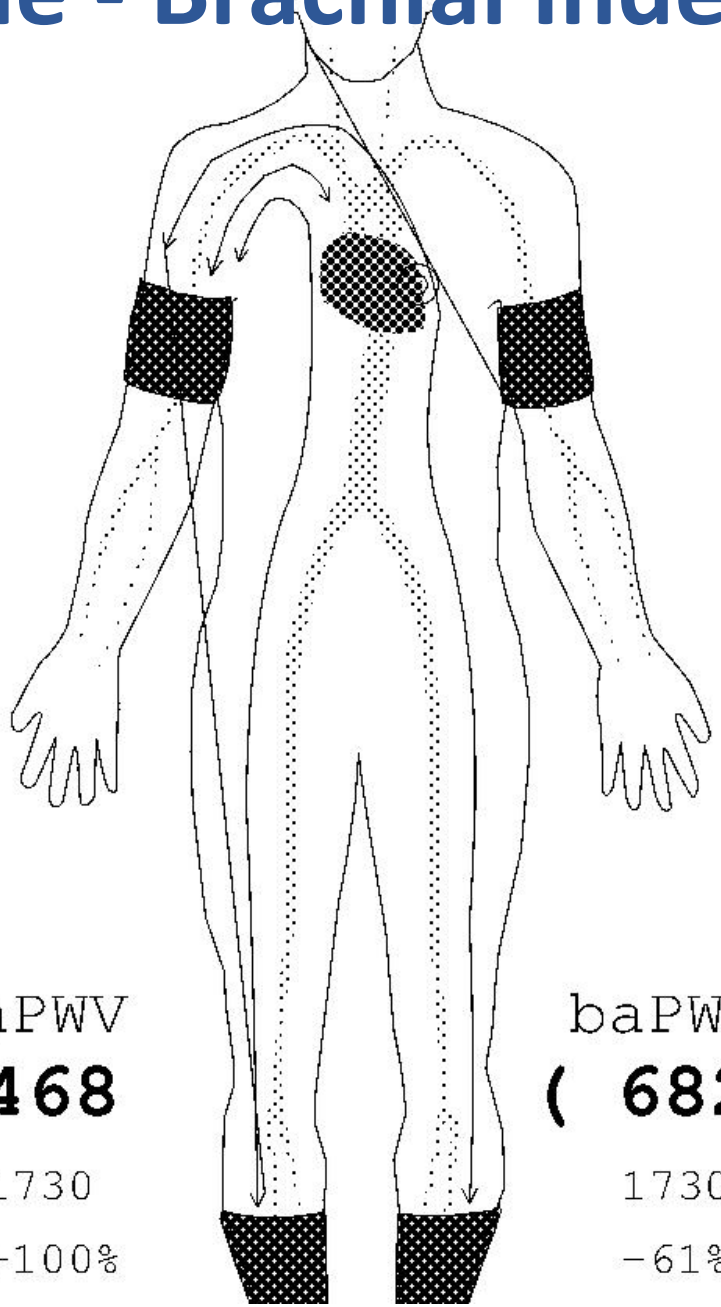
Case

- M/89
- Left leg pain & non-healing ulcer
  : onset- 2years ago, aggravated since 2~3months
- Diabetes, Hypertension, CKD (Cr eGFR 27)

