“Imaging – the key success in challenging pedal cases"

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Disclosure

Roberto Ferraresi, MD

I have the following potential conflicts of interest to report: consulting, travel reimbursement, teaching courses, training, proctoring:

Medtronic, Boston Scientific, Abbott, LimFlow, Terumo, Cook, Biotronik, Asahi, Shire, Kardia, Orbus

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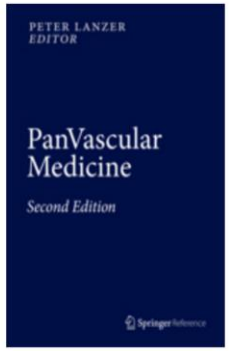
1. Anatomical variability
2. Pathology of foot arteries
3. Value of angiosomes
4. DPA-entrapment



Interventional Treatment of the Below the Ankle Peripheral Artery Disease

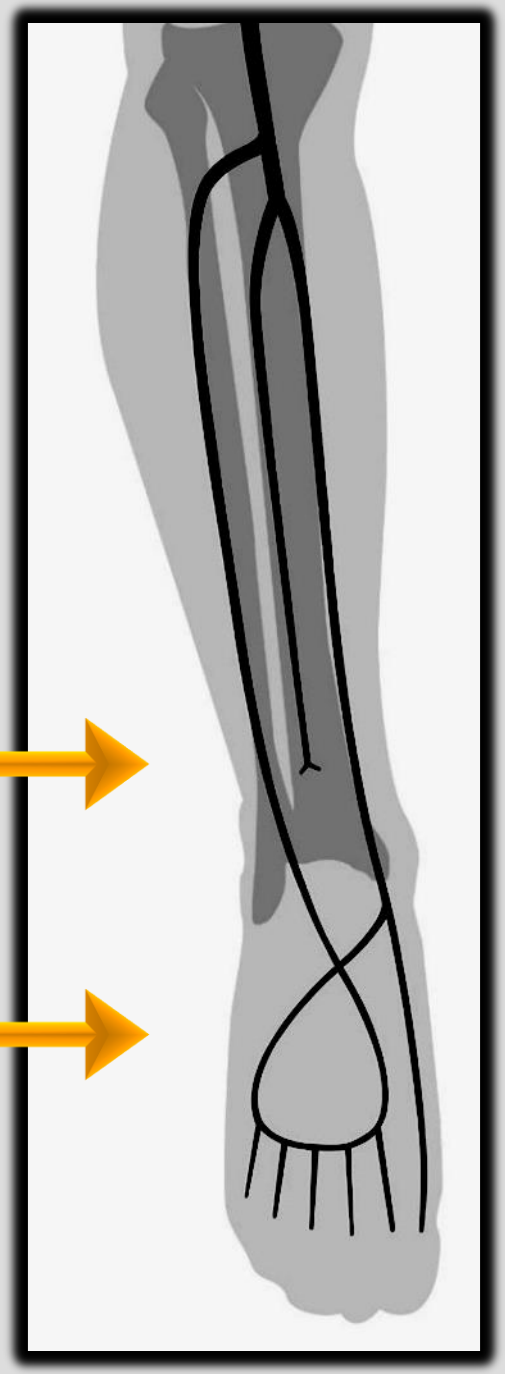
119

Roberto Ferraresi, Luis Mariano Palena, Giovanni Mauri, and Marco Manzi

Distal distribution pattern in 1624 leg

1° **Vascular abnormalities of ankle vessels distribution**

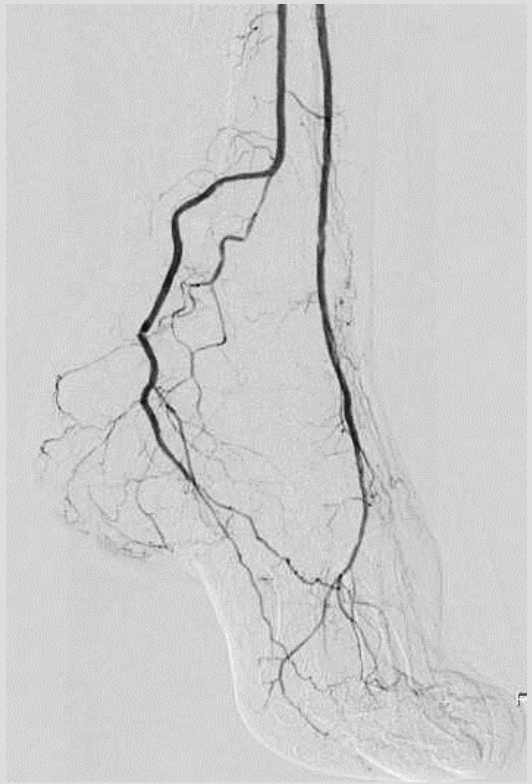
2° **Vascular abnormalities of foot vessels distribution**



Ankle distribution patterns	%
Balanced	94.8
Anterior dominant PER	2.4
Posterior dominant PER	1.9
Single PER	0.9

balanced

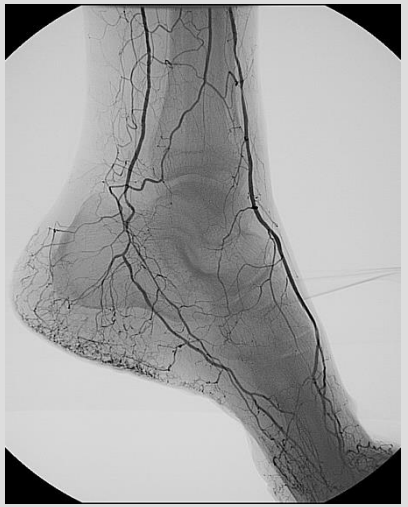
ant dominant PER



post dominant PER

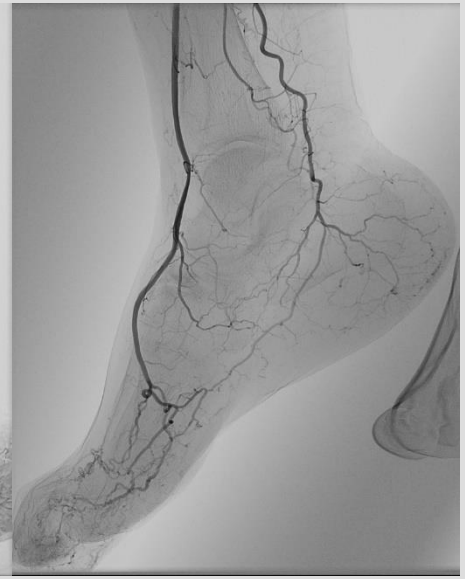
single PER

Foot distribution patterns	%
Balanced	79.1
Dominant DPA	0.4
Dominant LPA	13.2
Tarsal loop	7.2
Absence of the pedal-plantar loop	0.2



