Defining the Technical Needs of Second Generation BRS:

Lessons Learned from the Absorb BVS Program

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Disclosures

- Chairman of the ABSORB global clinical trial program (uncompensated)
- Consultant to Reva, Inc.

Causes of Absorb BVS Failure

1. Mechanisms common to metallic DES
(but which may be more frequent with BVS)

- Under-expansion (small MSA)
- Edge issues (dissection, residual disease)
- Geographic miss
- Coverage of side-branches
- Slow and/or incomplete endothelialization
- Neoatherosclerosis

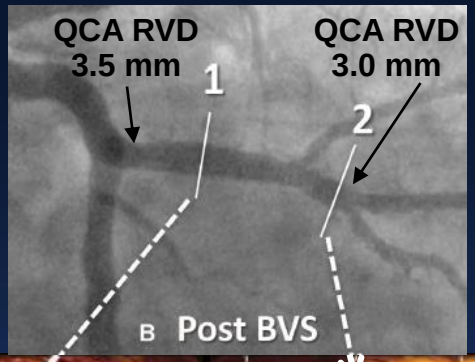
2. Mechanisms unique to BVS

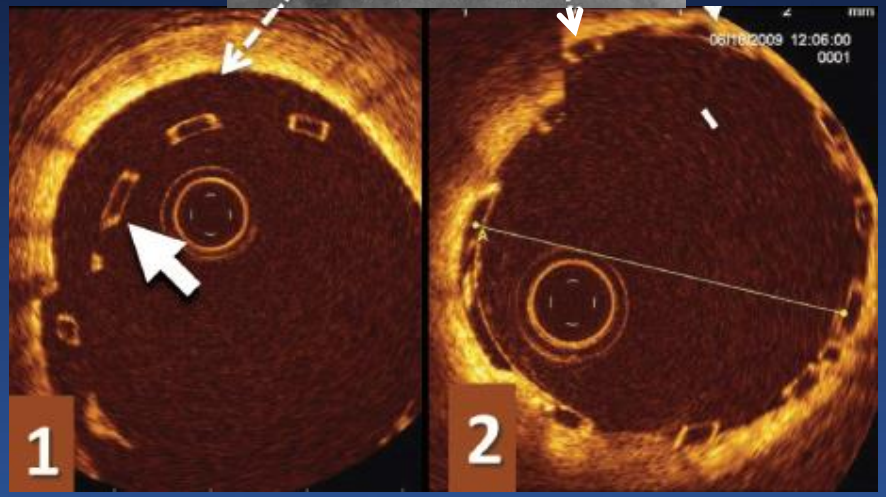
- Acute fracture
- Chronic recoil
- Late intraluminal scaffold dismantling (ILSD)
  - predisposed to by acute malapposition

Many of these may be impacted by suboptimal technique

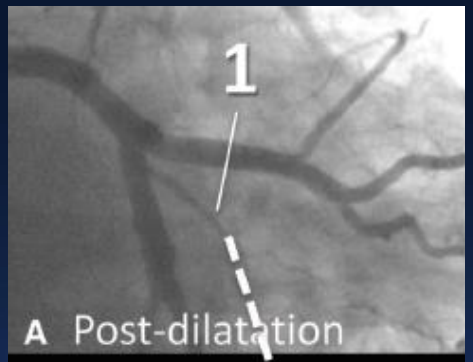
Acute Scaffold Fracture

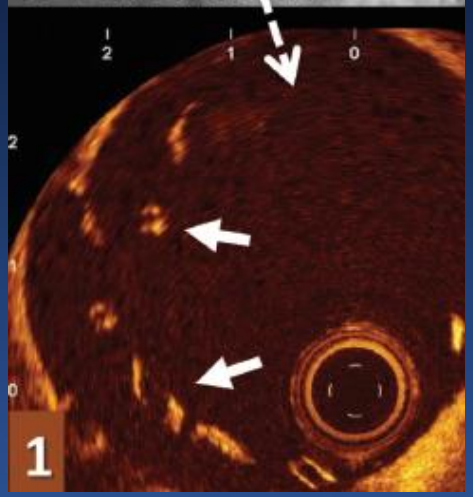
3.0 x 18 mm BVS after post-dil with 3.25 mm NC balloon at 24 atm.
Malapposition



