The role of IVUS in contemporary endovascular treatment

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Disclosure

Speaker name: ***Osamu Iida, MD***

I have the following potential conflicts of interest to report:

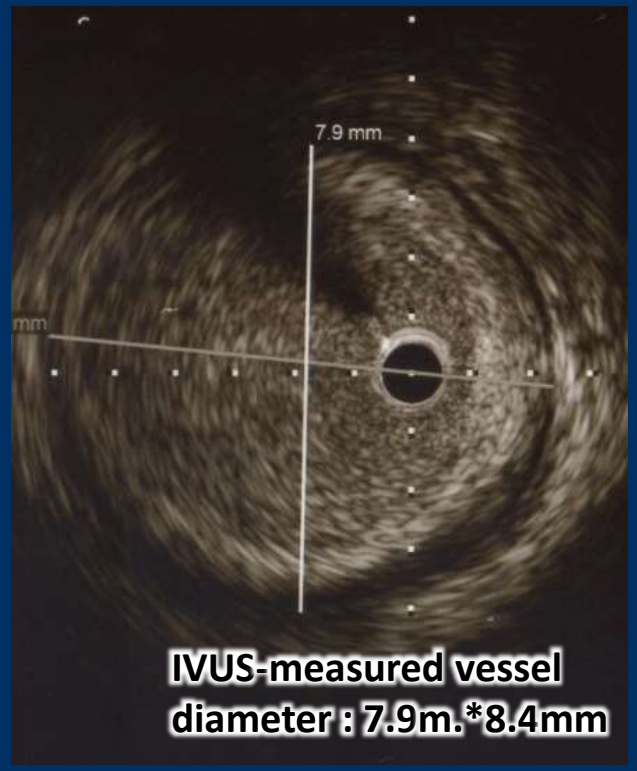
- ☐ Consulting
- ☐ Employment in industry
- ☐ Stockholder of a healthcare company
- ☐ Owner of a healthcare company
- ☐ Other(s)

- ■ I do not have any potential conflict of interest

What information can IVUS provide in peripheral intervention?

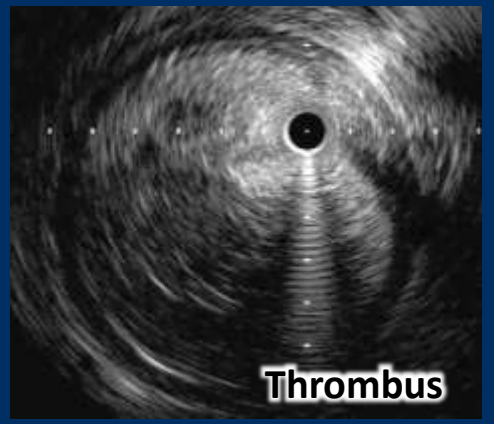
Accurate vessel diameter measurements

Angiography-measured vessel diameter : 6.4mm

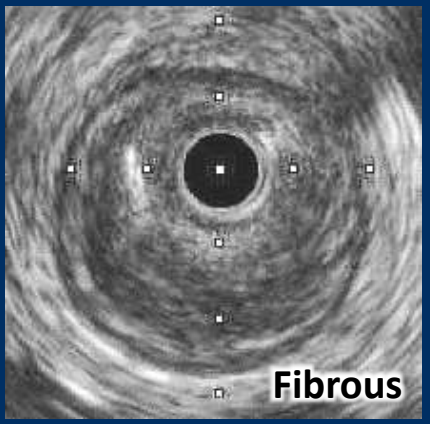


IVUS-measured vessel diameter : 7.9m.*8.4mm

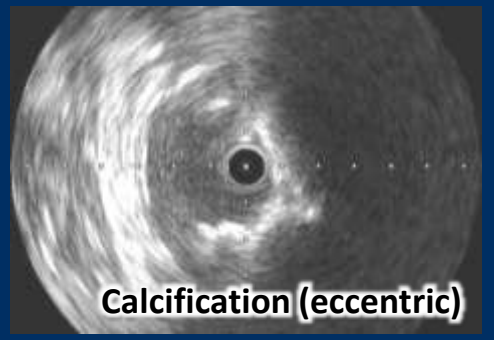
Detailed evaluation for plaque characteristics



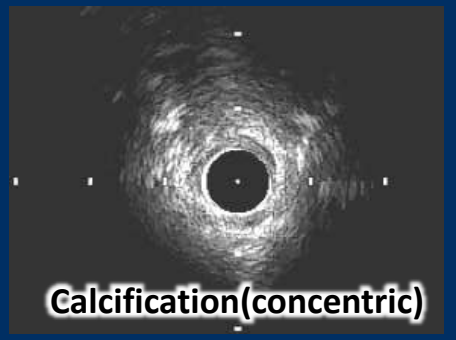
Thrombus



Fibrous



Calcification (eccentric)