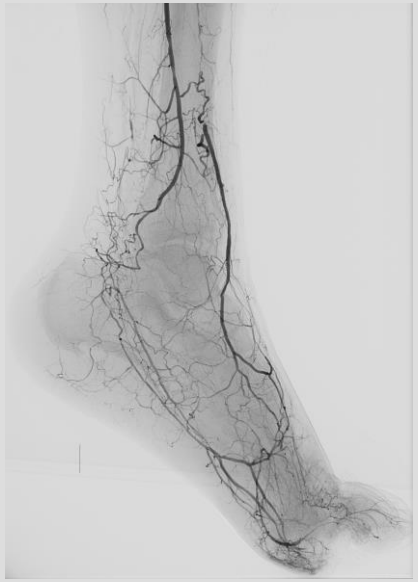
Absence of the pedal-plantar loop

balanced

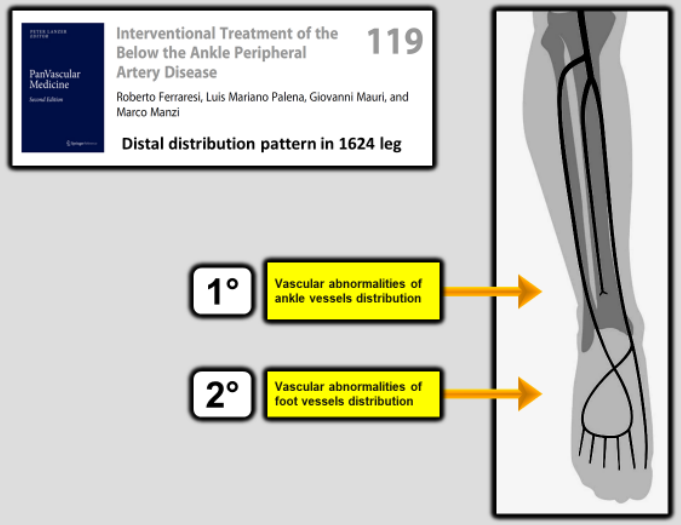


dominant DPA

dominant LPA



tarsal loop



Every patient is different:
Follow patient's anatomy and not book pictures

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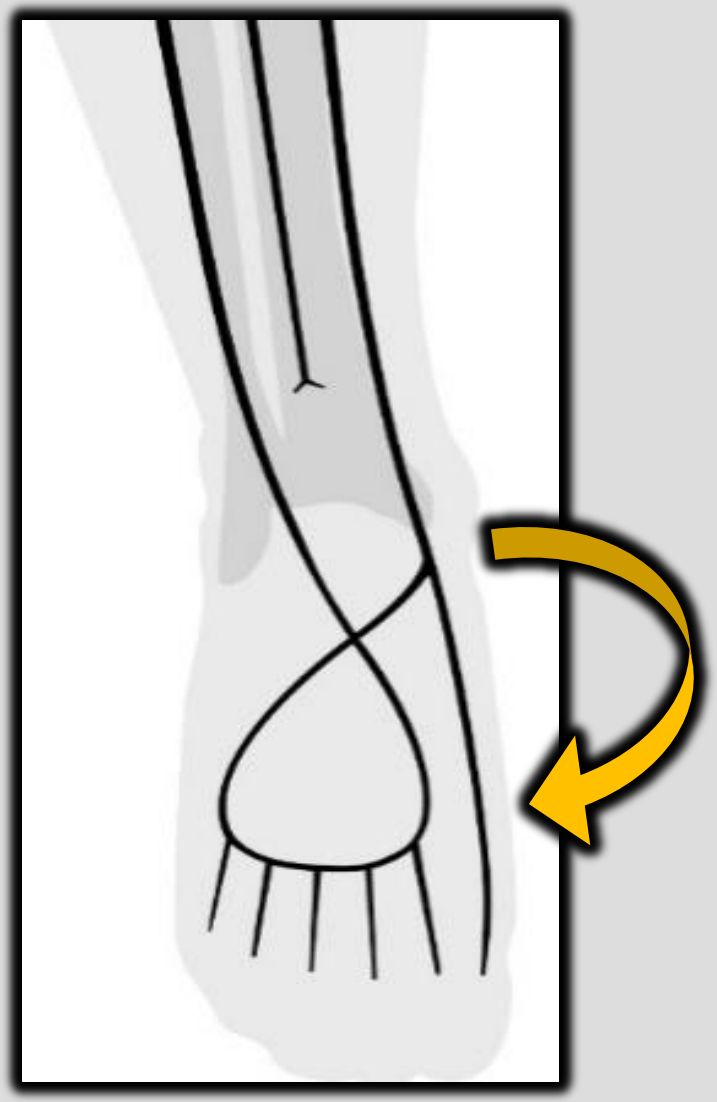
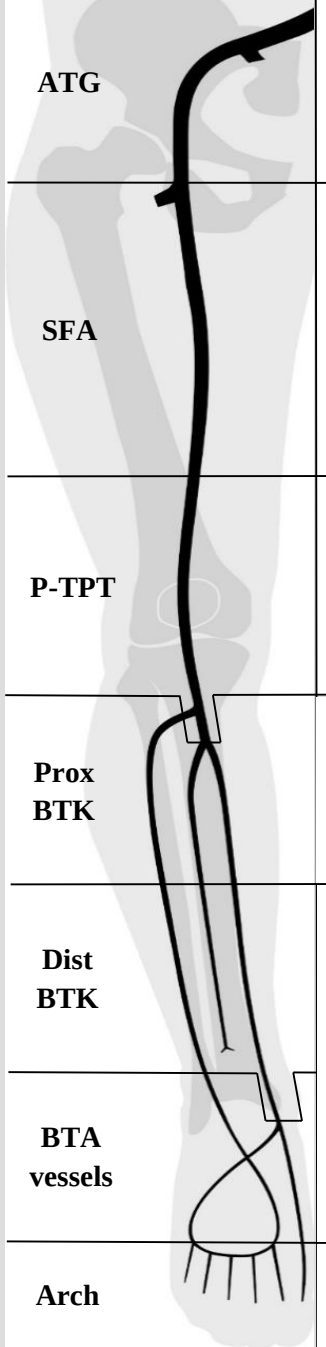


Key point in BTA-PTA!
Look at the outflow!