Ankle - Brachial Index

R-Bra.	
SYS	159
MAP	124
DIA	80
PP	79

R-Ank.	
SYS	171
MAP	70
DIA	41
PP	130
ABI	**1.08**



baPWV
3468
1730
+100%

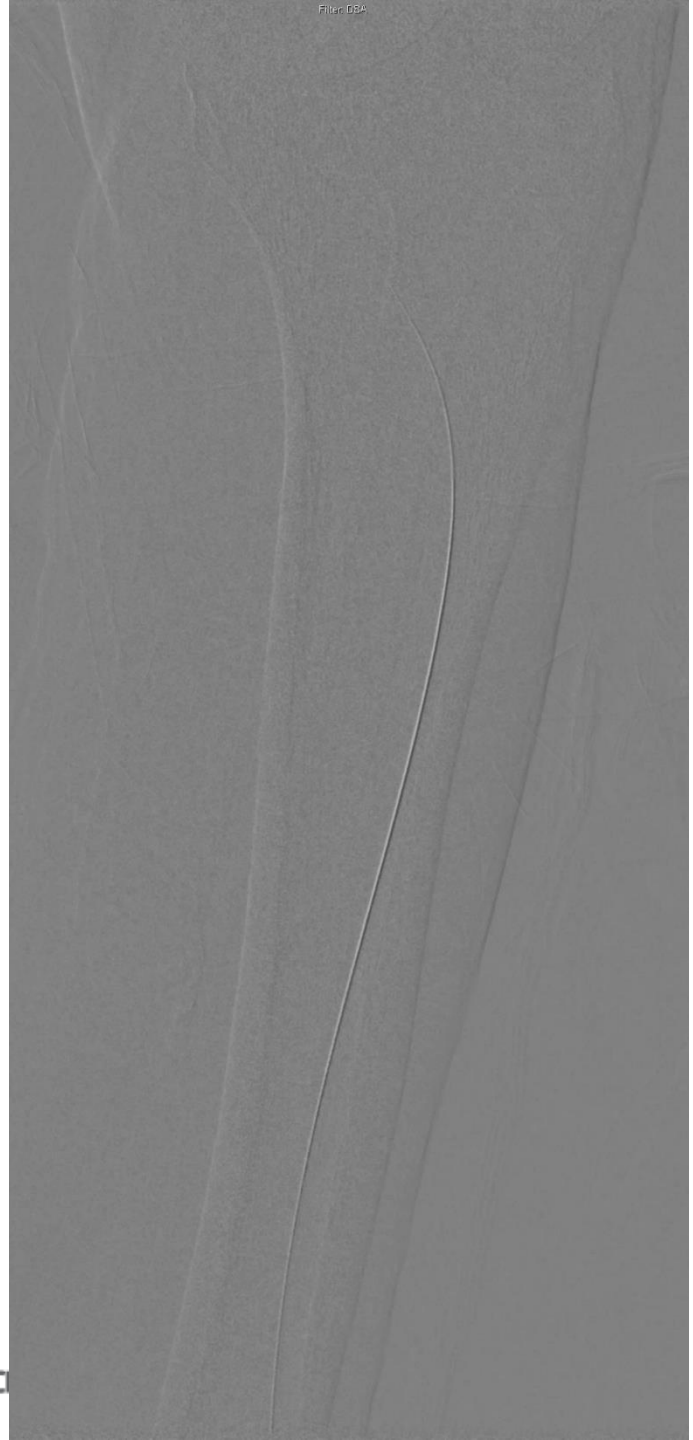
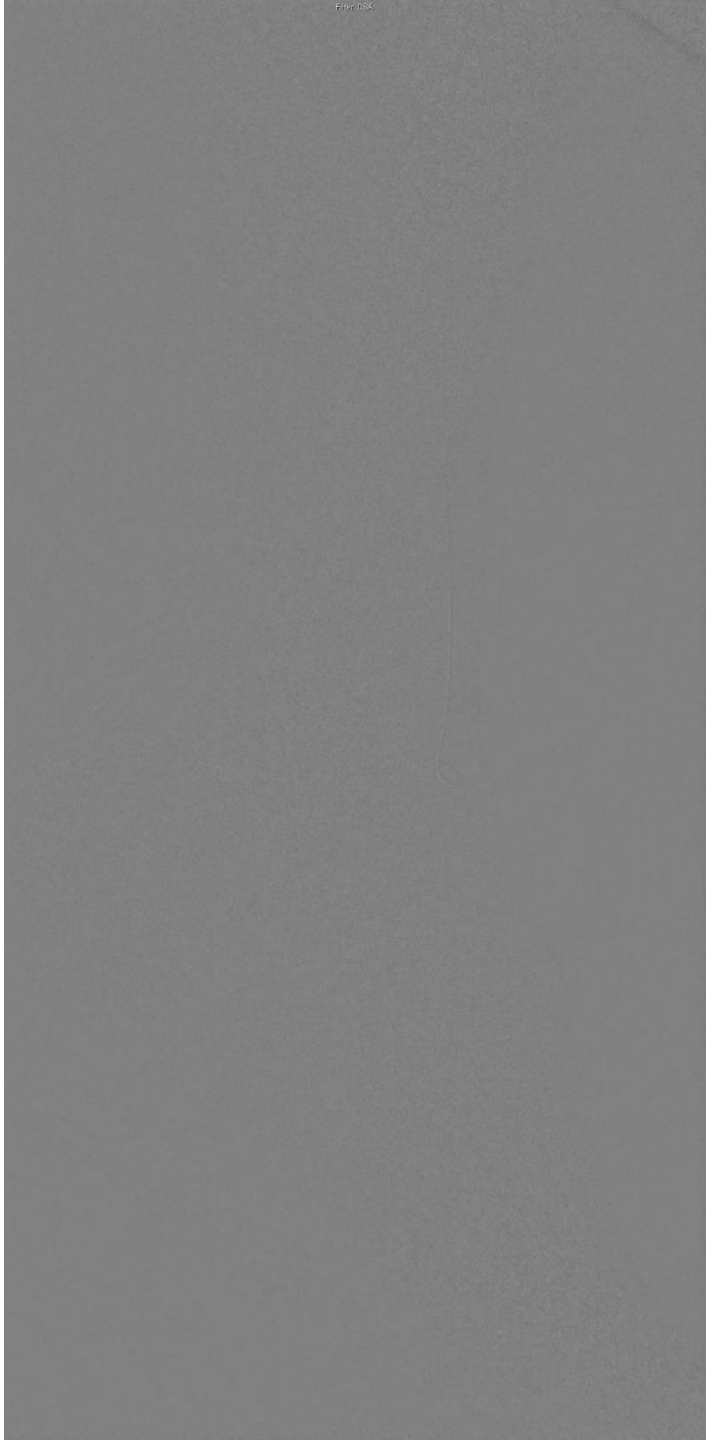
baPWV
(682)
1730
-61%

L-Bra.	
SYS	144
MAP	104
DIA	81
PP	63

L-Ank.	
SYS	(88)
MAP	62
DIA	32
PP	56
ABI	**0.55**

Cross-Over Approach

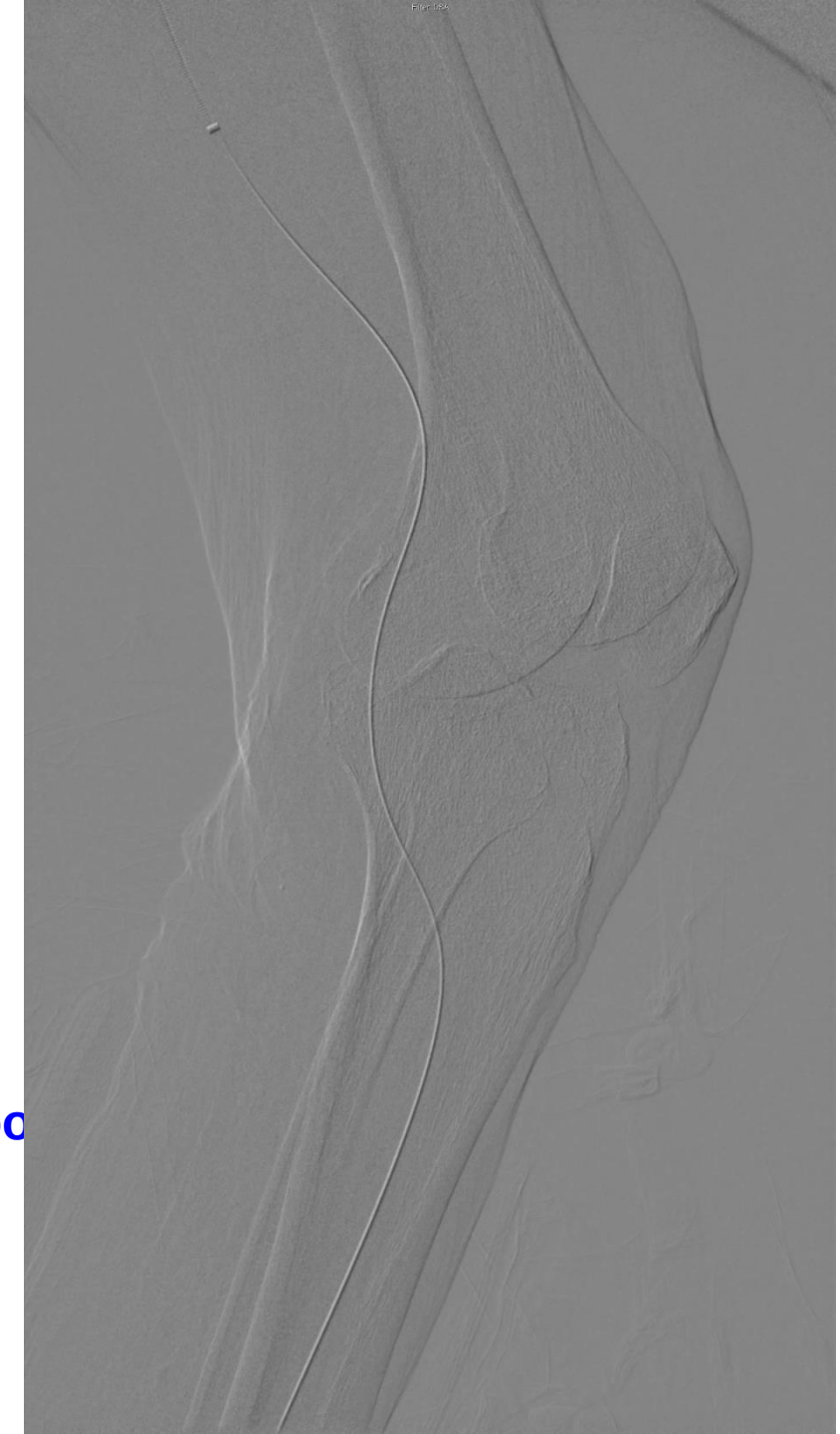
Flexor® Ansel Guiding Sheath 6Fr
CXI microcatheter, V18 wire