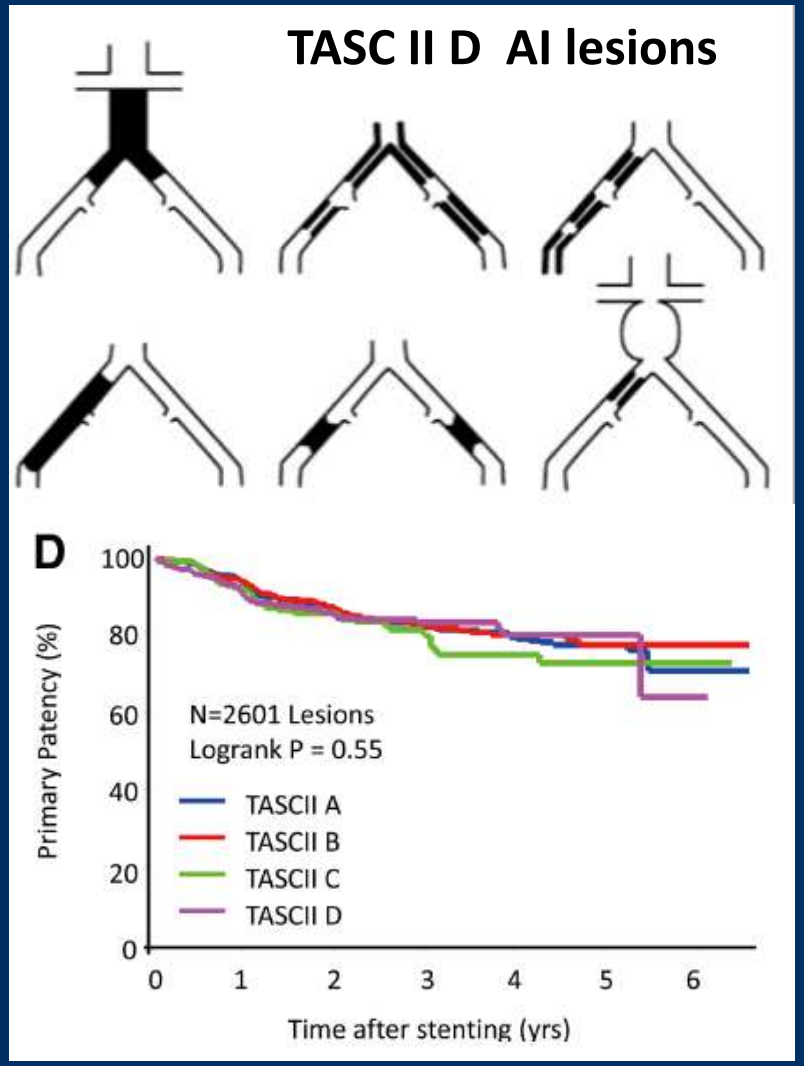


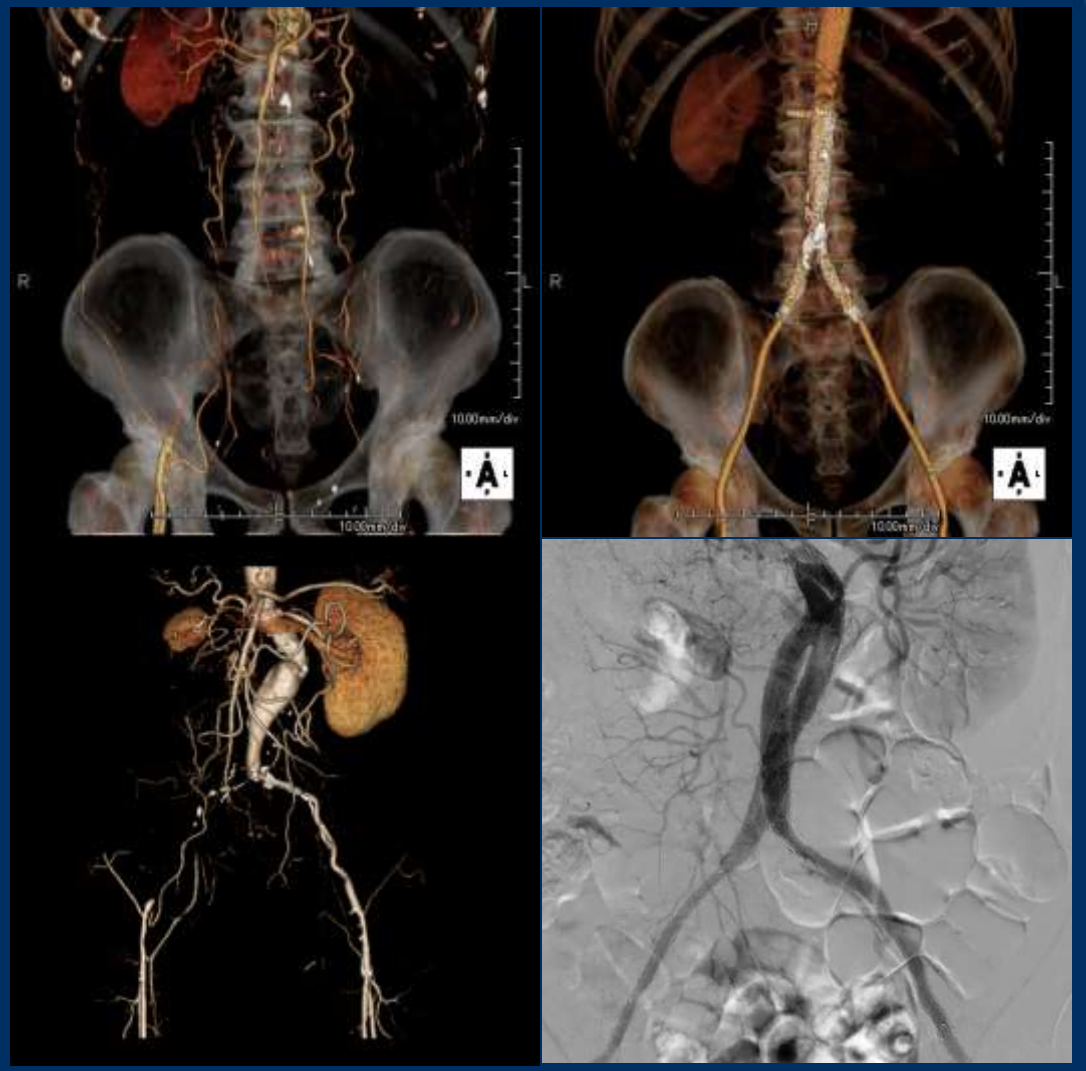
Calcification(concentric)

In principle, the angiography-measured vessel diameter is "**lumen-based**", whereas IVUS evaluation of the vessel diameter is "**external elastic membrane (EEM)-based**"

Plaque characteristics strongly influence decision making regarding 1) **treatment strategy**, 2) **technical approach**, 3) **device selection** and 4) **prediction of long-term success**

Aortoiliac occlusive disease (AIOD): Little room for improvement





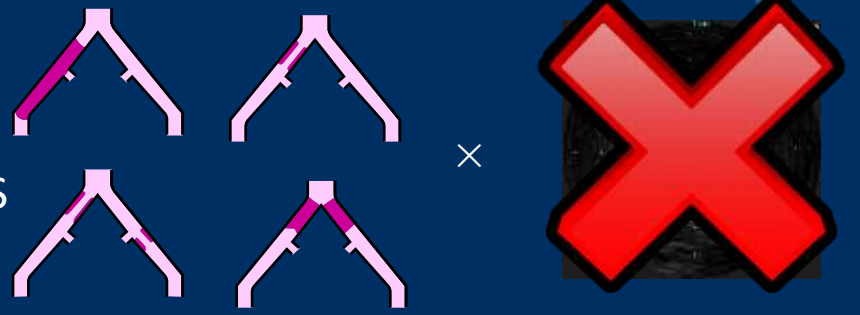
Soga Y, Iida O, et al. Circ J. 2012;76:2697-704.