Foot arteries are the border between two different worlds, two different diseases in terms of biology and clinical evolution: BAD & SAD

BAD = Big Artery Disease
SAD = Small Artery Disease

Aggregated segments	Prevalence of disease (%)
ATG	9.8
SFA	45.5
P-TPT	46.3
Prox BTK	0 artery 14.3 1 artery 24.3 2 arteries 37.7 3 arteries 23.7
Dist BTK	0 artery 13.2 1 artery 25.5 2 arteries 44.9 3 arteries 16.4
BTA vessels	0 artery 27.9 1 artery 20.2 2 arteries 31.5 3 arteries 20.4
Arch	25,1



[BAD transmission and SAD distribution: a new scenario for critical limb ischemia.](#)

Ferraresi R, Mauri G, Losurdo F, Troisi N, Brancaccio D, Caravaggi CM, Neri L.

J Cardiovasc Surg (Torino). 2018 May 22. doi: 10.23736/S0021-9509.18.10572-6. [Epub ahead of print]

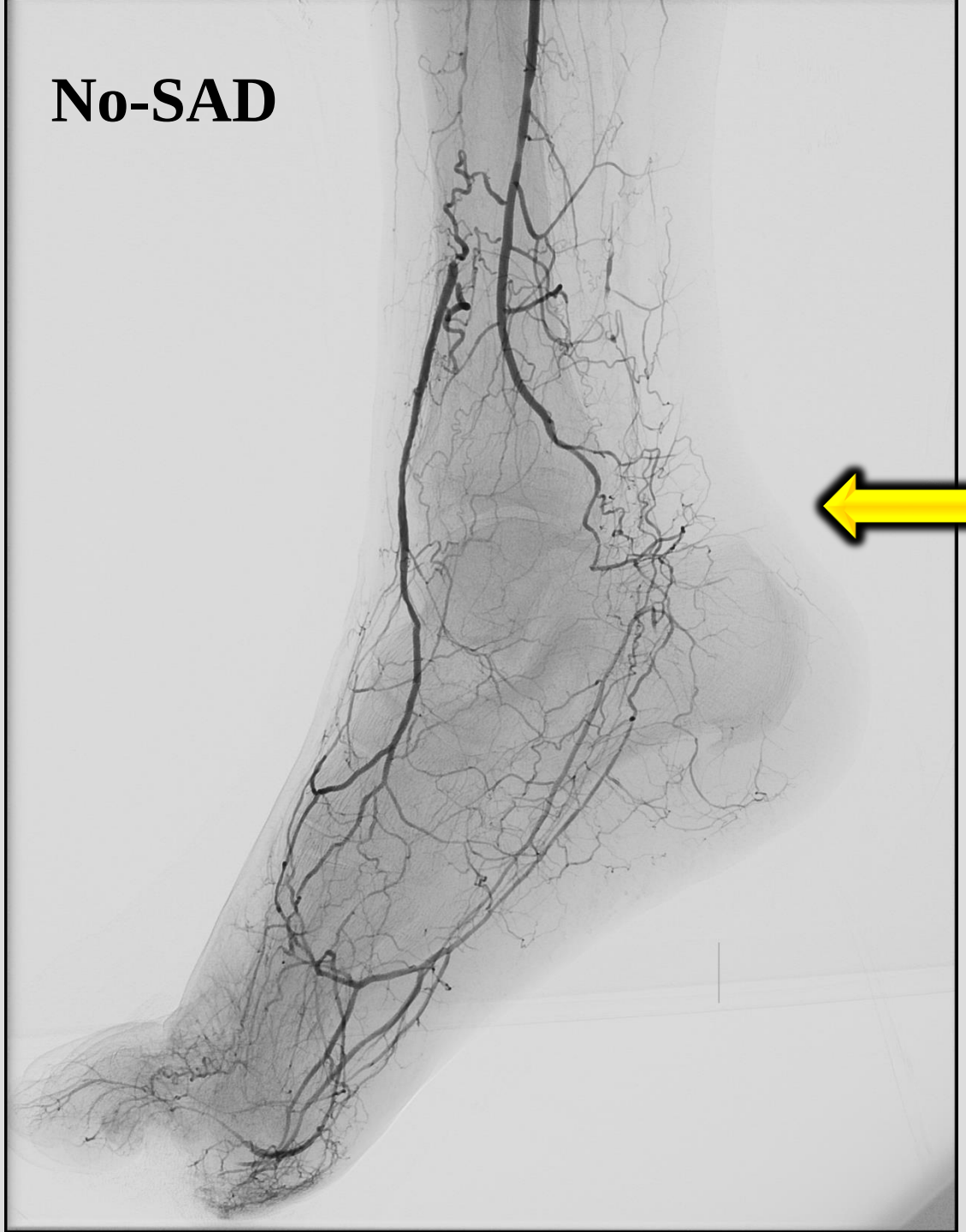
1915 pts with symptomatic PAD

183 claudicants

1732 CLI pts

> 50% 2-3 BTA vessel disease

25% arch disease = SAD



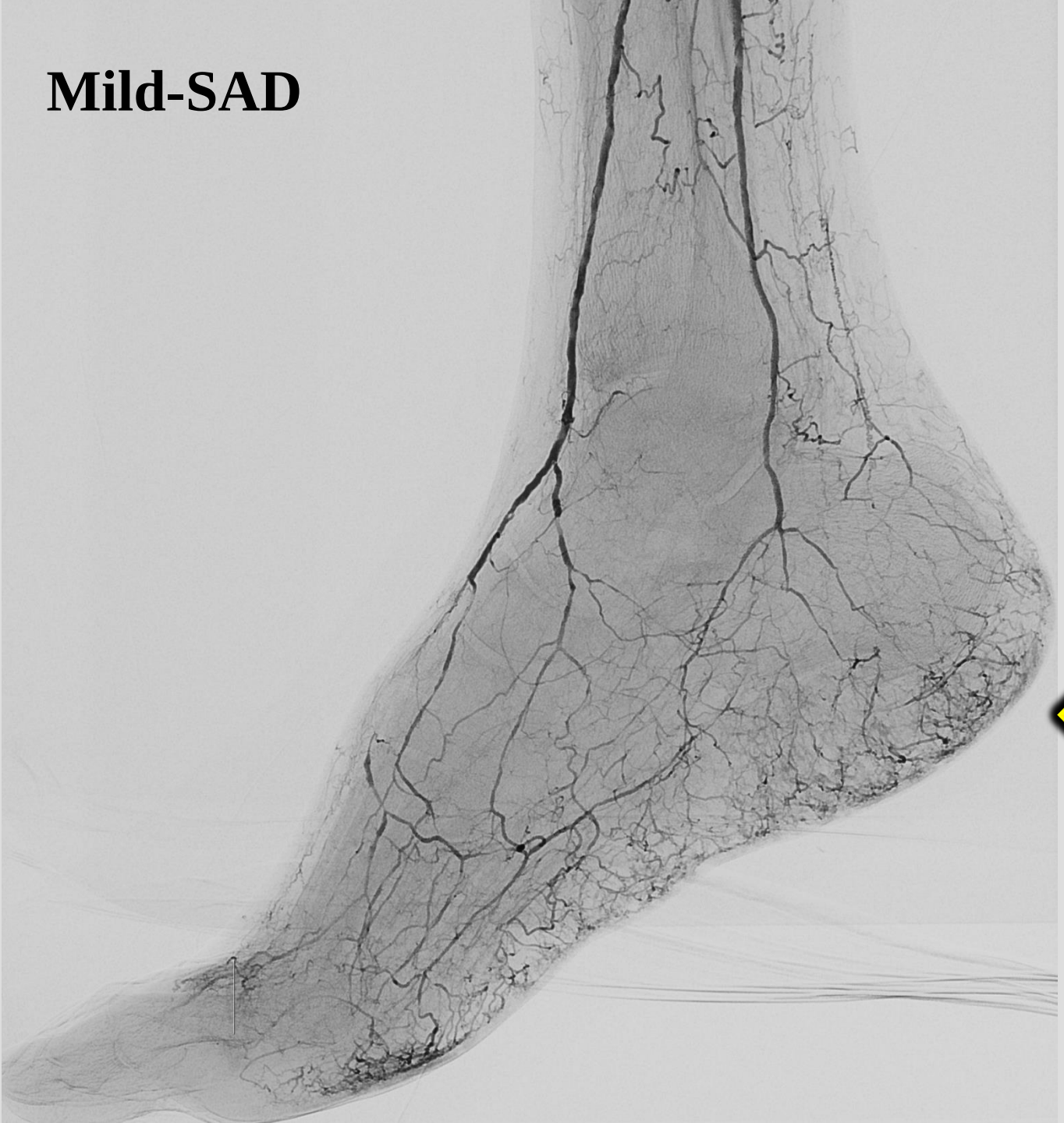
SAD was defined according to a global evaluation of the arch and the small foot arteries as:

1) **Patent (no-SAD):** absence of disease or mild disease with a well-represented network of forefoot and calcanear arteries

2) **Stenosis (or mild disease)**: diffuse disease with narrowing and poverty of metatarsal, digital and calcanear arteries

3) **Occlusion (or severe disease)**: extreme poverty of arch, metatarsal, digital and calcanear arteries

Mild-SAD



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Severe-SAD

SAD was defined according to a global evaluation of the arch and the small foot arteries as:

1) **Patent (no-SAD):** absence of disease or mild disease with a well-represented network of forefoot and calcanear arteries

2) **Stenosis (or mild disease)**: diffuse disease with narrowing and poverty of metatarsal, digital and calcanear arteries

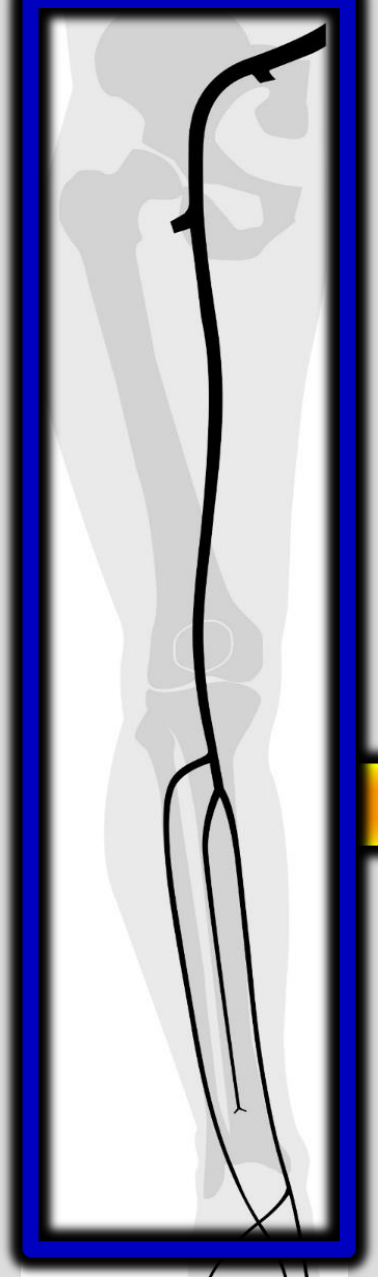
3) **Occlusion (or severe disease)**: extreme poverty of arch, metatarsal, digital and calcanear arteries

Aggregated segments	Risk factors for CLI Odds Ratio (95% CI)
ATG	0.53 (0.26 - 1.1)
SFA	0.51 (0.29 - 0.89)
P-TPT	1.17 (0.68 – 2.01)
Prox BTK	0 artery ref. 1 artery 1.7 (0.76 - 3.83) 2 arteries 1.86 (0.72 - 4.83) **3 arteries 4.84 (1.12 - 20.88)**
Dist BTK	0 artery ref. 1 artery 1.69 (0.74 - 3.87) **2 arteries 5.81 (1.91 - 17.62)** **3 arteries 5.71 (1.03 - 31.78)**
BTA vessels Arch	**Any of BTA and Arch** **13.25 (1.69 - 104.16)**