Femoro-Popliteal Occlusion

4.0x80mm balloon

5.0x150mm balloo



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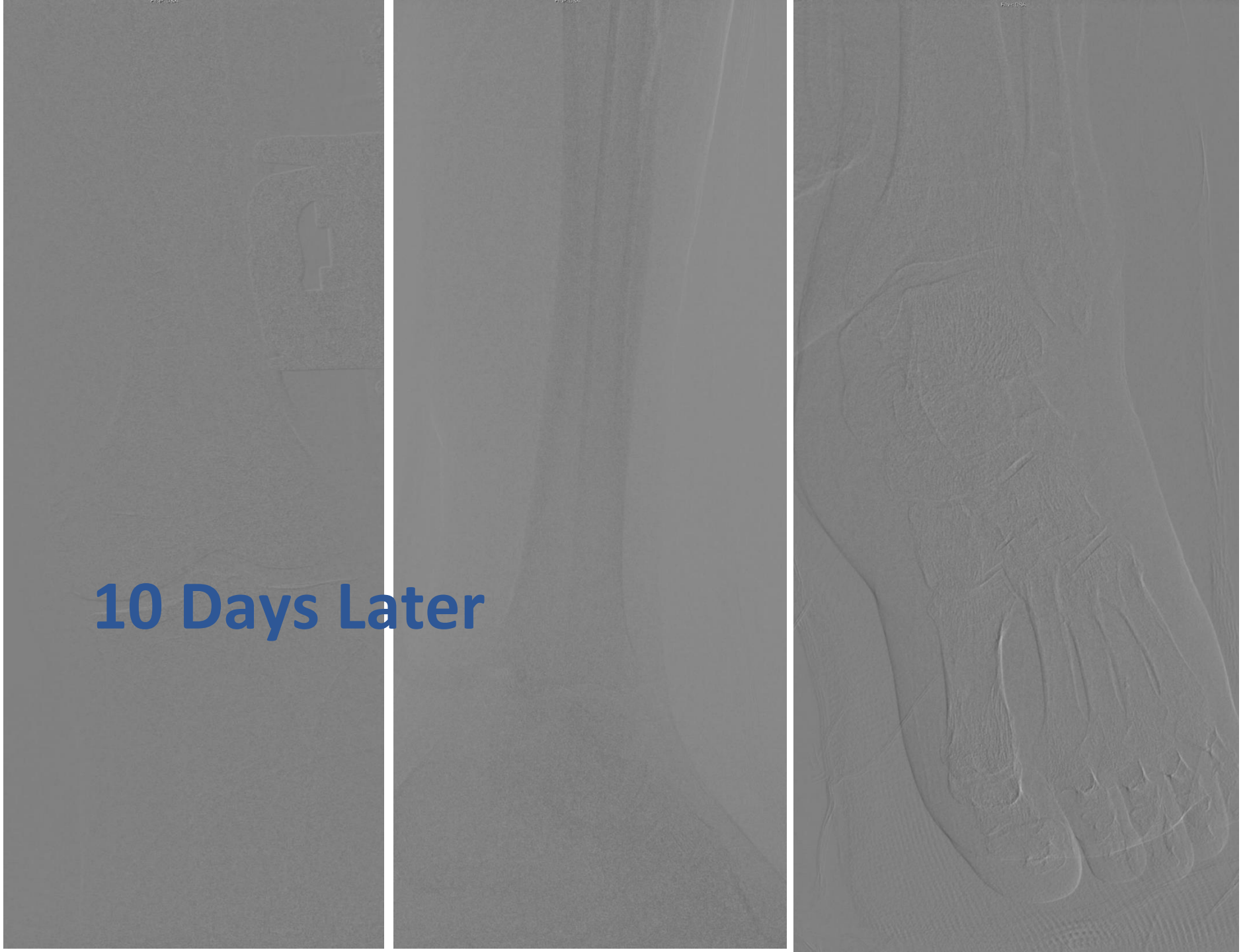
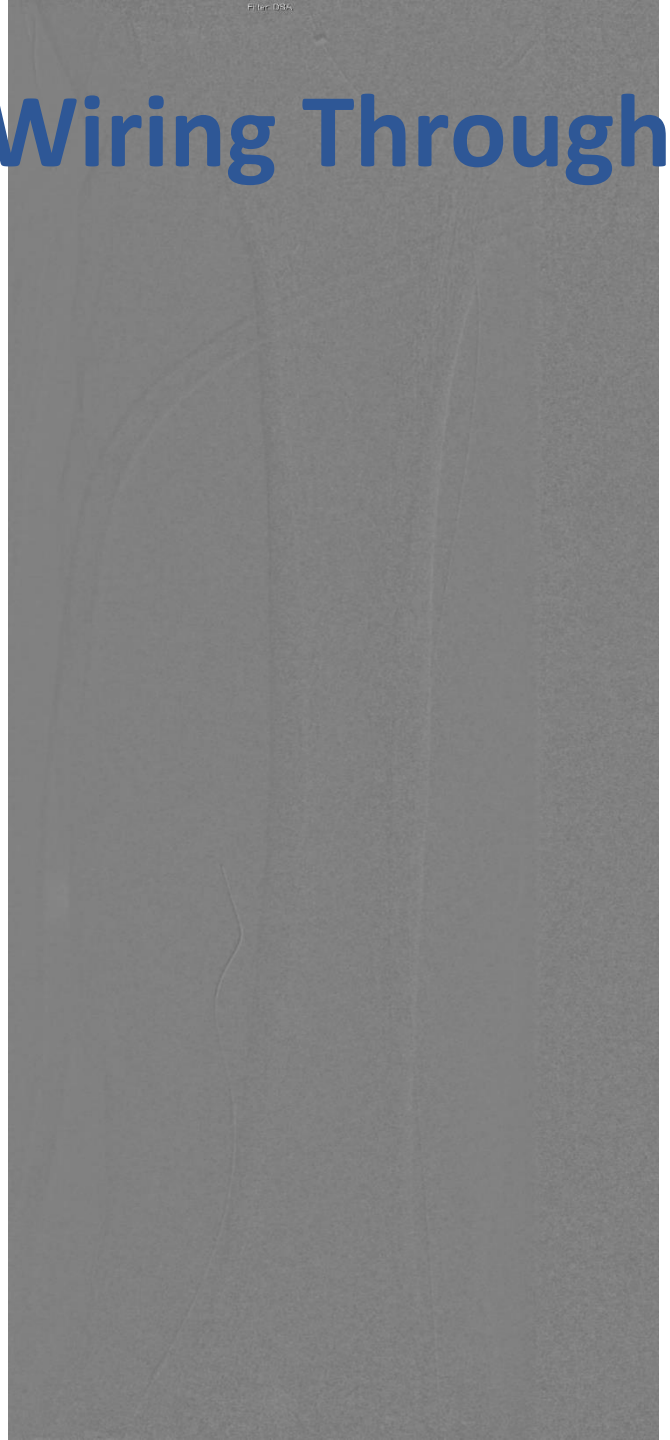
Surgical Procedure