IVUS Imaging During Aortoiliac Stenting: No Impact on Outcomes at 1 Year

Study design: Pre-specified analysis for prospective registry

Study subjects: 545 patients underwent IVUS-supported stent implantation versus 258 patients treated without IVUS

Outcomes: Technical and long-term success

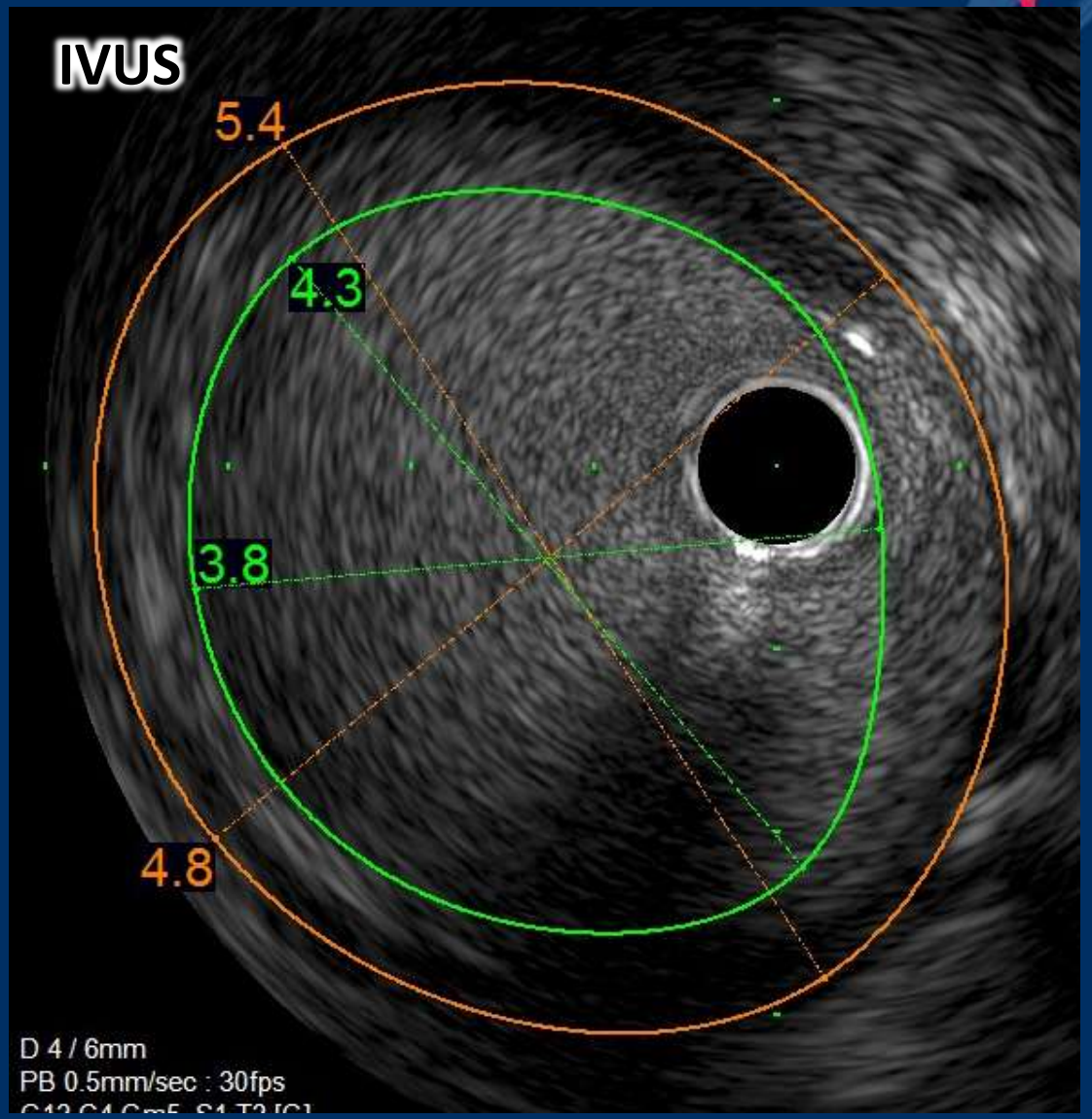


	IVUS	No IVUS	P value
Procedure time ≤1 hour	46.9% (42.0% to 51.9%)	71.6% (63.3% to 78.7%)	P<0.001
12-month restenosis	10.2% (6.9% to 14.9%)	10.3% (5.4% to 18.6%)	0.99

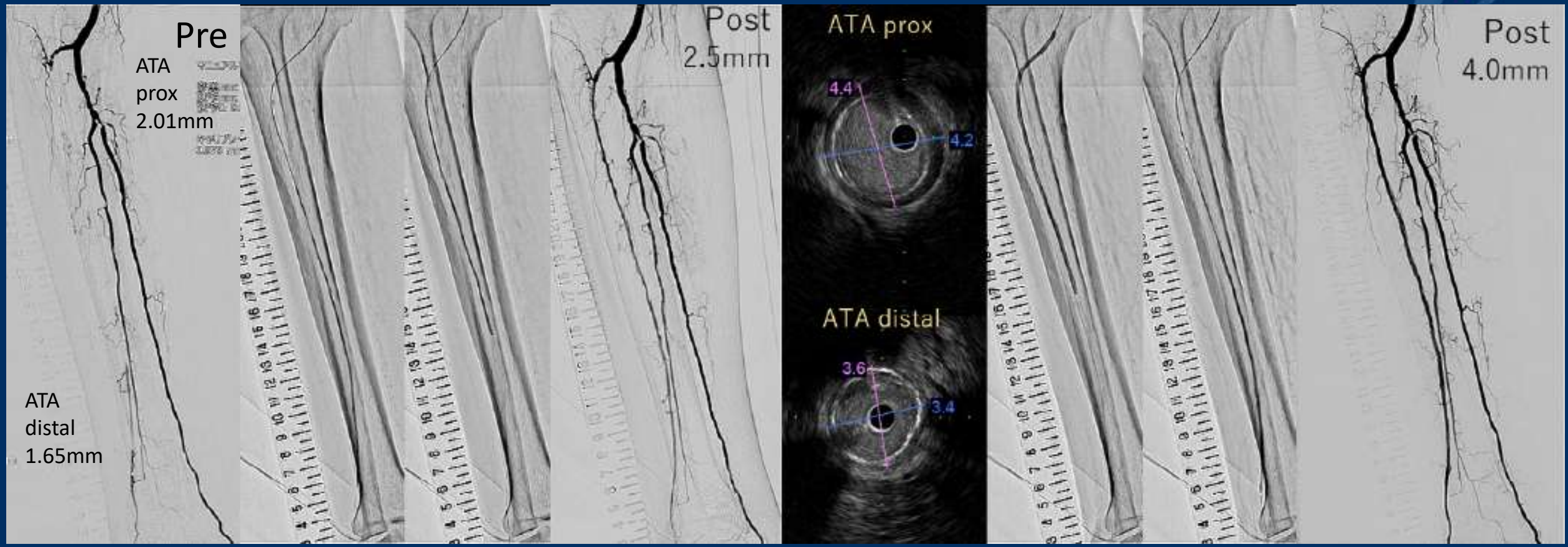
Propensity score matching analysis revealed that duration and fluoroscopy time during IVUS-supported procedures were SIGNIFICANTLY LONGER than in cases without IVUS use, whereas the 12-month restenosis rate was NOT significantly different between the groups.