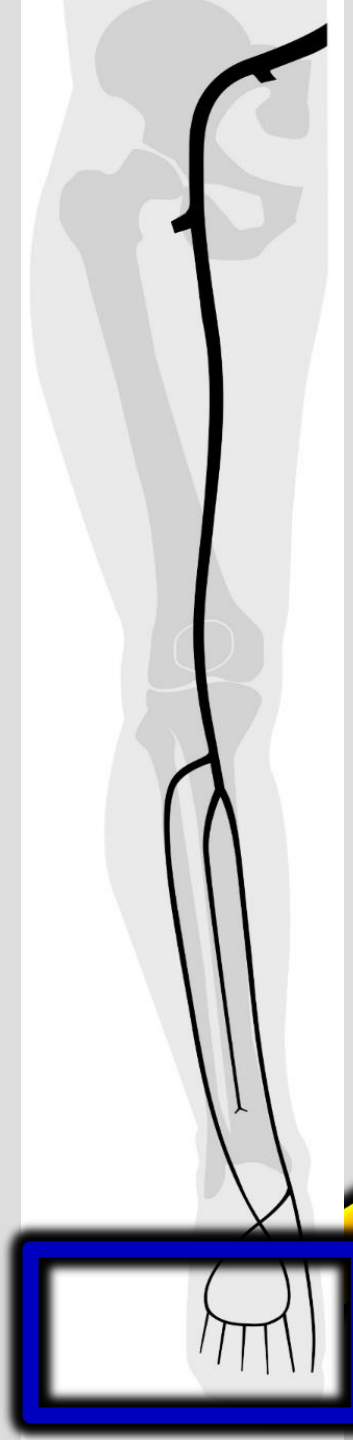
1915 pts with symptomatic PAD

183 claudicants

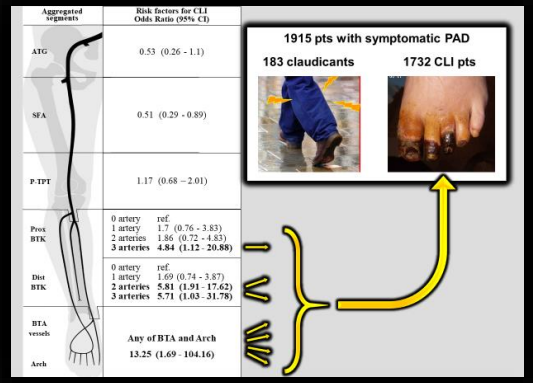
1732 CLI pts

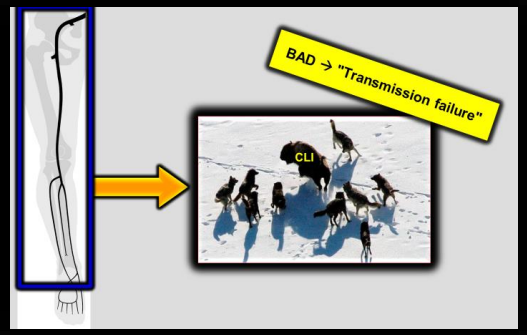


BAD → "Transmission failure"



SAD → "Distribution failure"





BAD transmission and SAD distribution: a new scenario for critical limb ischemia.

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Our data suggest that FAD, and particularly SAD, could play a crucial role in CLI and should be considered as a crucial target (or limit) for revascularization strategy.

It is remarkable to note that the most common test worldwide applied in detection of PAD, the ABI, is unable to reveal FAD, and that CT & MR-angiography are rarely extended and reliable in detecting FAD.

Based on this study, we should consider inappropriate to perform a proper clinical assessment and revascularization strategy in CLI patients without a complete angiographic evaluation of FAD & particularly SAD.

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3. Value of angiosomes
4. DPA-entrapment

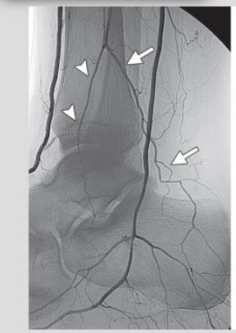
VASCULAR/INTERVENTIONAL RADIOLOGY

Vascular Imaging of the Foot: The First Step toward Endovascular Recanalization[1]

Marco Manzi, MD • Giacomo Cester, MD • Luis M. Palena, MD • Josef Alek, RT • Alessandro Candeo, RT • Roberto Ferraresi, MD

ATA: angiosome 1

PER: angiosome 5-6



PTA: angiosome 2-3-4

1.

Angiosome-targeted Lower Limb Revascularization for Ischemic Foot Wounds: Systematic Review and Meta-analysis

F. Biancari *, T. Juvonen

Department of Surgery, Oulu University Hospital, Oulu, Finland

EJVES 2014;47:517-22

2.

REVIEW European Journal of Vascular and Endovascular Surgery Volume 48 Issue 1 p. 88–97 July/2014

Systematic Review and Meta-analysis of Direct Versus Indirect Angiosomal Revascularisation of Infrapopliteal Arteries

D.C. Bosanquet [a,*], J.C.D. Glasbey [b], I.M. Williams [a], C.P. Twine [c]

3.

Direct Revascularization With the Angiosome Concept for Lower Limb Ischemia

A Systematic Review and Meta-Analysis

Tzu-Yen Huang, MD, Ting-Shuo Huang, MD, PhD, Yao-Chang Wang, MD, Pin-Fu Huang, MD, Hsiu-Chin Yu, MS, and Chi-Hsiao Yeh, MD, PhD

(*Medicine* 94(34):e1427)

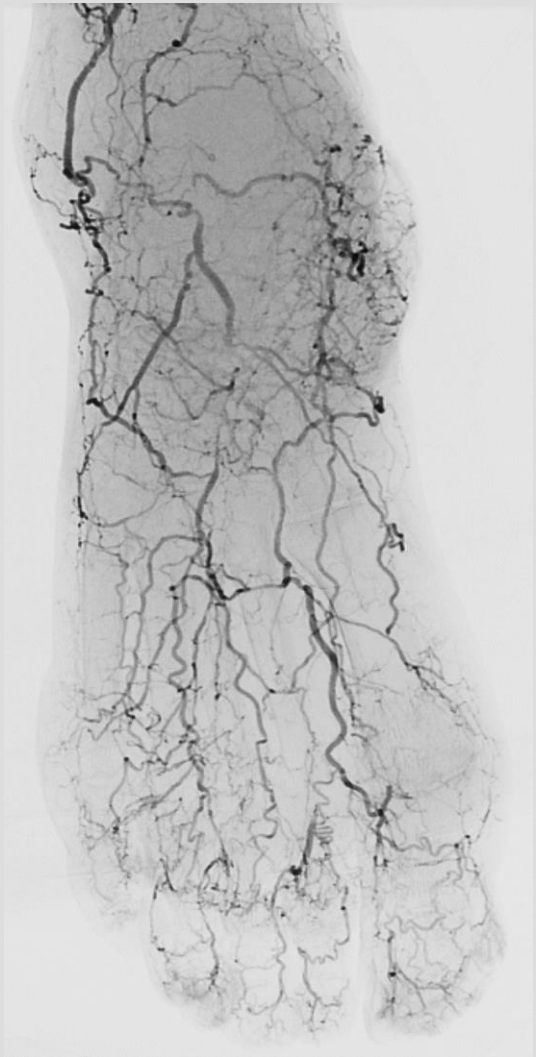
3 meta-analysis on the angiosome concept demonstrating that direct revascularization according to the angiosome concept seems to be better than indirect rev. in terms of wound healing and limb salvage

The value of an angiosome-oriented revascularization is inversely related to the function of collateral vessels

BAD without SAD

Collateral vessels are generally spared

→ ***good foot distribution system***



The value of an angiosome-oriented revascularization is inversely related to the function of collateral vessels

SAD with/without BAD

Collateral vessels are generally involved

→ ***failure of the foot distribution system***

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SAD with/without BAD

Collateral vessels are generally involved

→ ***failure of the foot distribution system***

The value of an angiosome-oriented revascularization is inversely related to the function of collateral vessels

SAD with/without BAD

Collateral vessels are generally involved

→ ***failure of the foot distribution system***

In SAD patients angiosome-oriented revascularization, when possible!, is the only way to get healing