Left ankle & heal wound was aggravated !!


10 Days Later

Antegrade Wiring Through Peroneal



Balloon Angioplasty for Peroneal

2.0x120mm balloon

2.5x80mm balloon

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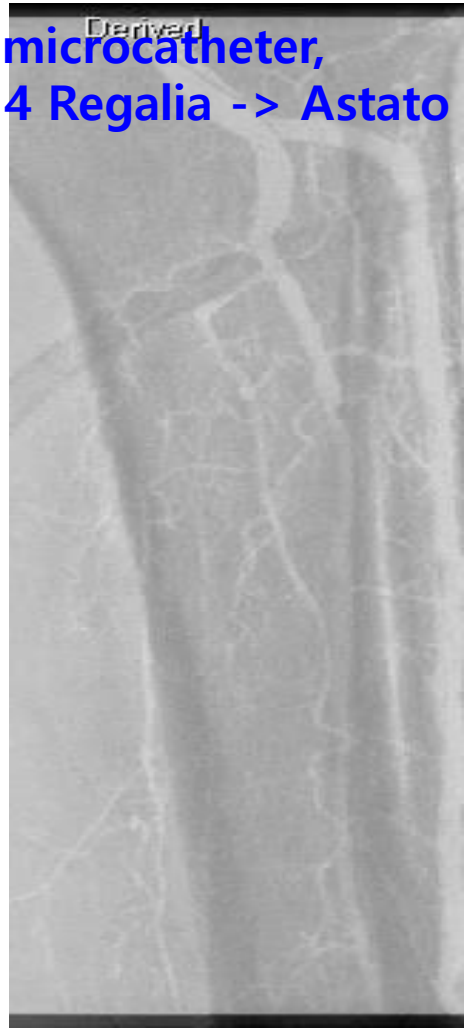
Looking For PTA