Tsujimura T, Takahara M, Iida O, et al. JEVT 2020;1526602820949872

Below-the-knee disease (BTKD): IVUS could make something



IVUS-guided “EEM approach” for BTK angioplasty

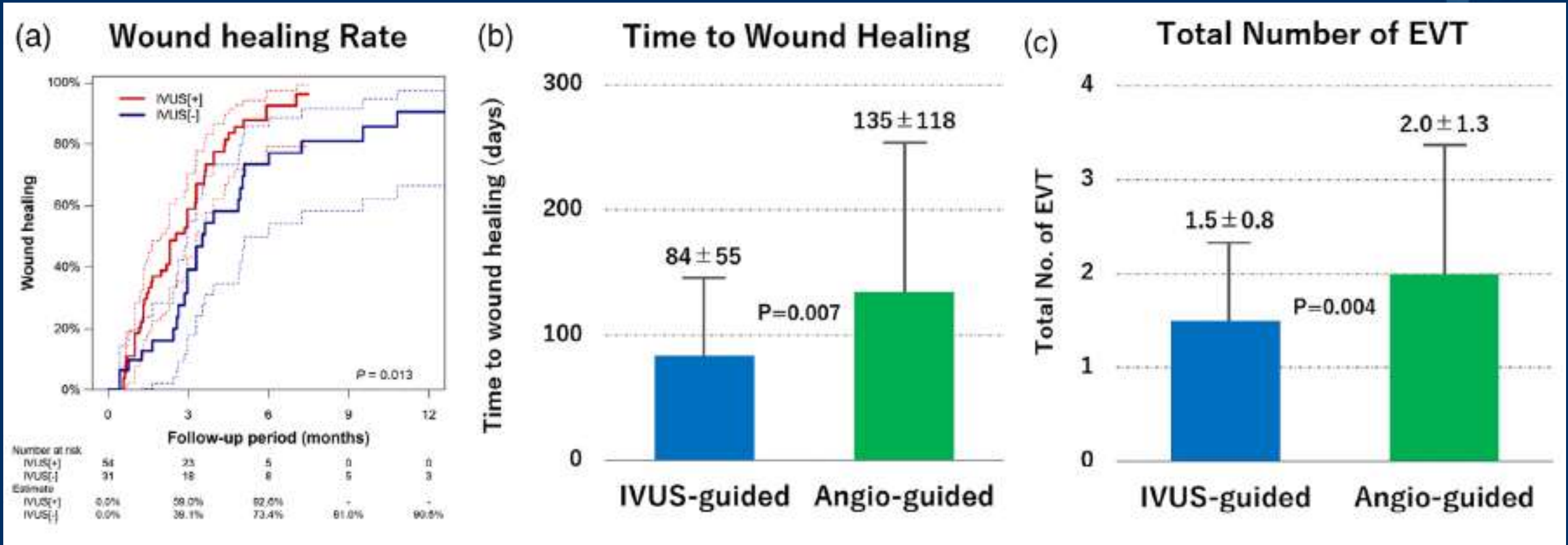


QVA | PTA 2.5x150mm | Angio-guide | PTA 4.0x150mm | IVUS-guide

The IVUS-guided group was treated with a larger balloon size for all types of below-the-knee vessel ($p < .001$), although lesion characteristics, including the QVA-measured vessel diameter, were similar between the two groups.

Soga Y et al. Catheter Cardiovasc Interv. 2020 Oct 21. doi: 10.1002/ccd.29347. Online ahead of print.

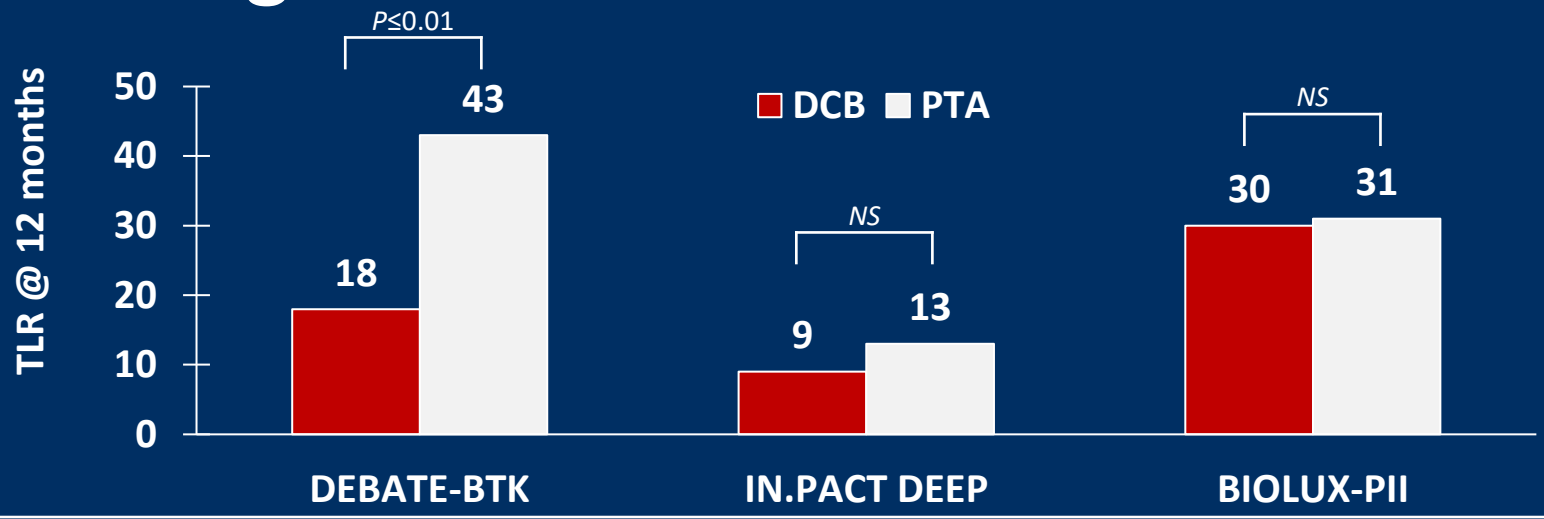
IVUS-guided “EEM approach” for BTK angioplasty

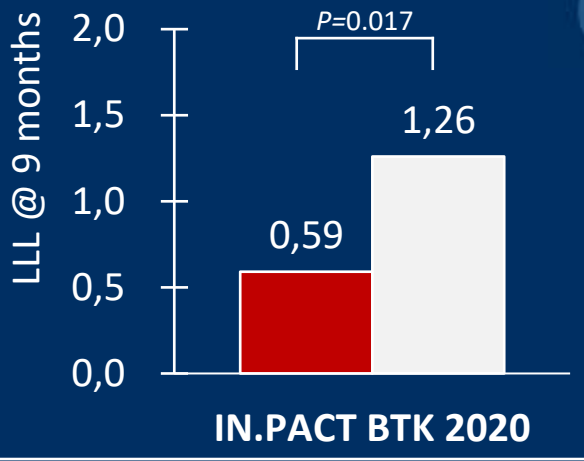


Wound healing was significantly earlier and the time to wound healing was significantly shorter in the IVUS-guided group. Total number of EVT to achieve complete wound healing for the index limb was also significantly lower in the IVUS-guided group.

