Utilizing complementary imaging modalities to guide strategy and optimize outcomes

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Disclosures

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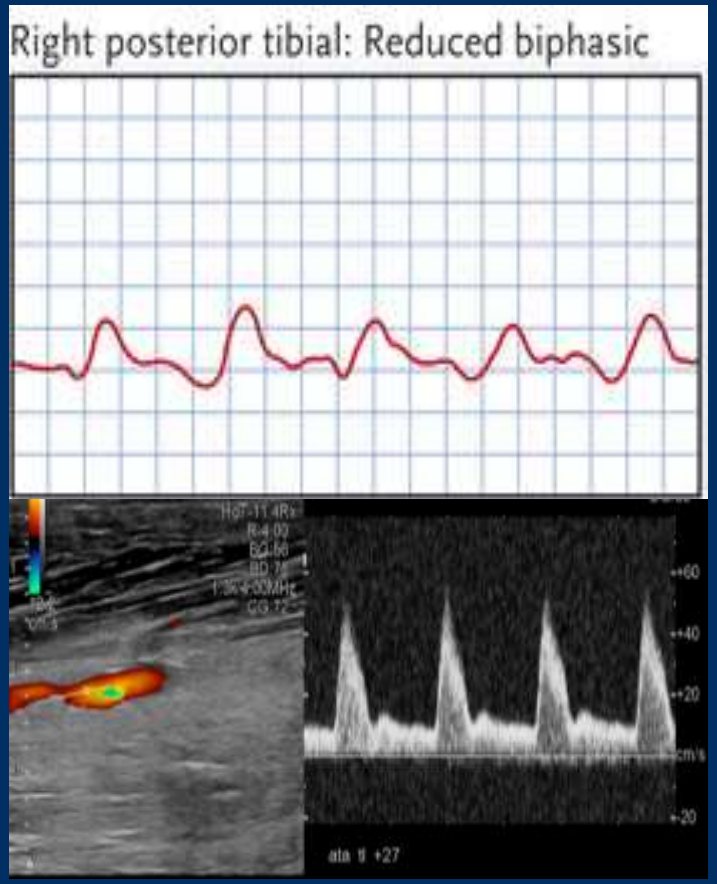
Consultant to LimFlow SA, Philips

Speaker for LimFlow SA, Philips, Asahi

Pre procedure imaging

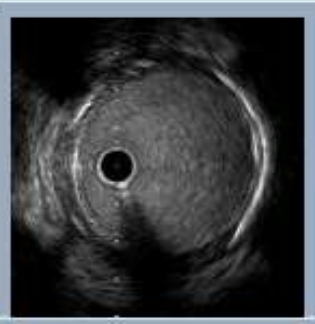
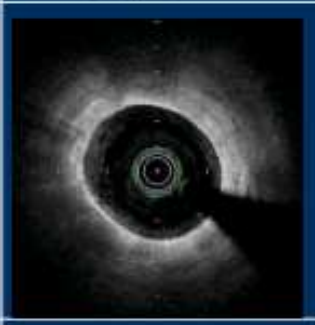
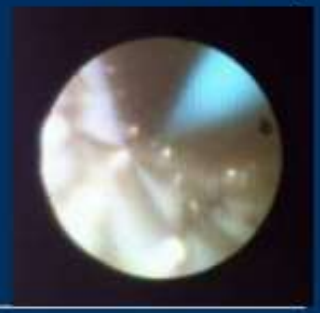
CE-MRA/CTA