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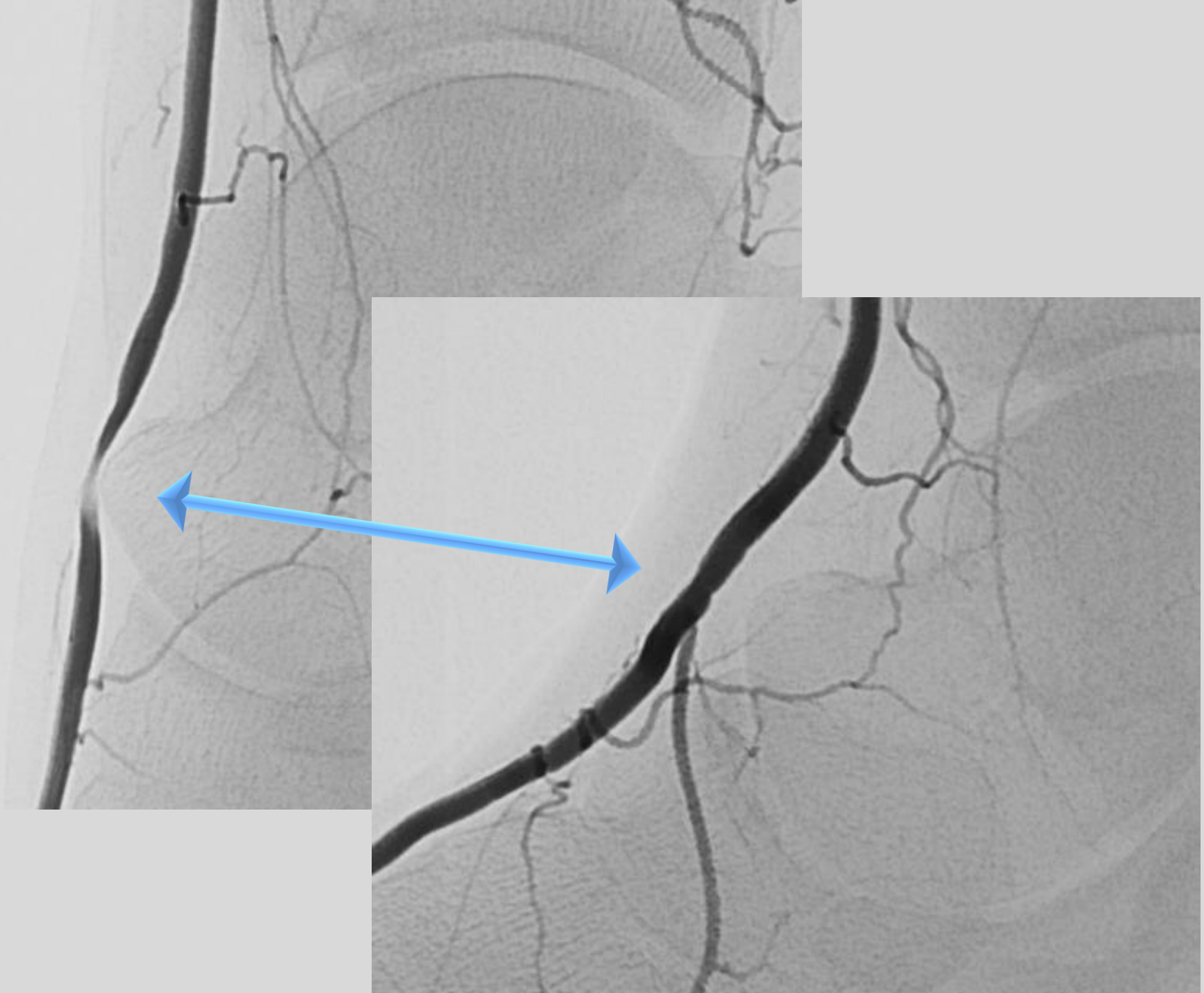
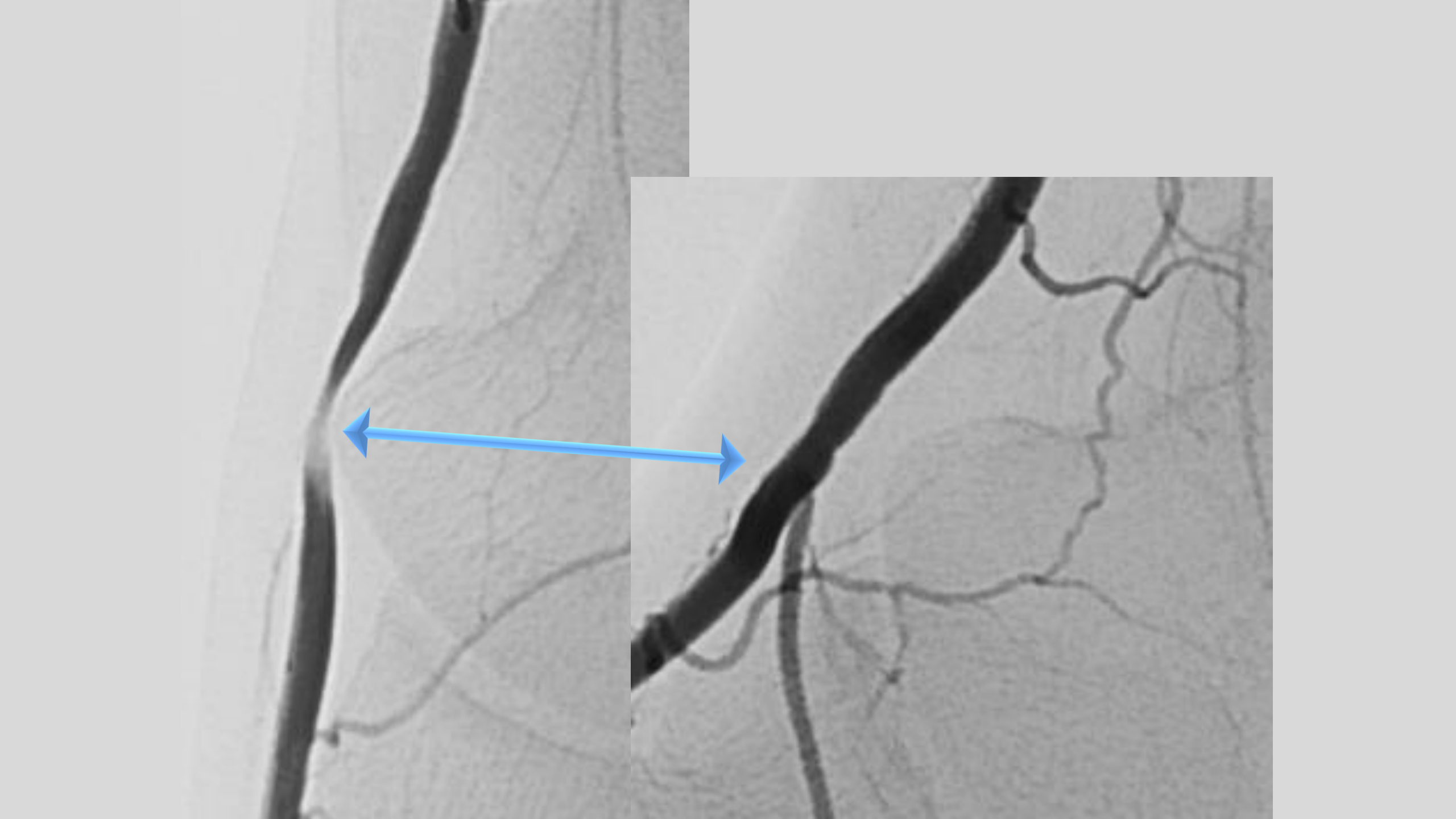
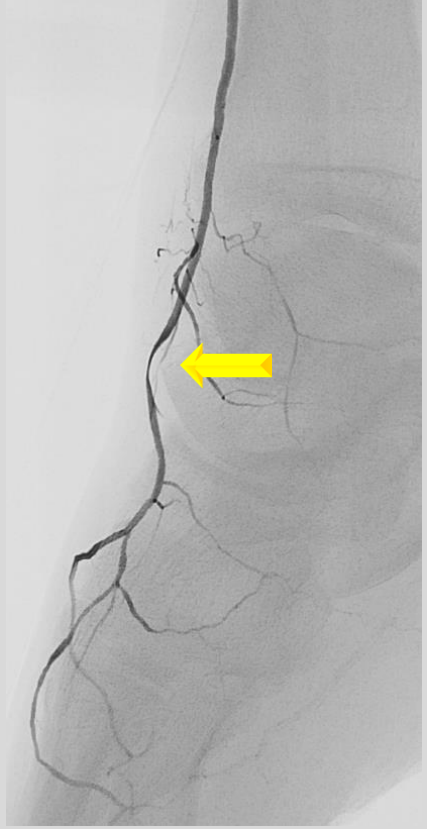
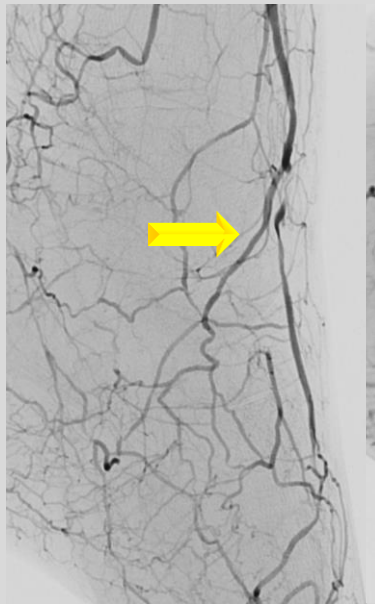
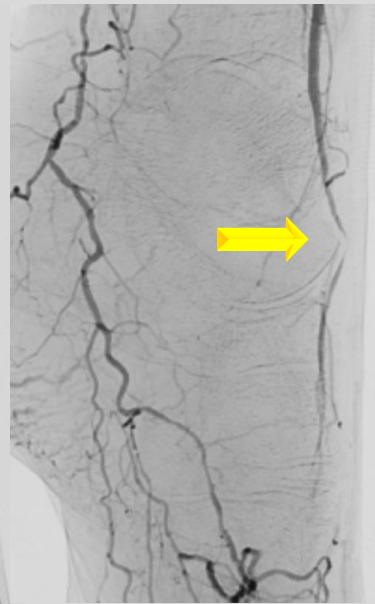
DPA-E patient 5