Soga Y et al. Catheter Cardiovasc Interv. 2020 Oct 21. doi: 10.1002/ccd.29347. Online ahead of print.

Larger DCB size selection would lead better outcome?





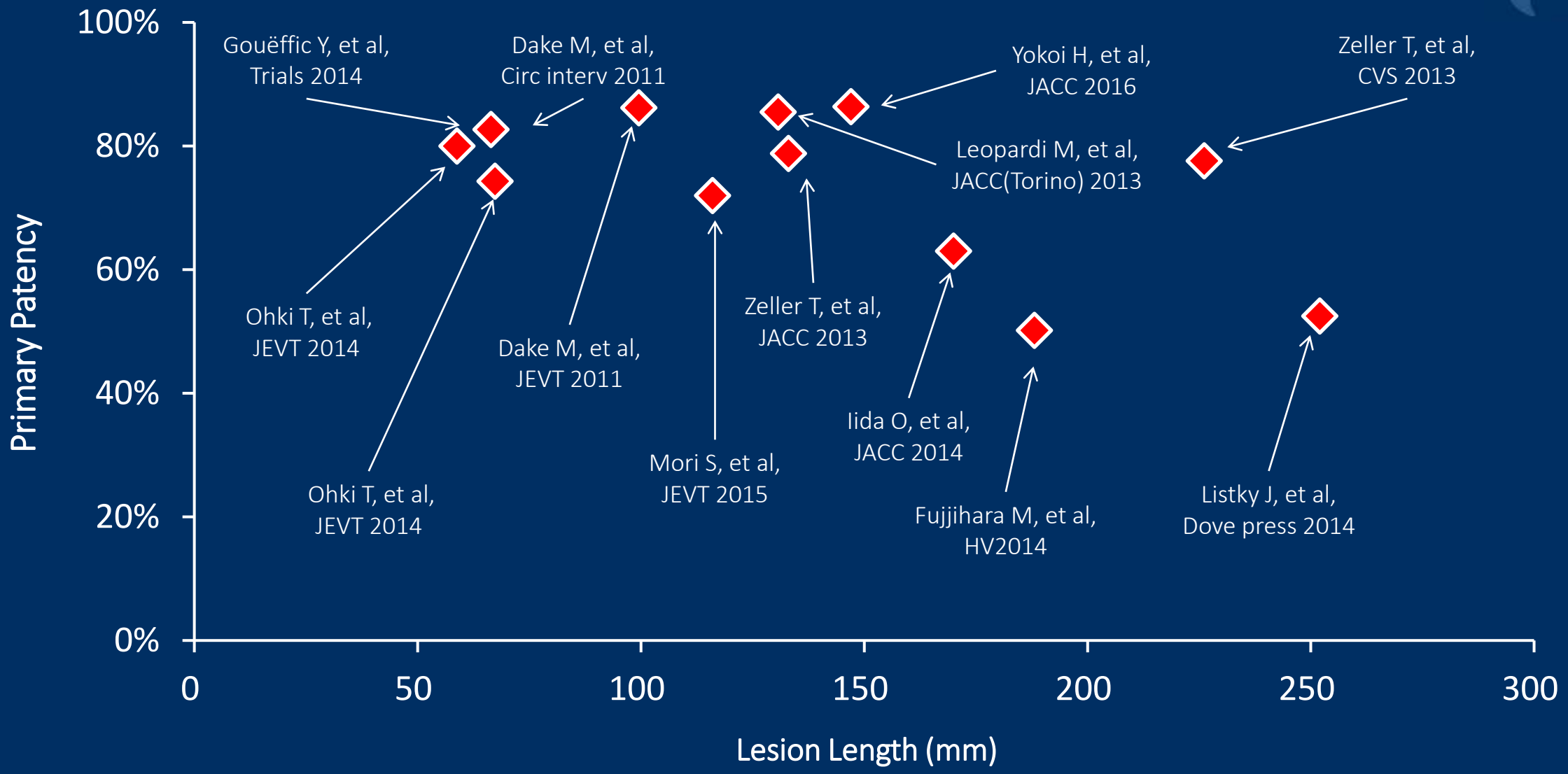
BTK RCT	DEBATE-BTK		IN.PACT DEEP		BIOLUX-PII		IN.PACT BTK 2020	
DCB type used	IN.PACT™ Amphirion		IN.PACT™ Amphirion		Passeo-18 Lux		IN.PACT 014 PTX-coated balloon	
	DCB	PTA	DCB	PTA	DCB	PTA	DCB	PTA
Number of patients (n)	65	67	239	119	36	36	23	27
Diabetics (%)	100	100	76	69	61	72	74	96
CLI (%)	100	100	100	99	78	78	100	100
Lesion length (mm)	129 ± 83	131 ± 79	101 ± 91	129 ± 95	113 ± 88	115 ± 87	215 ± 83	218 ± 80
De novo lesion (%)	100	100	93	96				
Total occlusion (%)	77	82	39	46				
Calcified lesion (%)			75	78	36	11		
Severe calcification (%)				14	11		42	8
RVD (mm)	2.91 ± 0.27	2.87 ± 0.29	2.46 ± 0.69	2.41 ± 0.56	2.28 ± 0.54,	2.19 ± 0.57	2.80 ± 0.54	2.71 ± 0.39

RVDs are different among studies, leading that selection of DCB size also differ from each DCB trial. Use of larger DCB size has more advantage to reduce restenosis rate.