Dx/ PSV and Continuous waveform

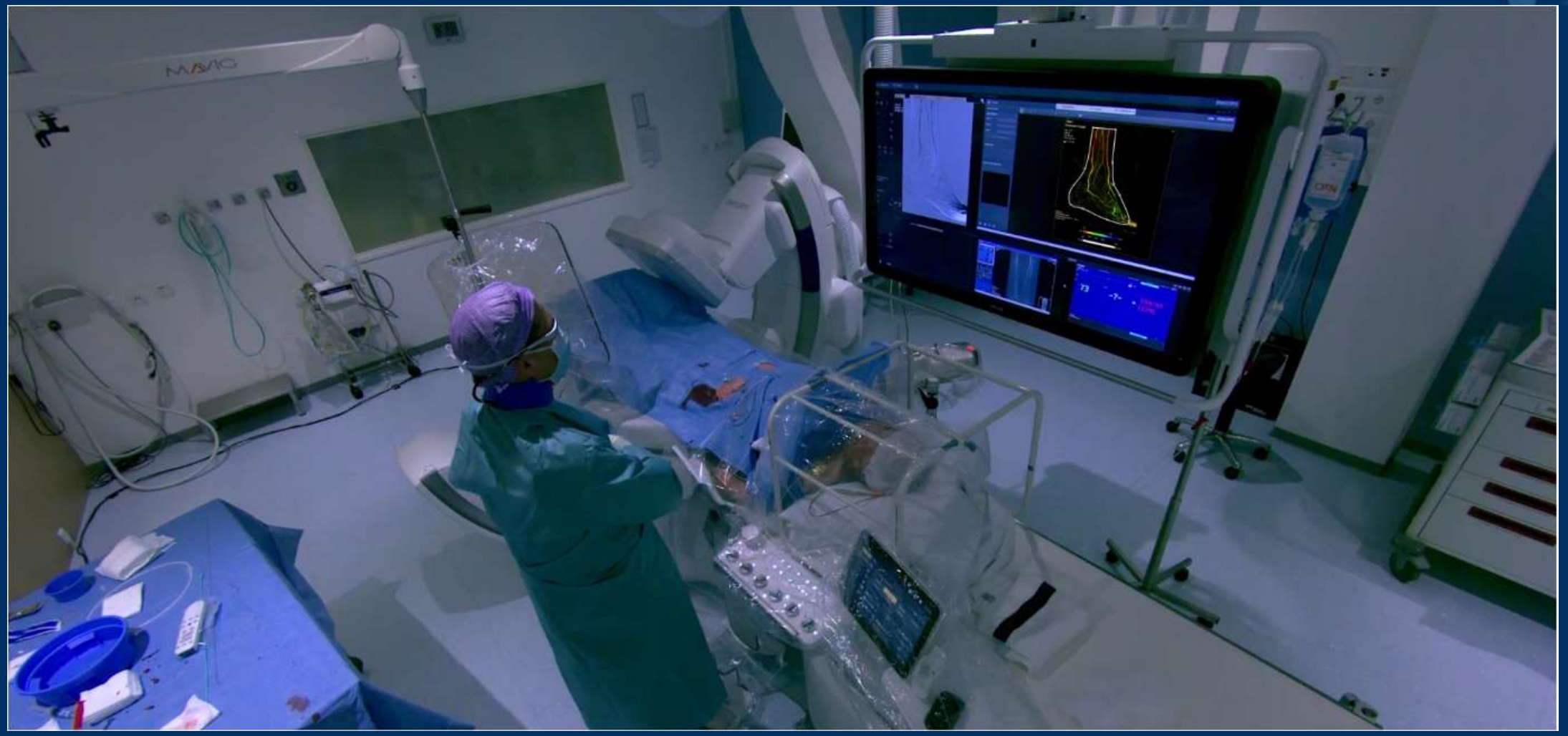
Complementary Imaging Modalities?

Imaging modality for peripheral intervention field

Modality	Angiography	CTA	IVUS	OCT/OFDI	Angioscopy
IMAGE		 			
resolution(μm)	200	300	80-150	10-20	200
Radiation Exposure	+	++	-	-	-
Contrast Media	+	++	-	+/-	+/-
Technique	-	-	Easy	So So	Complex
Calcification	Yes	Yes	Just superficial	Yes	Yes
Vessel size	Underestimation	Difficult	Overestimation	Accurate	Difficult
Long Axis	Yes	Yes	Yes (AltaView)	Yes	No
Reimbursement	Yes	Yes	Yes	No	Yes

Masahiko Fujihara MD, Kishiwada Tokushukai Hospital, Osaka, Japan

Intervention lab with Azurion 7C20 FlexArm



St. Antonius hospital Nieuwegein

Why Complementary Imaging Modalities?