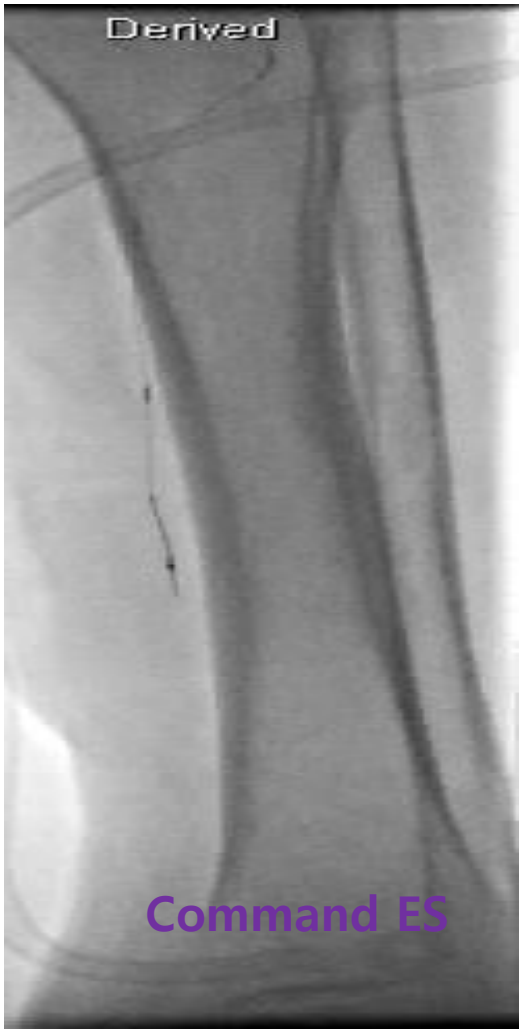
Retrograde Wiring Through Plantar Arch

CXI microcatheter, 0.014 Regalia ->

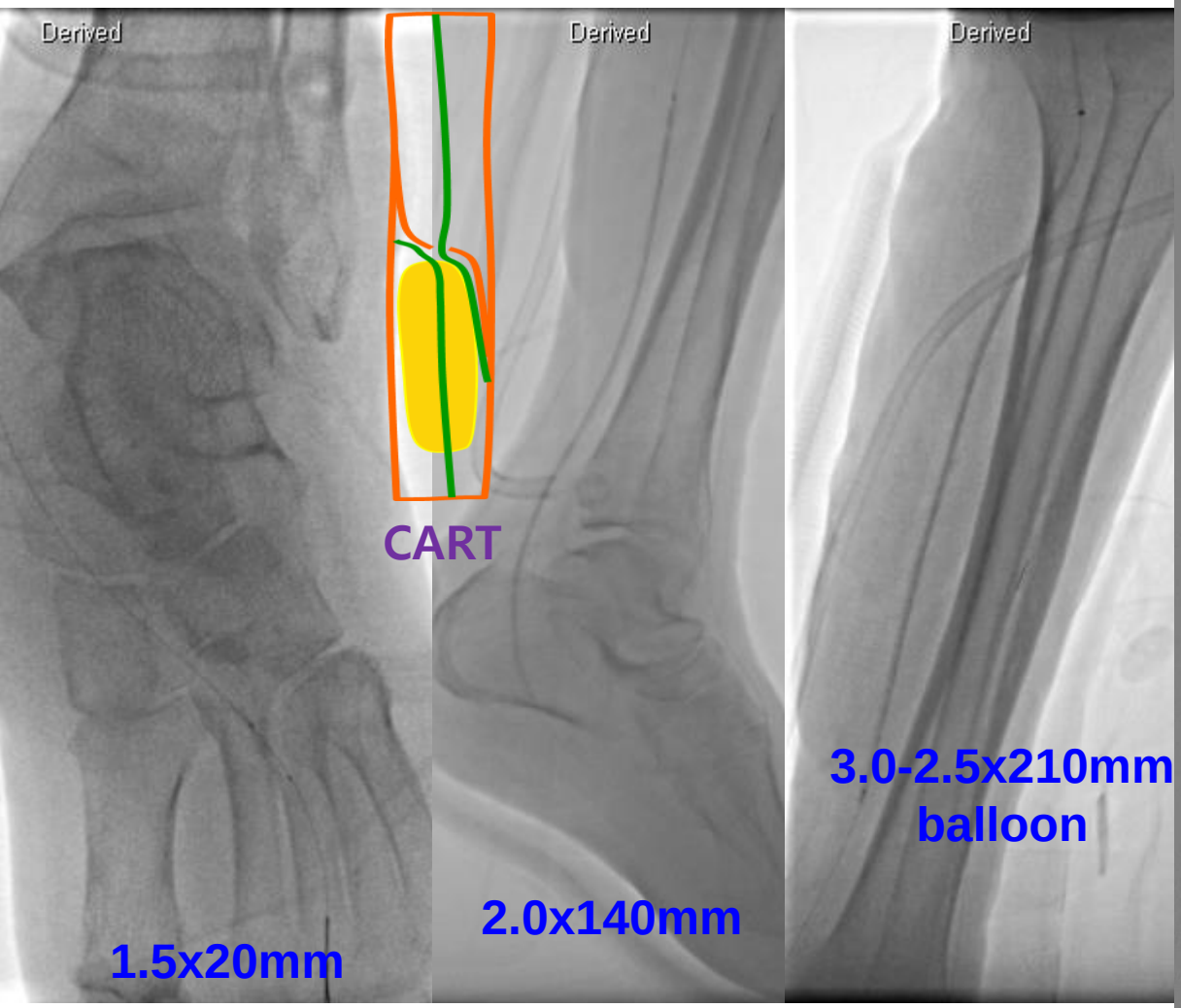
Antegrade Wiring Through PTA

CXI microcatheter,
0.014 Regalia -> Astato 20gm





Balloon Angioplasty for PTA



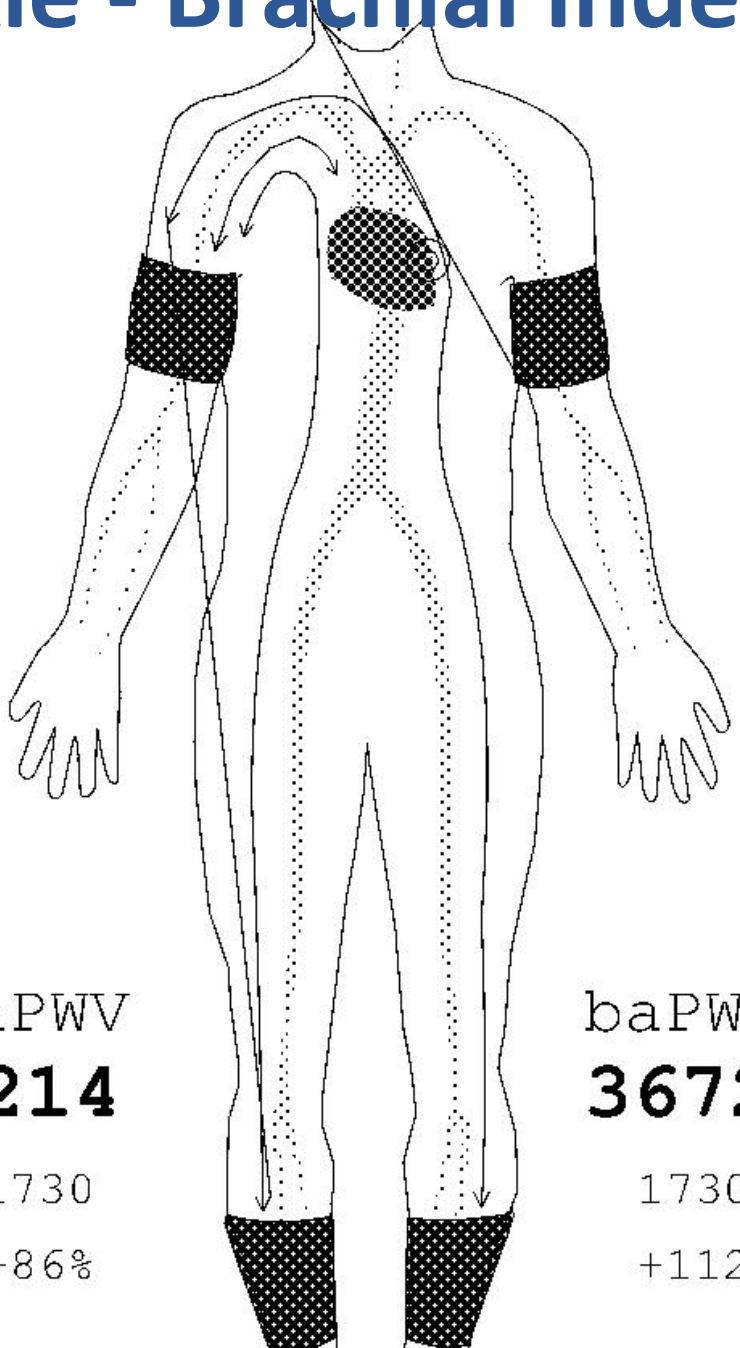
Ankle - Brachial Index

R-Bra.	
SYS	155
MAP	119
DIA	79
PP	76

L-Bra.	
SYS	142
MAP	99
DIA	76
PP	66

R-Ank.	
SYS	144
MAP	83
DIA	57
PP	87
ABI	**0.93**

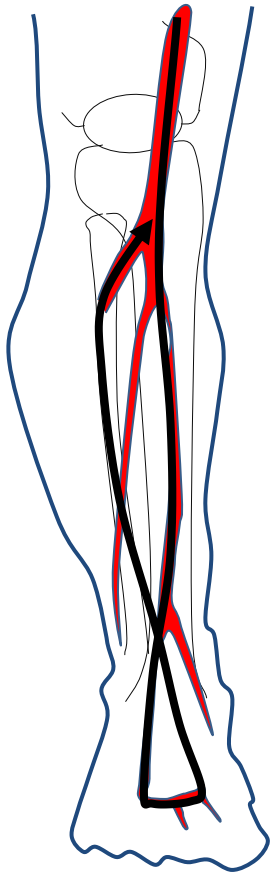
L-Ank.	
SYS	192
MAP	117
DIA	61
PP	131
ABI	**1.24**



baPWV
3214
1730
+86%

baPWV
3672
1730
+112%

Make Pedal – Plantar Loop



Pre-existing collateral channel = pedal arch

Pedal artery reconstruction is important to improve clinical outcomes in CLI patients with pedal artery disease ??