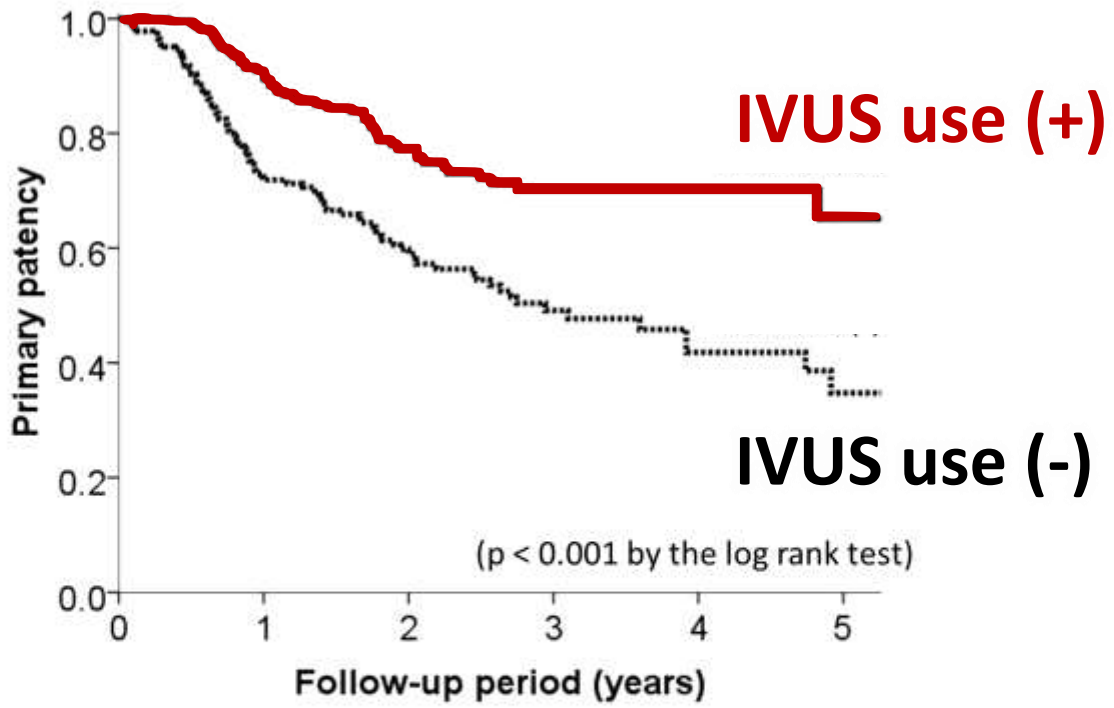
Herten M et al. Vasc Health Risk Manag. 2016;12:341-56.

Femoropopliteal disease (FPD): IVUS plays an important role

DES era: Primary patency after Zilver PTX implantation for SFA



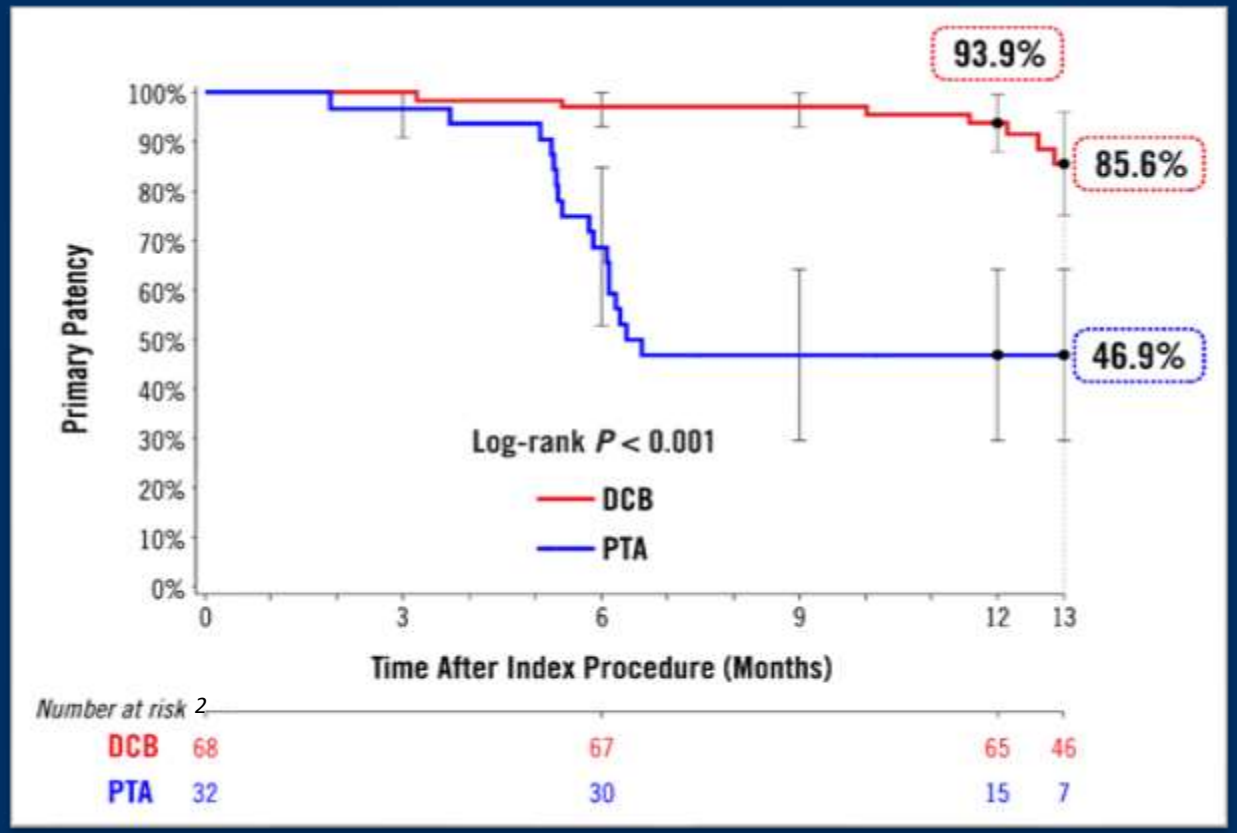
Efficacy of IVUS in FP stenting for PAD with TASC II class A to C lesion