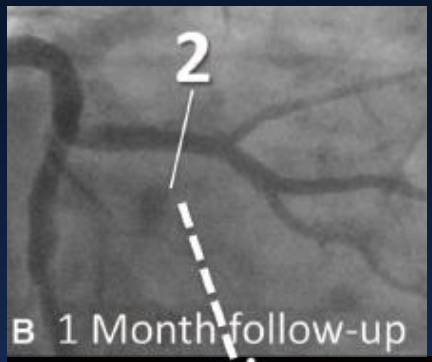


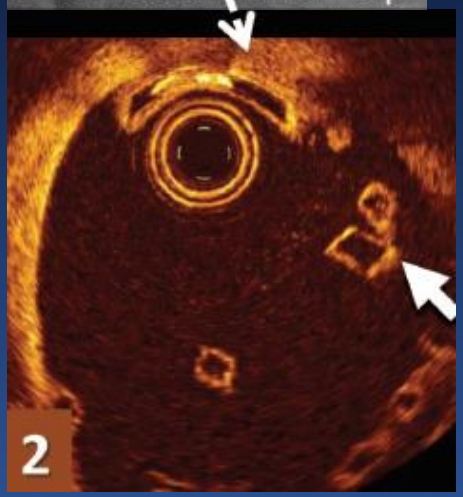
Post-dil with 3.5 mm compliant balloon at 16 atm (expected 4.0 mm).
Fracture





Unstable angina at 1 month;
Treated with metallic DES





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Ormiston JA et al. Circ Cardiovasc Interv 2011;4:535-8

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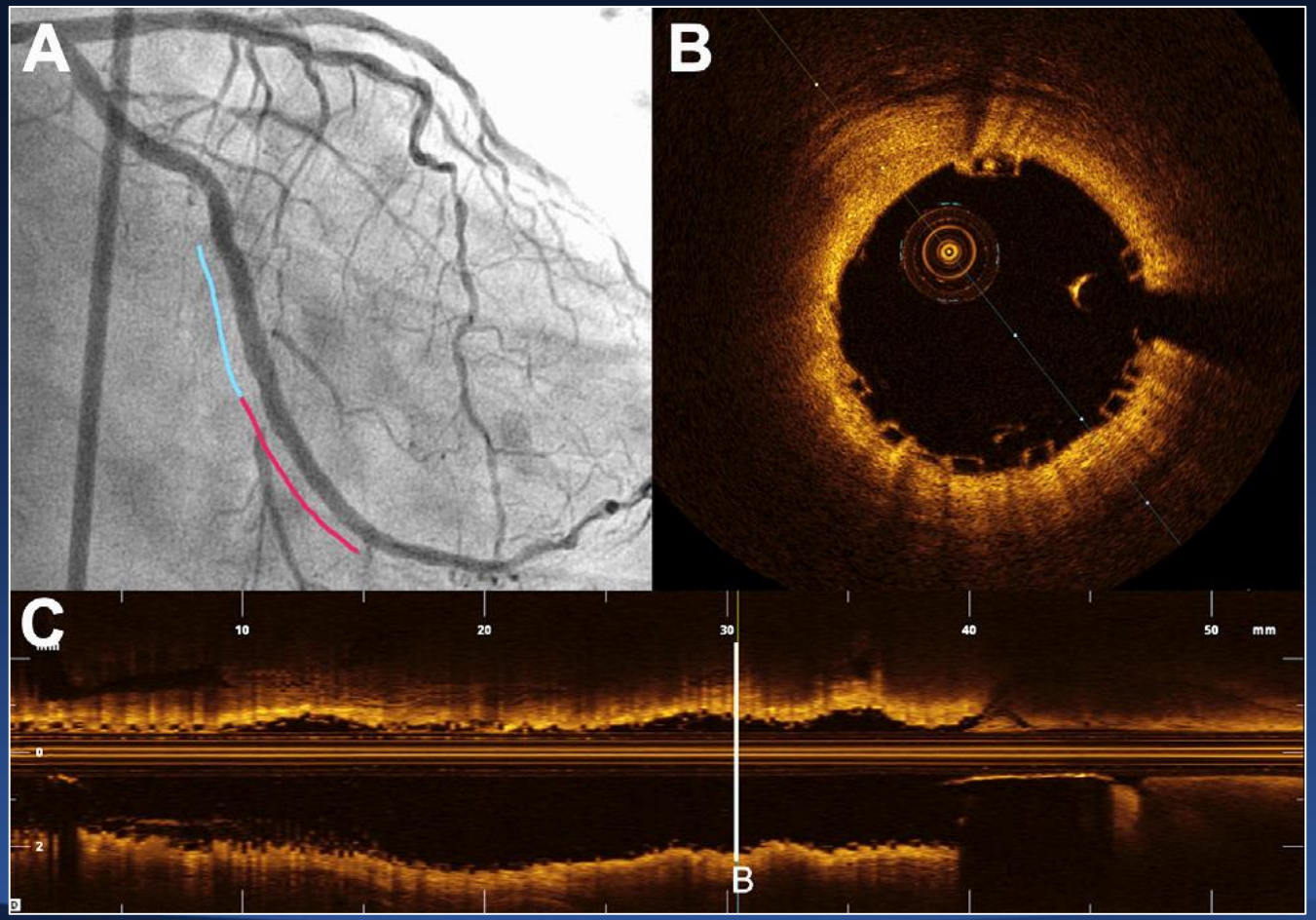
Very Late Absorb Restenosis