Crossing the Rubicon: A Closer Look at the Pedal Loop Technique

Lanfroi Graziani, Brescia, Italy

1,331 consecutive CLI
Pedal arch angioplasty : 135 (10.1%),
Technical success rate: 85%

After 15 days,

TcPO2 improvement

(59 ± 16 mm Hg) in patients with successful Pedal loop (42 ± 12 mm Hg) improvement in subjects with patency of 2 BTK arteries but with incomplete patency of the Pedal arch ($P < 0.001$).

Ann Vasc Surg 2017; 45: 315–323

Clinical Outcomes of Pedal Artery Angioplasty for Patients With Ischemic Wounds

Results From the Multicenter RENDEZVOUS Registry

Pedal artery angioplasty
PAA (n=140) vs. not PAA (n=117)

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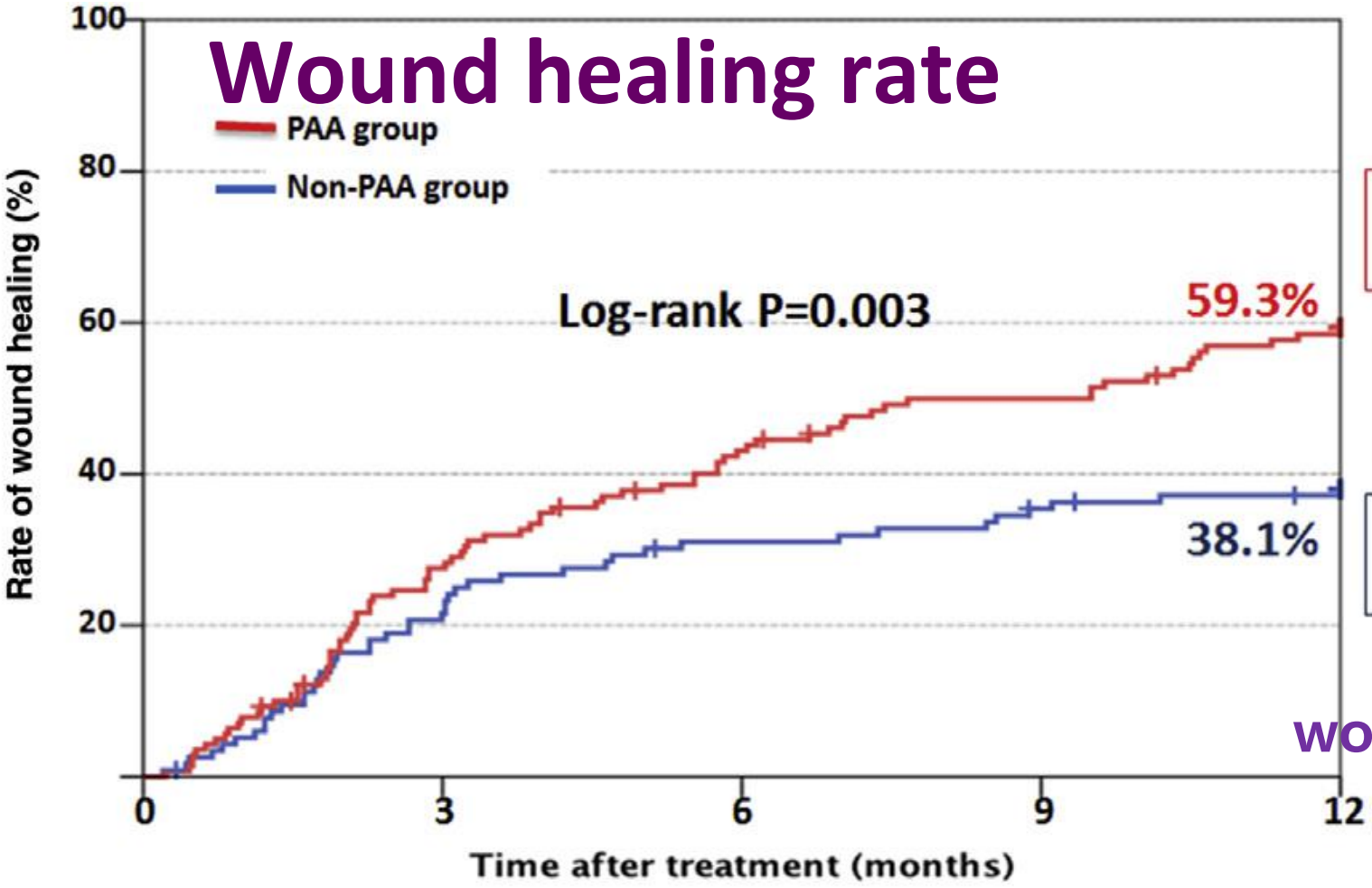
J Am Coll Cardiol Intv 2017;10:79–90