- Digital Subtraction Angiography/ Fluoroscopy
- Extra Vascular Ultra-Sound (EVUS)
- Intra Vascular Ultra-Sound (IVUS)
- Optical Coherence Tomography (OCT)

Treatment Algorithm PAD

Wire Crossing

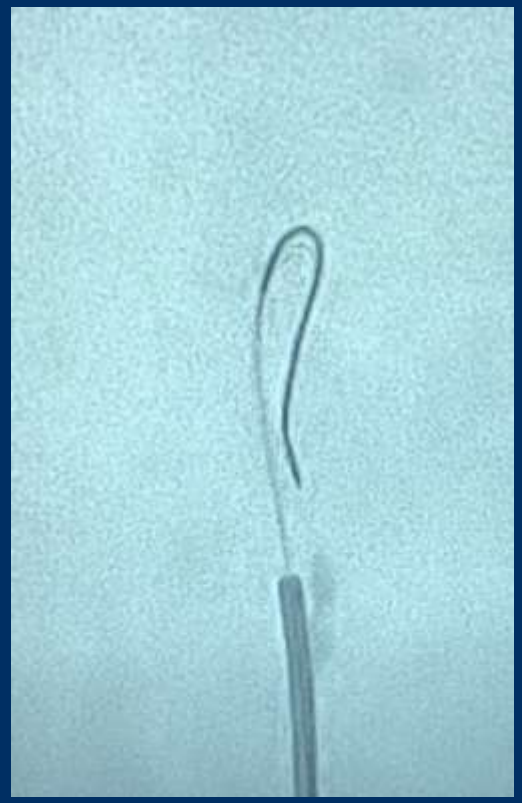
Determine best treatment

Optimal Result

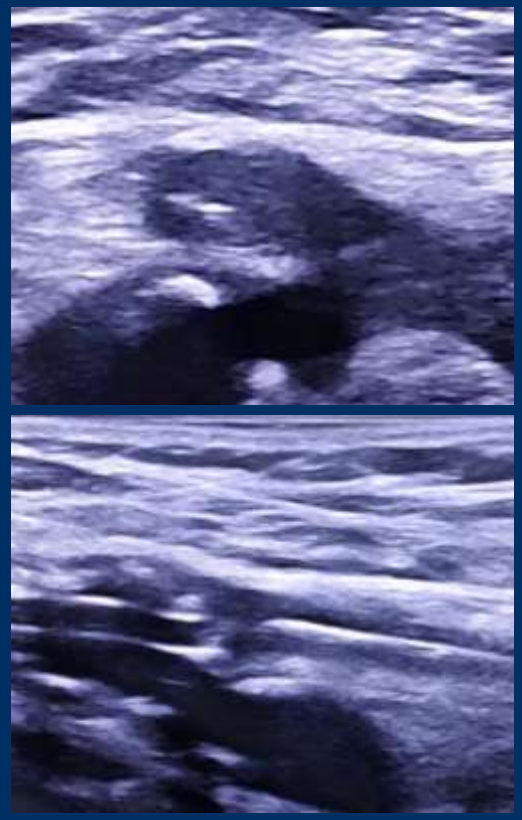
Assess treatment outcome

Wire Crossing

Vessel wall calcification

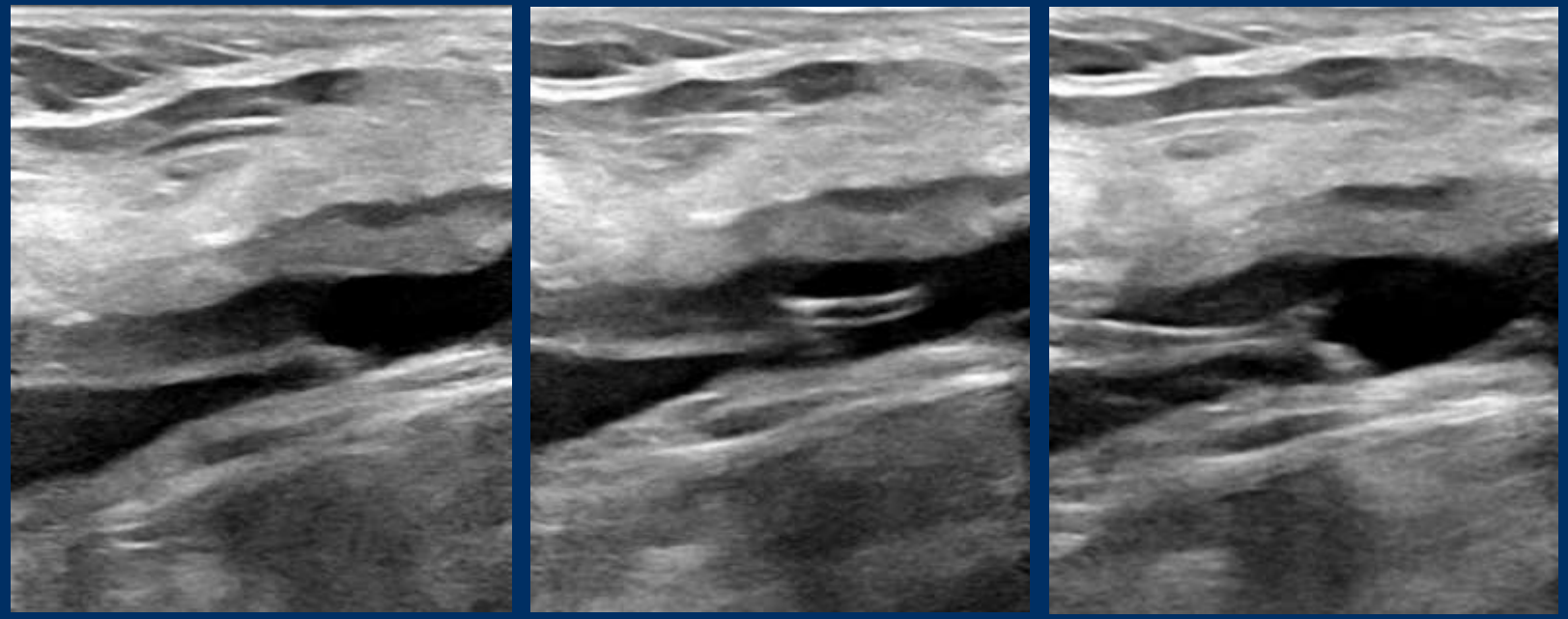


Wire movement



Wire Location

Wire Crossing



EVUS Assisted recanalization of SFA origin

Determine Best Treatment

Imaging requirements

Characterize Vessel Wall Calcification

Determine Lumen diameter

Diagnose large subintimal space
Flow Limiting Dissections

Balloon size, prevent DCB undersizing, achieve maximal luminal gain,

Atherectomy

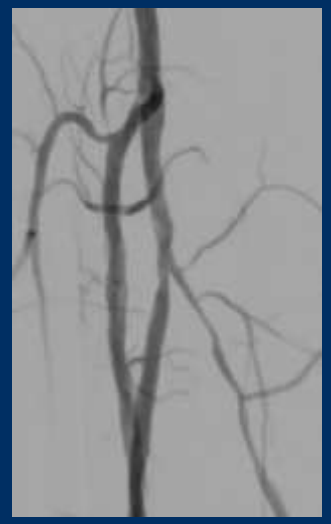
Stent type: SNS/ DES/ VMI/ Tack

Assess Treatment Outcome

Geometric and Functional parameters

Recoil
Luminal Gain
Flow limiting Dissections

Determine Dx waveform and PSV



Easy assessment of Luminal Gain

IVUS?