Chronic recoil

LCX treated with 2 BVS (3.0 x 18 mm and 2.5 x 28 mm), post-dilated with 3.0-mm NC balloon. Full expansion, well apposed struts.



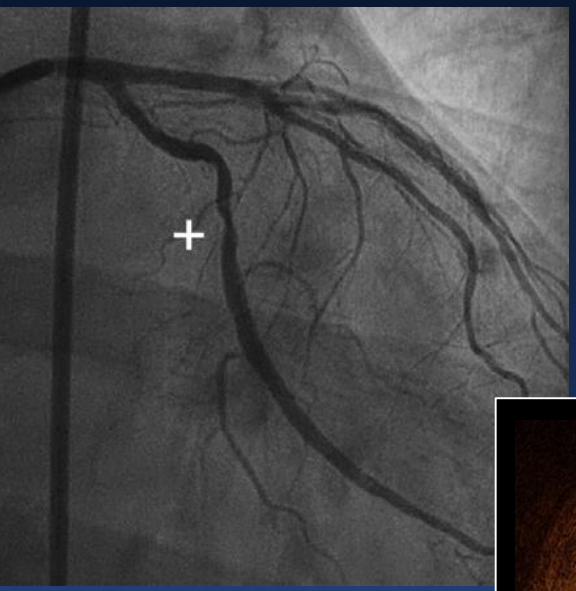
Dommasch M et al. JACC Int 2016:9:2571-2