Wound healing rate



211 days, IQR(69.25-365)

P=0.008

365 days, IQR(86.5-365)

Time to wound healing

Interval (months)		0	3	6	9	12
PAA group (n= 140)	at risk	140	99	75	65	52
	%	0.0	28.3	43.8	49.9	59.3
Non-PAA group (n= 117)	at risk	117	88	79	72	68
	%	0.0	24.1	31.0	36.3	38.1

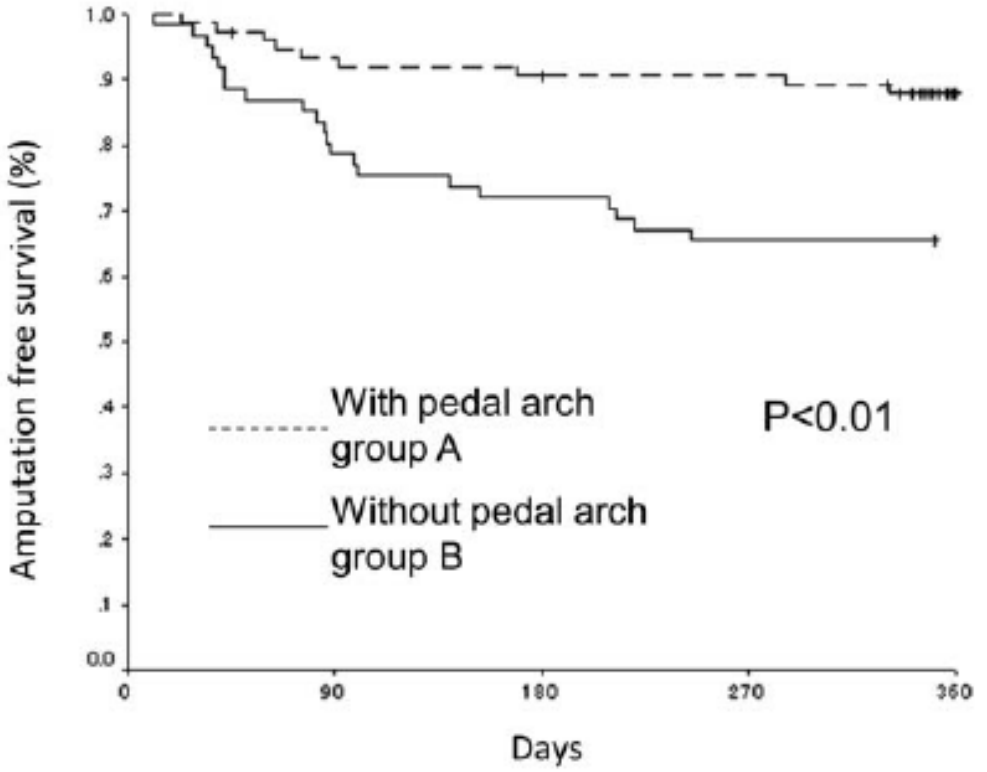
J Am Coll Cardiol Intv 2017;10:79–90

Outcomes of One Straight-Line Flow With and Without Pedal Arch in Patients With Critical Limb Ischemia

Limb salvage rate

OLIVE registry

314 patients



With	76	70	67	67	63
without	61	48	44	41	41

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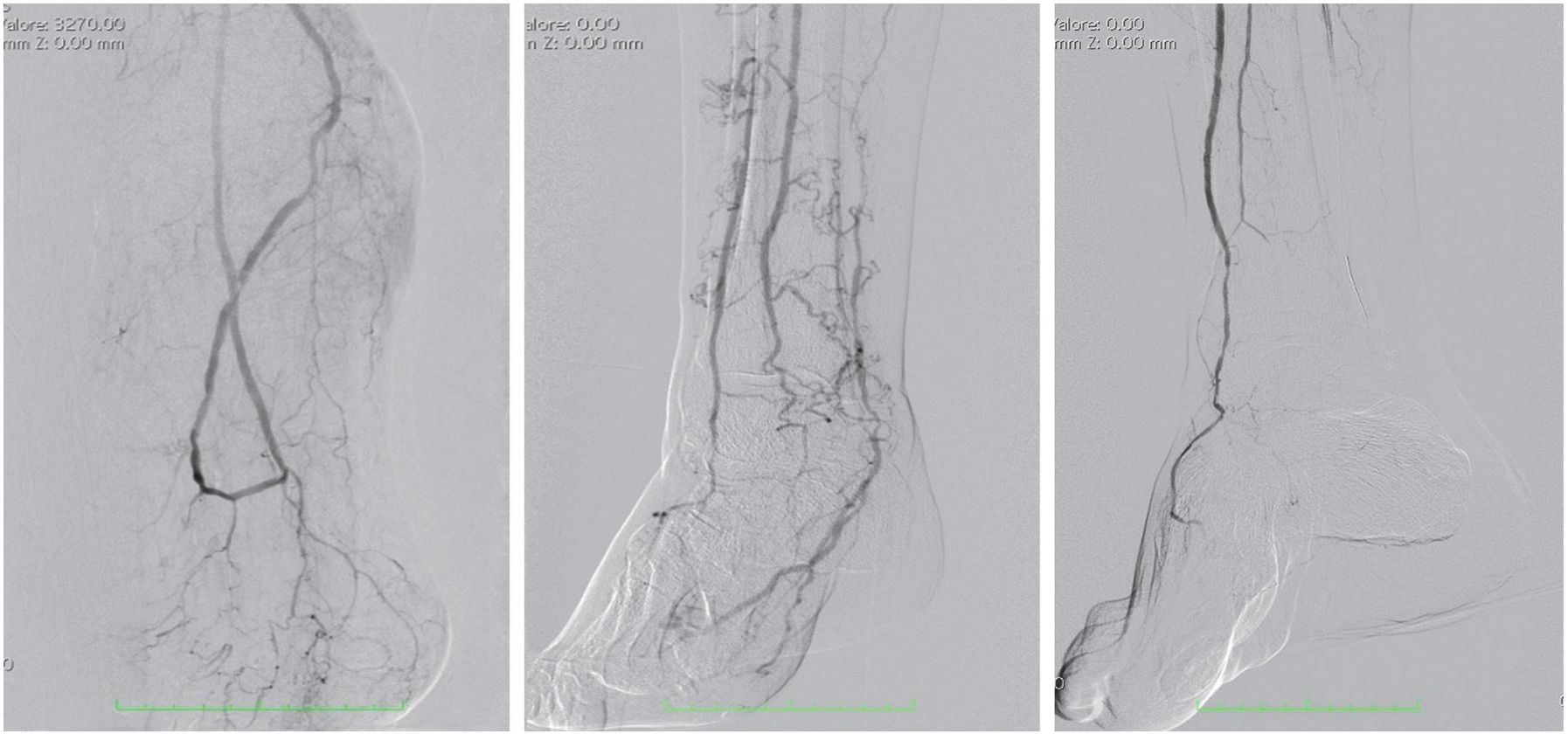
Cath and Cardiovas Interv 2016; 87:129–133