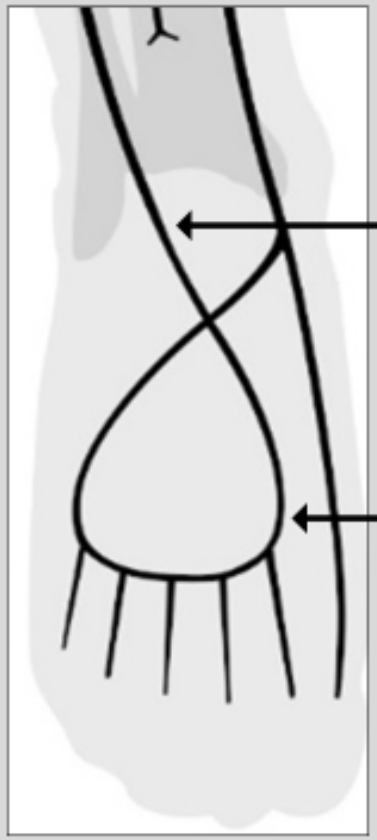




1. **DPA-E is an anatomical condition that can affect the true DPA or the tarsal artery**
2. **DPA-E must be considered when there is a focal stenosis at the passage ATA-DPA**
3. **In the majority of the cases the dynamic obstruction is in corrispondence of the distal astragalus**

How many people have DPA-E?



Duplex scan flow dynamic evaluation in 126 legs

Distal ATA

Distal DPA

1-6/126 pts presented a functional DPA obstruction in forced plantar flexion

We started an analysis on DPA-E prevalence in the healthy population, however we are far from standardizing the measurement method