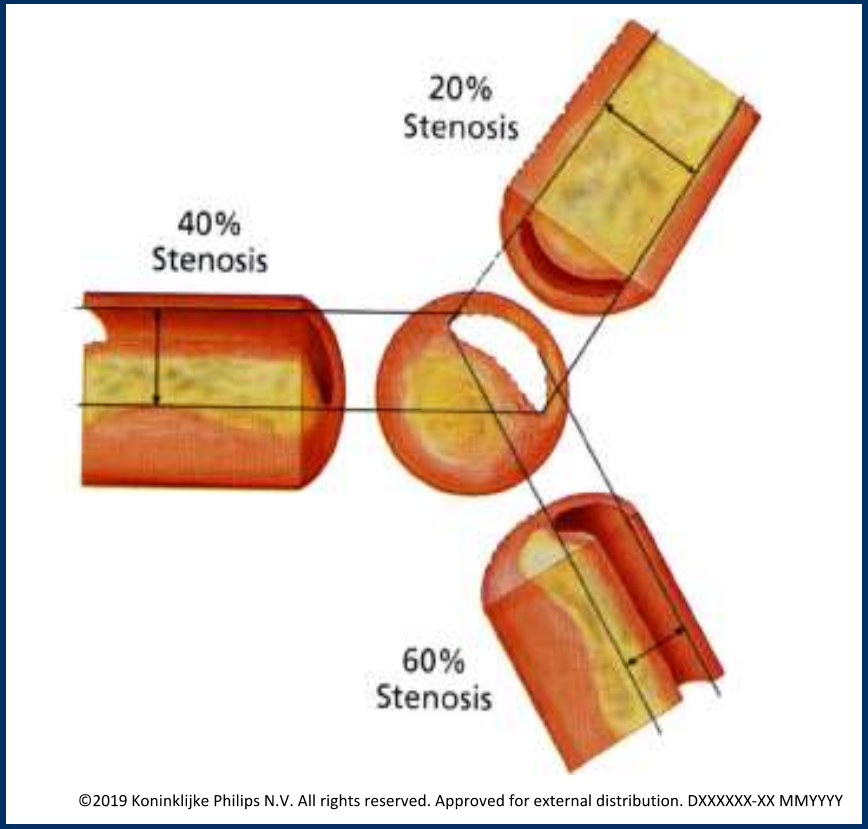
Balloon Sizing

Balloon sizing	DSA/QVA	EVUS	IVUS
SFA/POP	+	++	+++
Prox. Tibial	++	+	+++
Dist. Tibial	+	++	++

Eiberg JP, Gronvall Rasmussen JB, Hansen MA, Schroeder TV. Duplex ultrasound scanning of peripheral arterial disease of the lower limb. Eur J Vasc Endovasc Surg. 2010;40:507-512.

Balloon Sizing

- Angiography is actually lumenography
- With angiography lumen diameter is underestimated
- An artery consists of a lumen AND a vessel wall

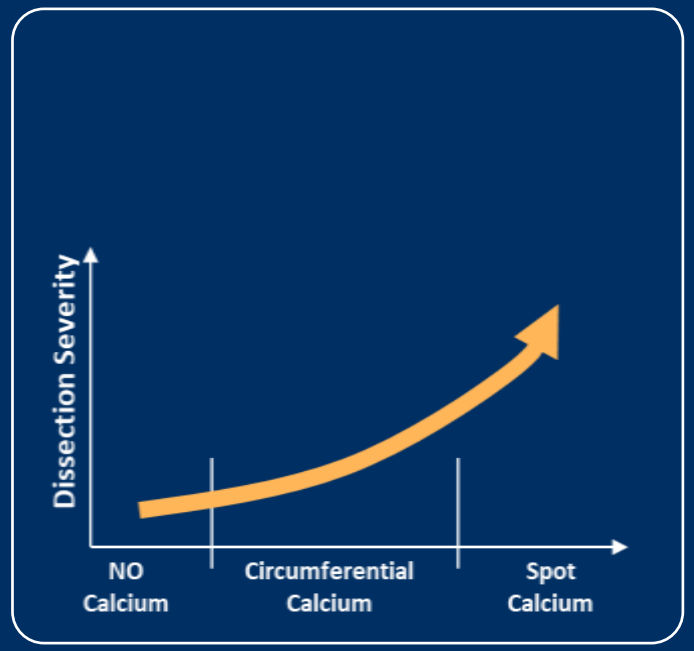


Vessel Wall Calcifications

Calcifications	DSA/QVA	EVUS	IVUS
SFA/POP	++	+	+++
Prox. Tibial	++	+	+++
Dist. Tibial	++	+	+++

Mintz GS, Popma JJ, Pichard AD, et al.. *Circulation*. 1995;91(7):1959–1965. doi:10.1161/01.cir.91.7.1959

Vessel wall calcifications histopathology



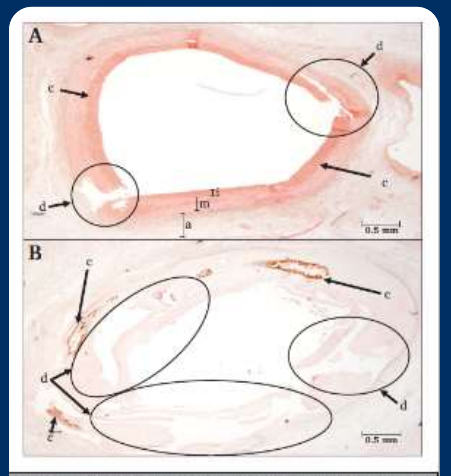


Figure 1. Examples of histological results after 100% balloon oversizing in two human cadaver tibial arteries (A, B) in the von Kossa staining (calcium deposits brown; c). The iDissection classification is based on the circumferential extend (1 = <180°, 2 = ≥180°), and depth of vessel damage in intima (i), media (m) or adventitia (a). Circumferentially distributed calcium (A) in the vessel wall results in less severe dissection patterns (d) (iDissection classification C1) compared to spot calcium deposits (B, iDissection class C2).