Pedal arch & angiosome in DM after EVT

CPA: complete pedal arch **IPA: incomplete pedal arch** **NPA: no pedal arch**



93 diabetic patients

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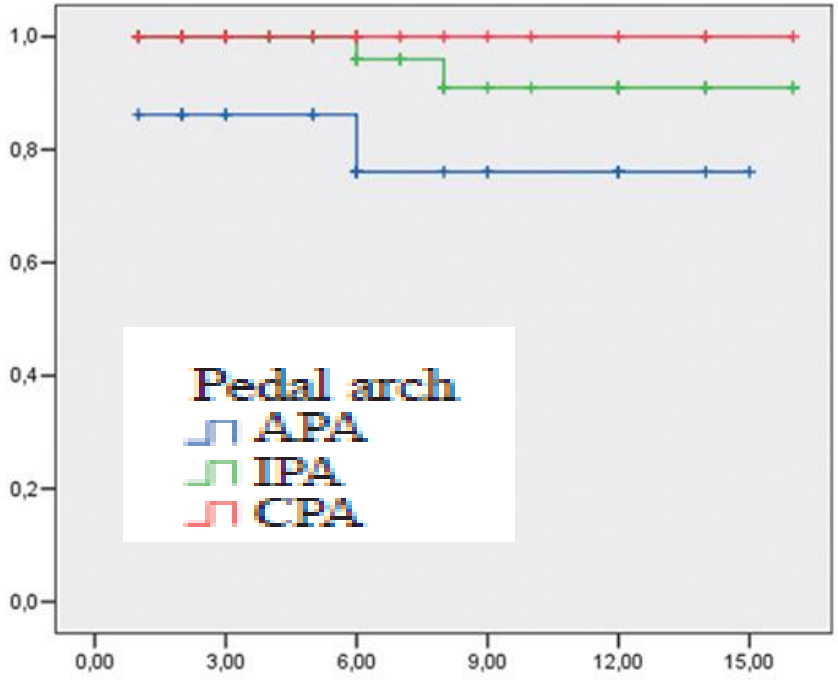
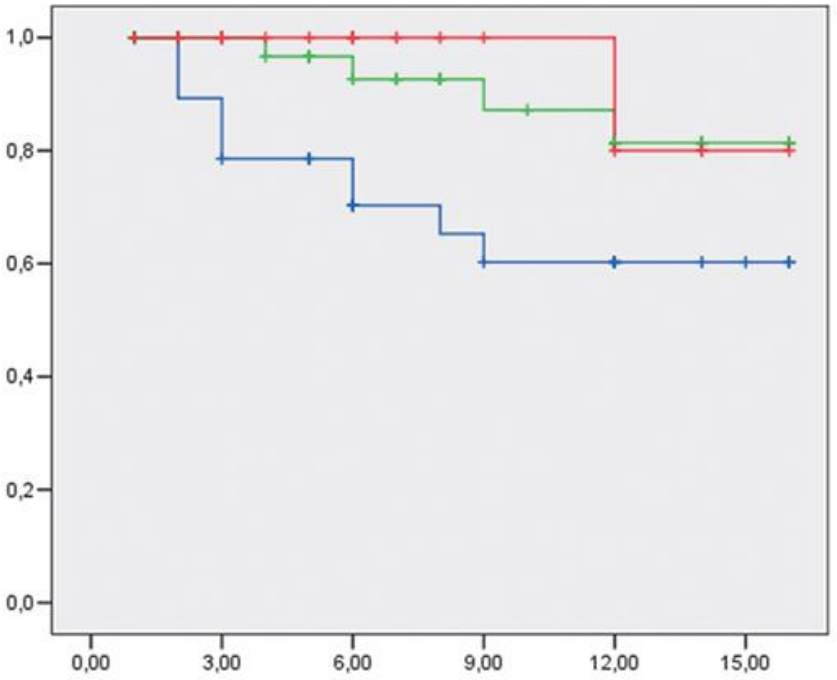
International Angiology 2017;36(5):438-44

Pedal arch patency and outcomes

Limb salvage



Survival



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International Angiology 2017;36(5):438-44

Conclusion

Pedal arch (artery) reconstruction (PAR)

- Improve hemodynamic parameters (TcpO2, SPP…)
- Improve wound healing rate
- Shorten time to wound healing
- Pedal loop technique is sometimes useful for complex BTK CTO lesions

To get Pedal arch reconstruction

- Knowledge of anatomy
- Clear and proper image

Thanks for your attention