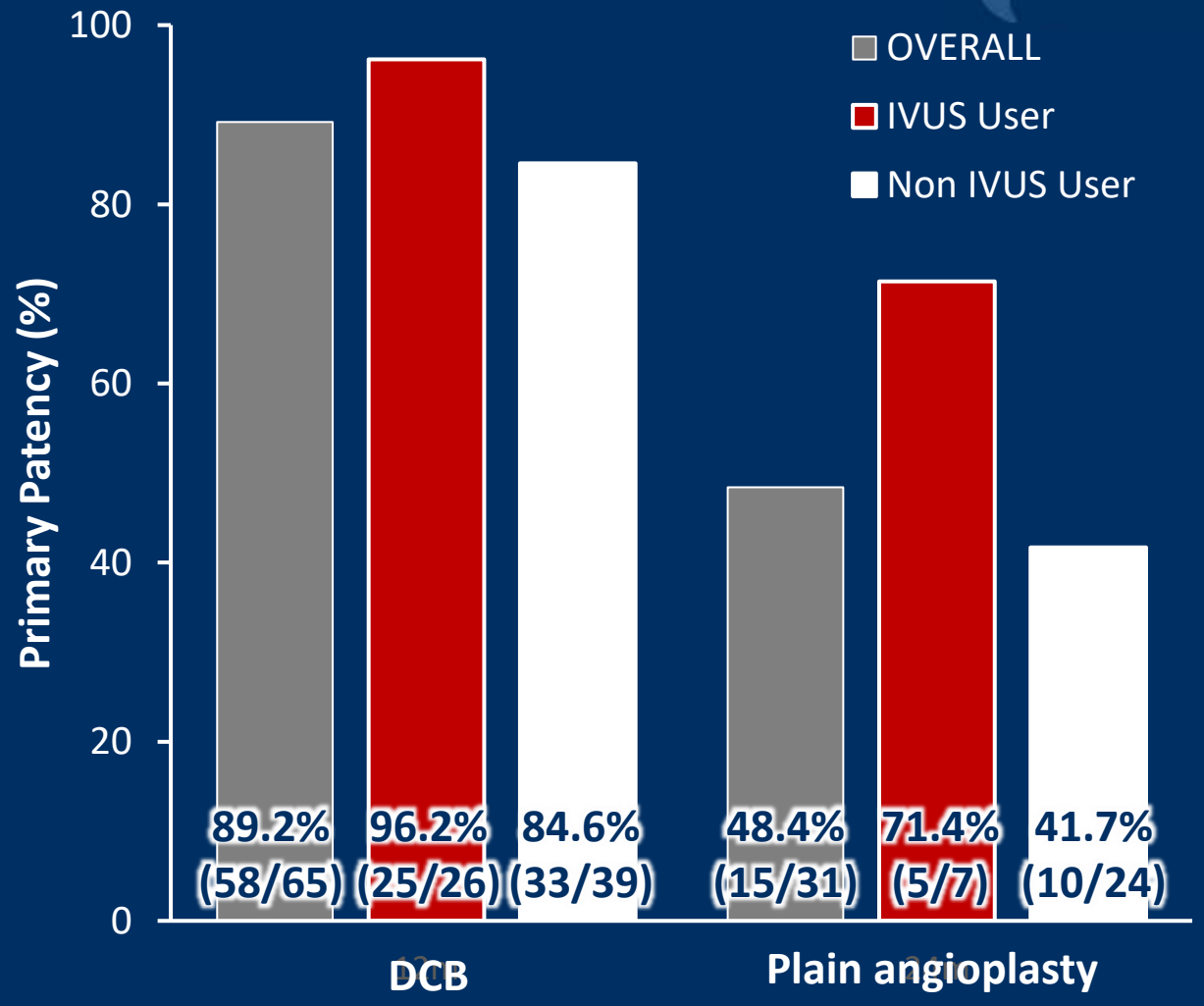
		0 yr	1 yr	2 yr	3 yr	4 yr	5 yr
IVUS use(-)	No. at risk	234	126	74	37	20	9
	Rate±SE	100±0%	72±3%	60±4%	49±4%	42±5%	35±6%
IVUS use(+)	No. at risk	234	173	96	58	34	13
	Rate±SE	100±0%	90±2%	77±3%	70±4%	70±4%	65±6%

Iida O, Soga Y, et al. J Endovasc Ther. 2014;21:485-492.

IN.PACT SFA Japan (overall vs. case with or without IVUS)



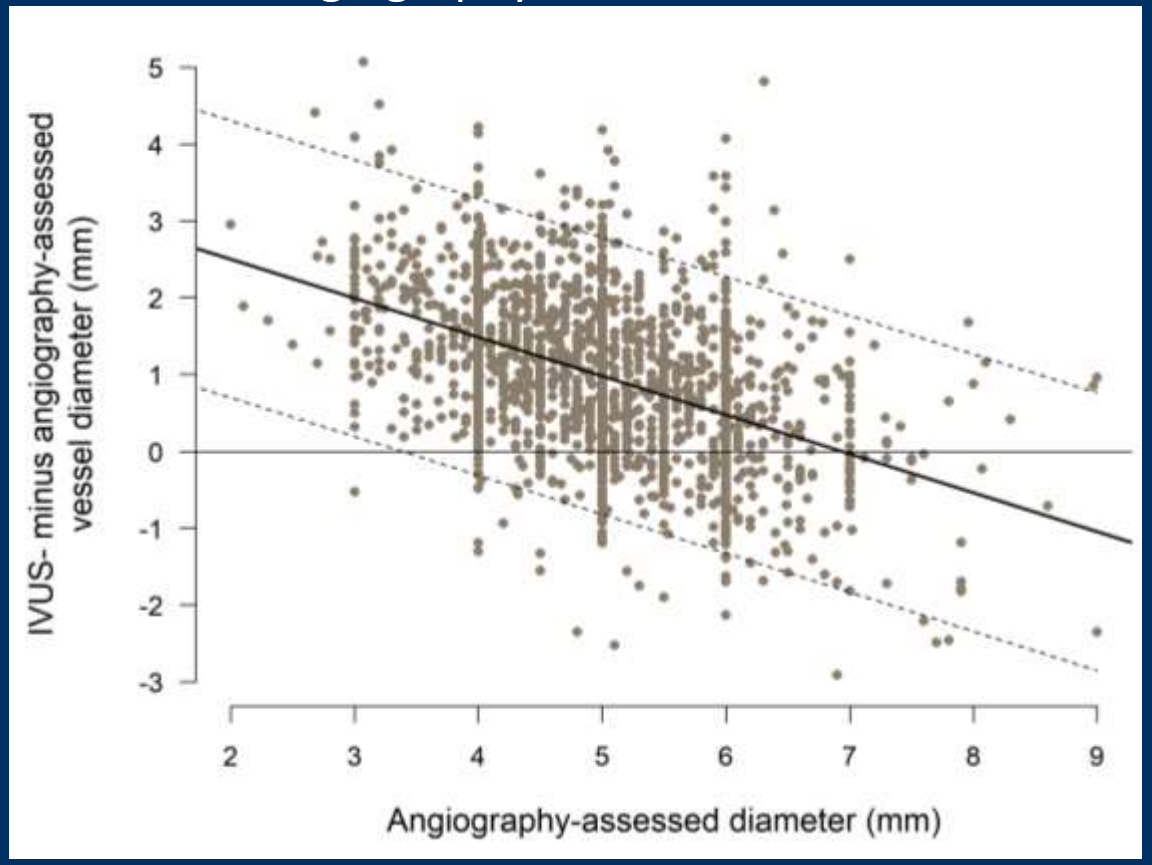
Importantly, there was a trend towards improved outcomes in patients whose vessels were evaluated with IVUS pre-procedure (1-year patency in both DCB and non DCB treated with IVUS) was numerically higher.