Calcium absence → Circumferential → Spot distribution

Welling RHA, de Borst GJ, van den Heuvel DAF, et al. Vessel Calcification Patterns Should Determine Optimal Balloon Size Strategy in Below the Knee Angioplasty Procedures [published online ahead of print, 2020 Jul 2]. Eur J Vasc Endovasc Surg. 2020;S1078-5884(20)30454-8. doi:10.1016/j.ejvs.2020.05.032

Significance of Vessel wall calcifications

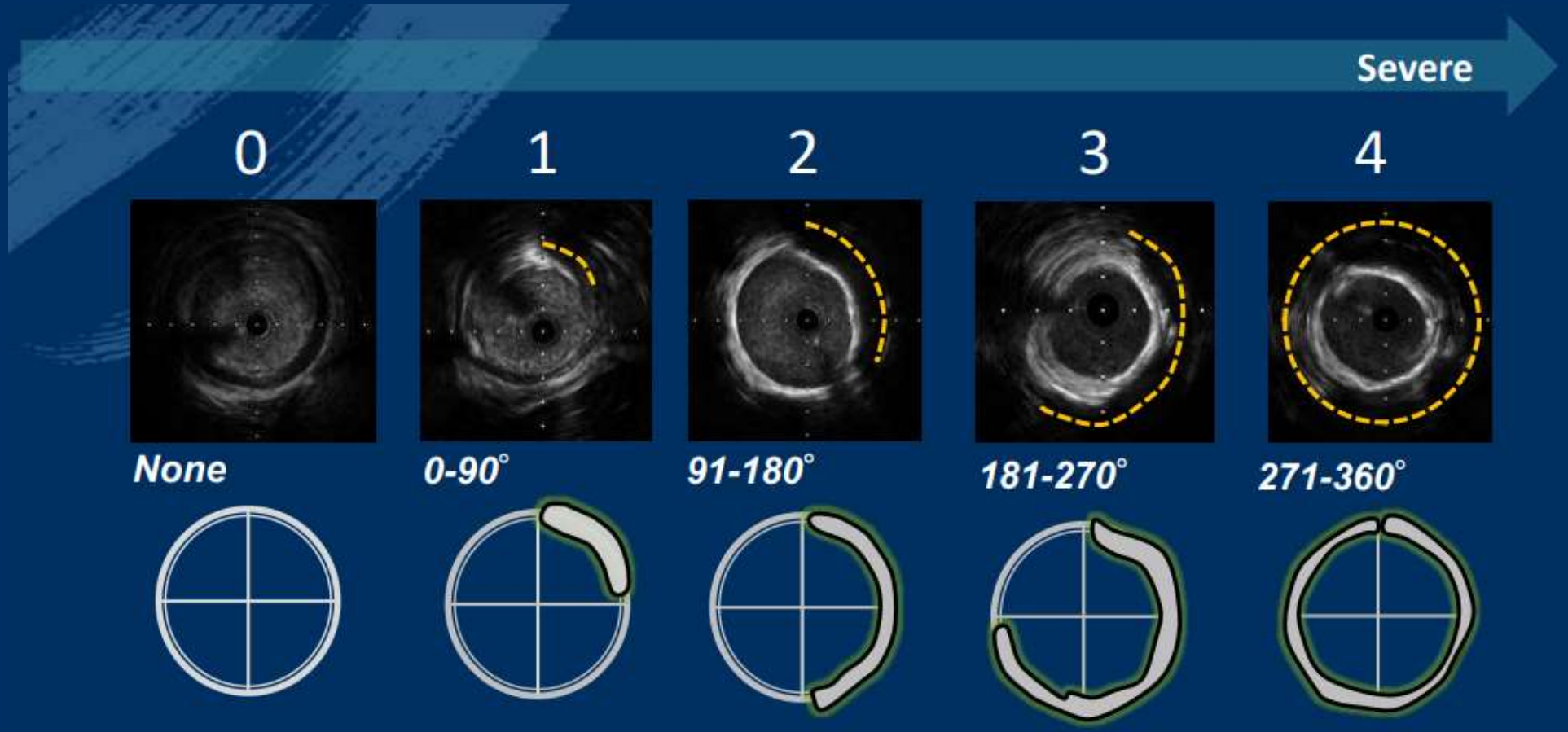
Vessel Calcification Patterns should Determine Balloon Size Strategy in BTK Angioplasty