< 5%

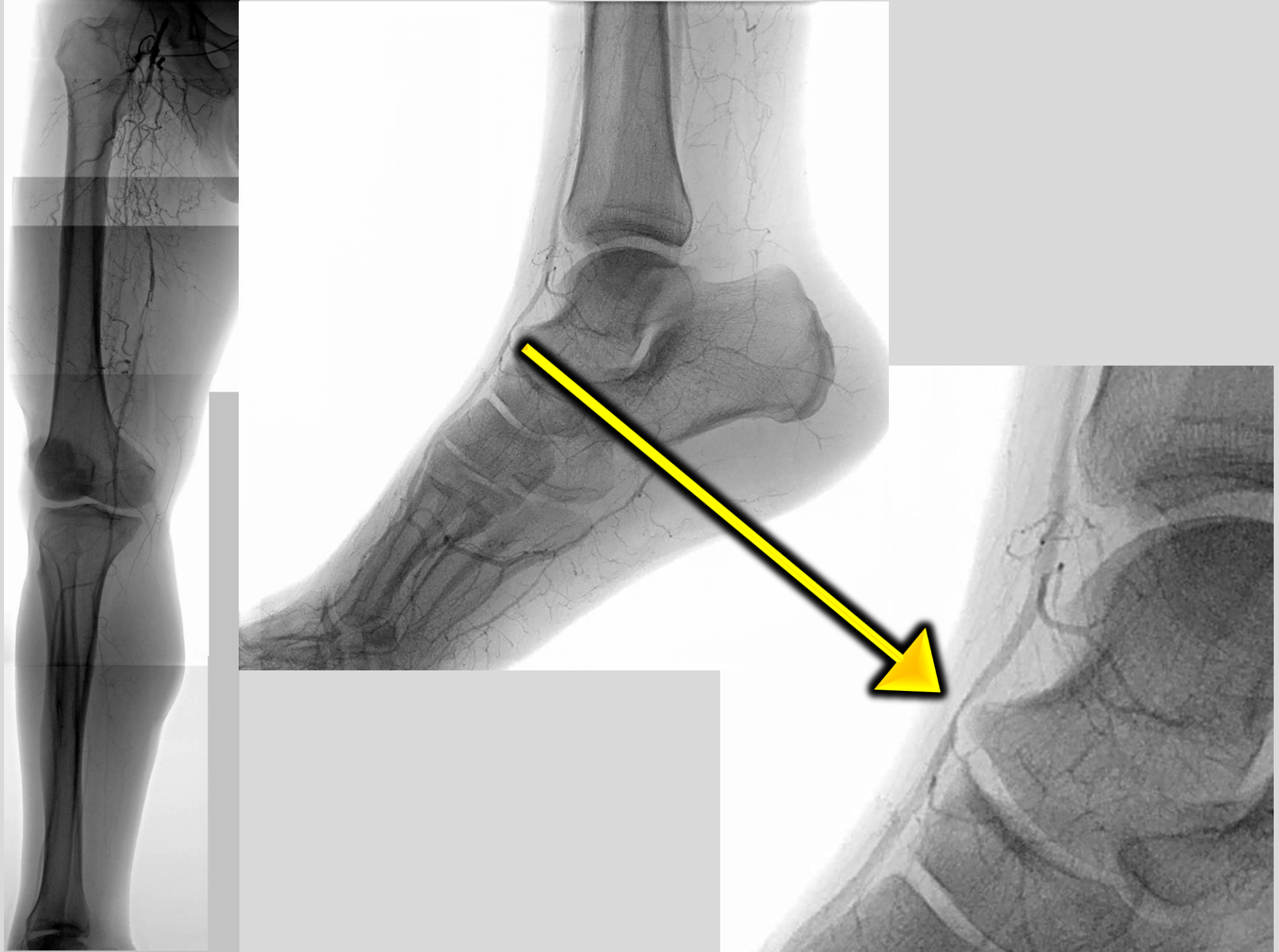
Can DPA-E become symptomatic?

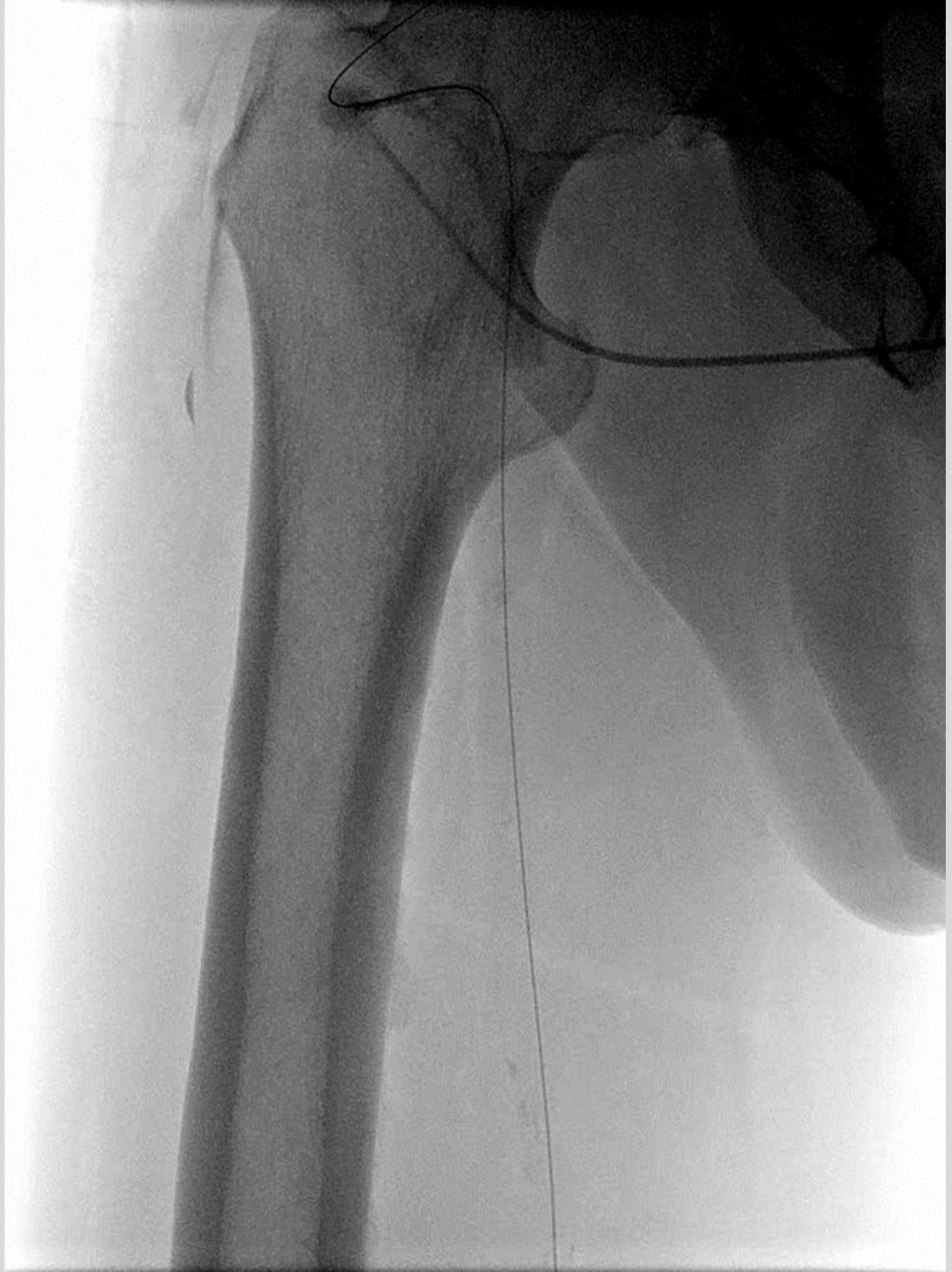
Many patients, especially bedridden & neuropathic pts, assume a plantar flexed foot position as the resting position while lying on the bed

In these pts we cannot exclude that DPA-E could play a role in developing or maintaining CLI

In the last 6 yy I made ≈ 4000 angio on CLI pts and I found 15 DPA-E cases → 0.4%

DPA-E patient 6






What can we do?

In DPA-E patients, heel protectors can save heel and patency