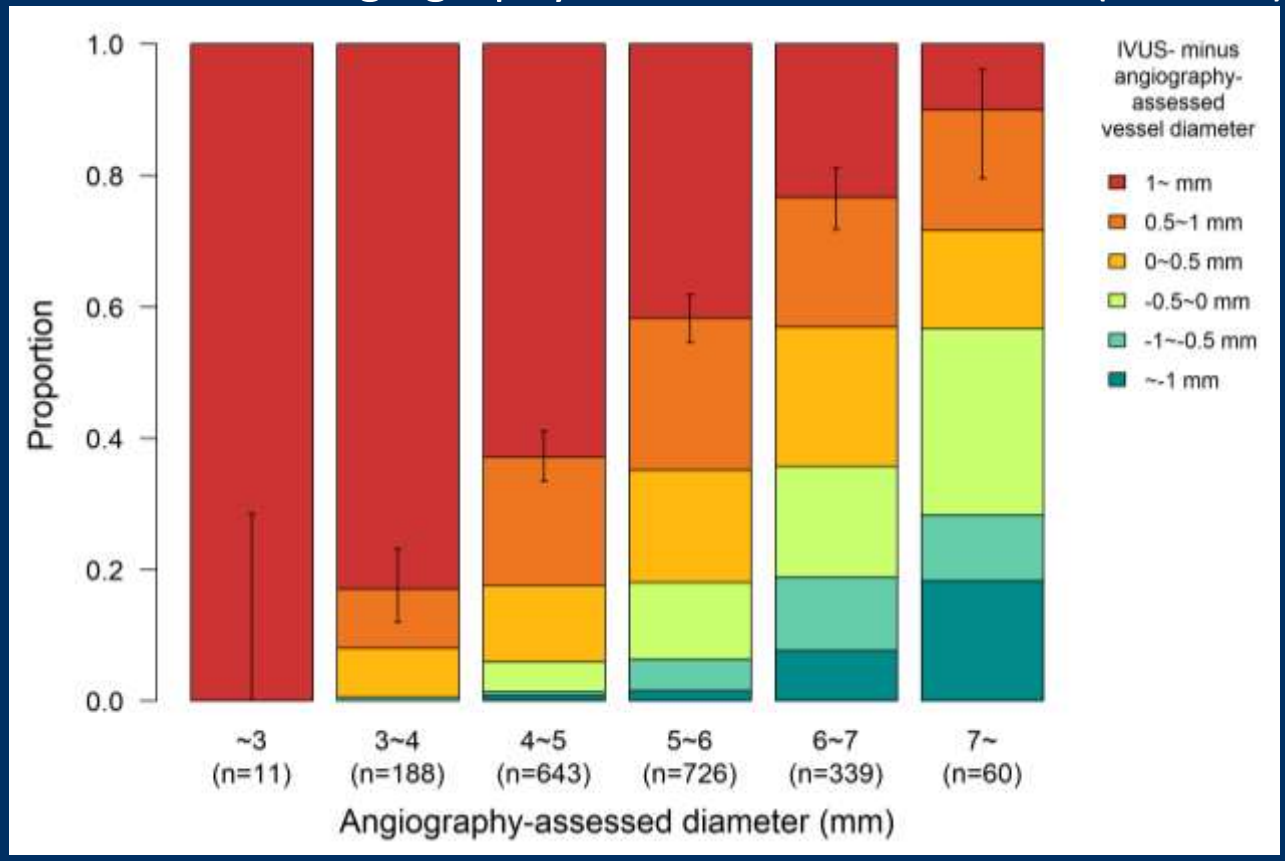


Iida O, et al. J Endovasc Ther. 2018;25:109-117.

Apparent difference between the vessel diameter (VD) assessed by angiography and that by IVUS in FP-EVT

Association of angiography-assessed VD with the difference between angiography- and IVUS-assessed VD (n=1725)





IVUS-assessed VD was significantly larger than angiography-assessed RVD (6.0 ± 1.0 mm versus 5.0 ± 1.0 mm; P<0.001). The difference of IVUS- versus angiography-assessed VD was more marked in cases with a smaller angiography-assessed VD.

Work in progress

Association of anatomical factors with IVUS- minus angiography-assessed RVD of 1 mm or larger

the association of anatomical factors with ΔRVD ≥1 mm (n=1725)

	Unadjusted odds ratio	Adjusted odds ratio
Popliteal lesion	1.61 [1.31 to 1.96] (P<0.001)	1.20 [0.95 to 1.51] (P=0.13)
Angiography-assessed RVD (per 1 mm)	**0.38 [0.34 to 0.43] (P<0.001)**	**0.38 [0.34 to 0.43] (P<0.001)**
Chronic total occlusion	**0.78 [0.65 to 0.94] (P=0.008)**	**0.63 [0.50 to 0.80] (P<0.001)**
Lesion length (per 10 cm)	1.06 [0.97 to 1.16] (P=0.19)	1.01 [0.90 to 1.14] (P=0.81)
Angiography-assessed calcification (versus none)	1.00 (Ref)	1.00 (Ref)
Unilateral calcification	1.20 [0.97 to 1.50] (P=0.099)	1.18 [0.93 to 1.51] (P=0.18)
Bilateral calcification	**1.34 [1.08 to 1.67] (P=0.008)**	**1.36 [1.06 to 1.74] (P=0.014)**
History of revascularization (versus never)	1.00 (Ref)	1.00 (Ref)
History of plain angioplasty	0.90 [0.50 to 1.62] (P=0.73)	0.66 [0.34 to 1.27] (P=0.21)
History of stent implantation	**1.86 [1.39 to 2.51] (P<0.001)**	**1.72 [1.23 to 2.41] (P=0.001)**

A smaller angiography-assessed RVD, a lesion without chronic total occlusion, angiography-assessed bilateral calcification, and history of stent implantation were significantly associated with ΔRVD ≥1 mm.

Work in progress

Take home message

- ✓ During aorto-iliac stenting, IVUS had No Impact on Outcomes at 1 Year.
- ✓ In FP and BTK treatment, IVUS guided EVT would improve clinical outcomes.
- ✓ IVUS-assessed VD was significantly larger than angiography-assessed RVD (6.0 ± 1.0 mm versus 5.0 ± 1.0 mm; P<0.001).
- ✓ The difference of IVUS- versus angiography-assessed VD was more marked in cases with a smaller angiography-assessed VD.
- ✓ A smaller angiography-assessed RVD, a lesion without chronic total occlusion, angiography-assessed bilateral calcification, and history of stent implantation were significantly associated with ΔRVD ≥1 mm.

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