IVUS GUIDED TREATMENT STRATEGY

1. avoids balloon under-sizing
2. drives ad-hoc balloon over-sizing
   - beneficial in circumferential calcium (limited vessel damage and ↑ likelihod to maximize lumen gain)
   - to be avoided in spot-calcium (↑ incidence of severe dissections)

Welling RHA, de Borst GJ, van den Heuvel DAF, et al. Vessel Calcification Patterns Should Determine Optimal Balloon Size Strategy in Below the Knee Angioplasty Procedures [published online ahead of print, 2020 Jul 2]. Eur J Vasc Endovasc Surg. 2020;S1078-5884(20)30454-8. doi:10.1016/j.ejvs.2020.05.032

Vessel wall calcifications by IVUS



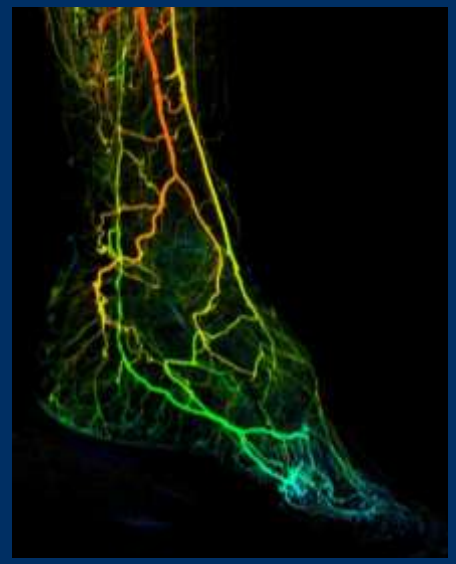
Fanelli F, Cannavale A, Gazzetti M, Lucatelli P, Wlderk A, Cirelli C, d'Adamo A, Salvatori FM. Calcium burden assessment and impact on drug-eluting balloons in peripheral arterial disease. Cardiovasc Intervent Radiol. 2014 Aug;37(4):898-907

Complementary EVUS

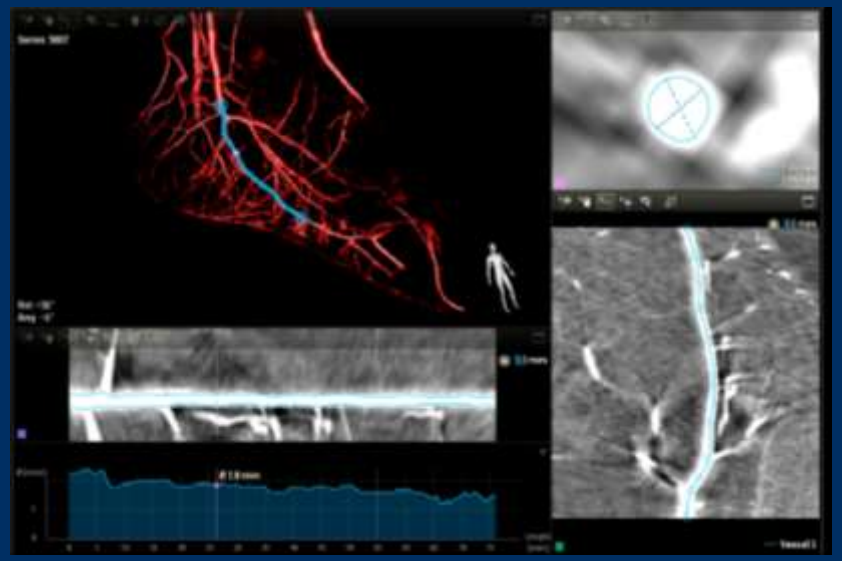
In addition to functional imaging:

- EVUS Assisted Vessel Access
- EVUS Assisted vessel closure
- US guided nerve blocks

Innovative Imaging Modalities



Perfusion Angiography



Vessel analysis

Fiber Optic RealShape (FORS) technology

Augmented Reality

Summary

- DSA/ Fluoroscopy and EVUS are complementary imaging modalities
- IVUS is the next level imaging tool for vessel assessment
- EVUS remains indispensable for optimizing treatment outcome

Utilizing complementary imaging modalities to guide strategy and optimize outcomes

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