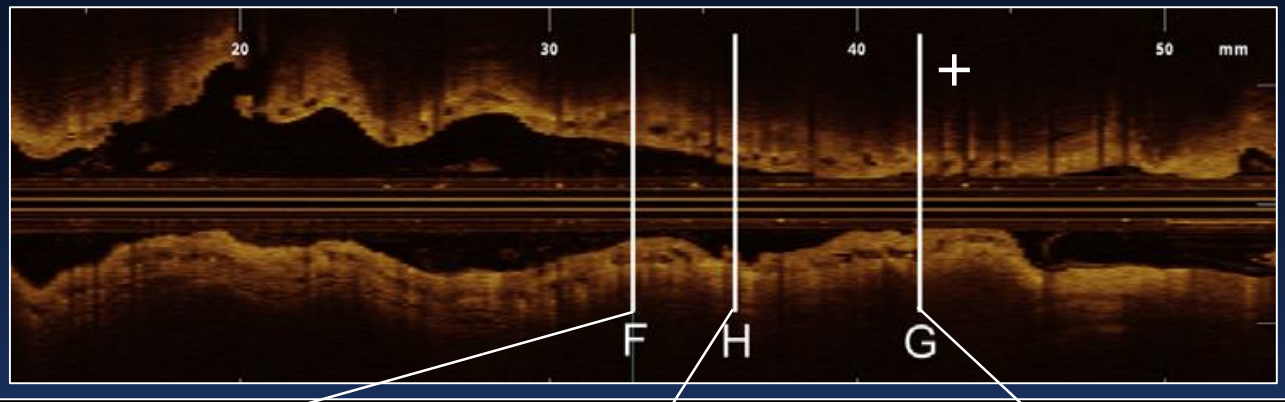
Very Late Absorb Restenosis

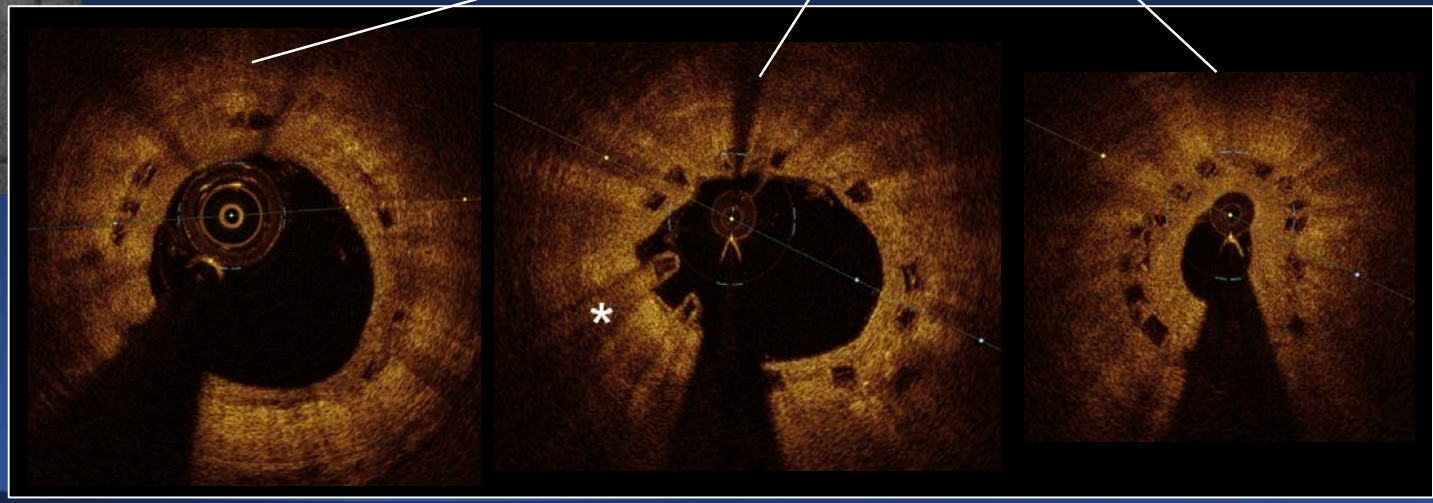
Chronic recoil

44 months later unstable angina; focal LCX restenosis

Neointimal proliferation with proximal scaffold collapse





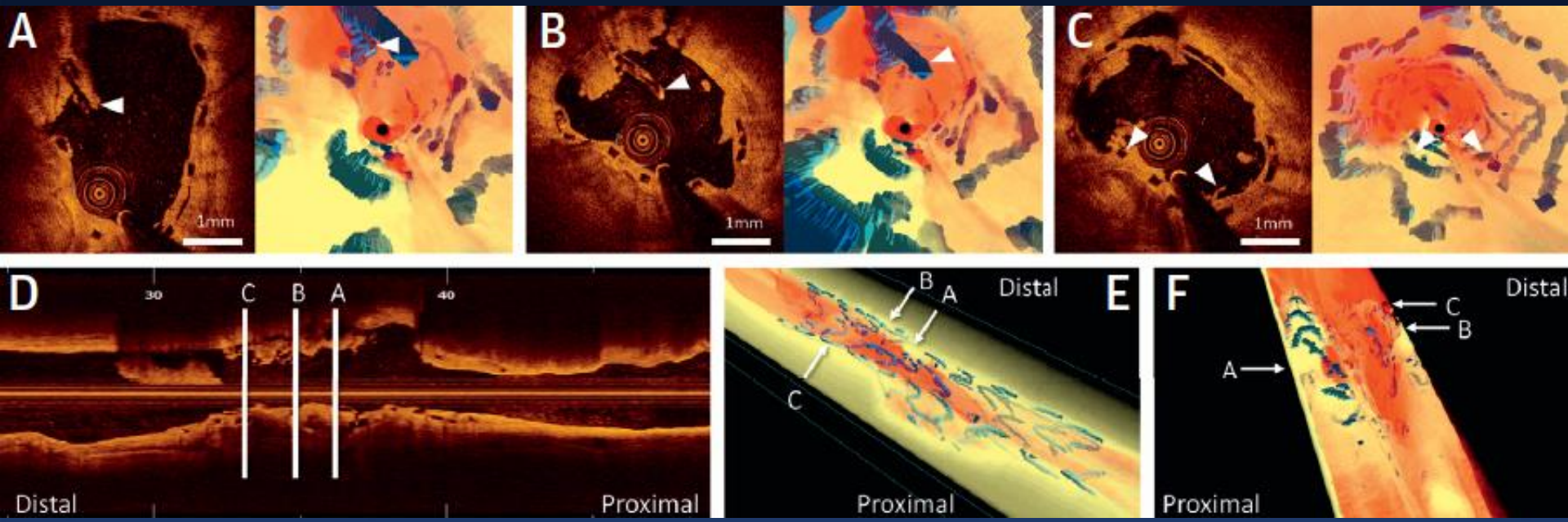


Note: Scaffold struts still apparent at 44 mo (“ghosts”?)

Dommasch M et al. JACC Int 2016:9:2571-2

Very Late Absorb Thrombosis

Intraluminal scaffold dismantling



Minimal intimal hyperplasia. Main findings are breaks in the scaffold structure with malapposition and luminal encroachment (intraluminal scaffold dismantling – ILSD), and thrombus

Raber L et al. JACC 2015;66:1901–14
Stone GW and Granada JF. J Am Coll Cardiol. 2015;66:1915-7

ABSORB

ABSORB PSP Analysis

Pre-specified Definitions of Optimal PSP Technique

- Pre-dilatation: Performed in all lesions with a balloon to QCA-RVD ratio ≥1:1
- Sizing: QCA-RVD ≥2.25 mm - ≤3.75 mm for all treated lesions
- Post-dilatation: Performed with a non-compliant balloon at ≥18 atm. and with nominal diameter larger than the nominal scaffold diameter, but not >0.5 mm larger

Performance of Optimal PSP Technique in 5 ABSORB studies

Featured Clinical Research

Mile High Ballroom 1A-1B

Today, 12:45 PM – 12:55 PM

Stone GW et al. JACC 2017:on-line

[1]Performed in all lesions with a balloon to QCA-RVD ratio ≥1:1; [2]QCA-RVD ≥2.25 mm - ≤3.75 mm for all treated lesions; [3]Performed with a non-compliant balloon at ≥18 atm. and with nominal diameter larger than the nominal scaffold diameter, but not >0.5 mm larger

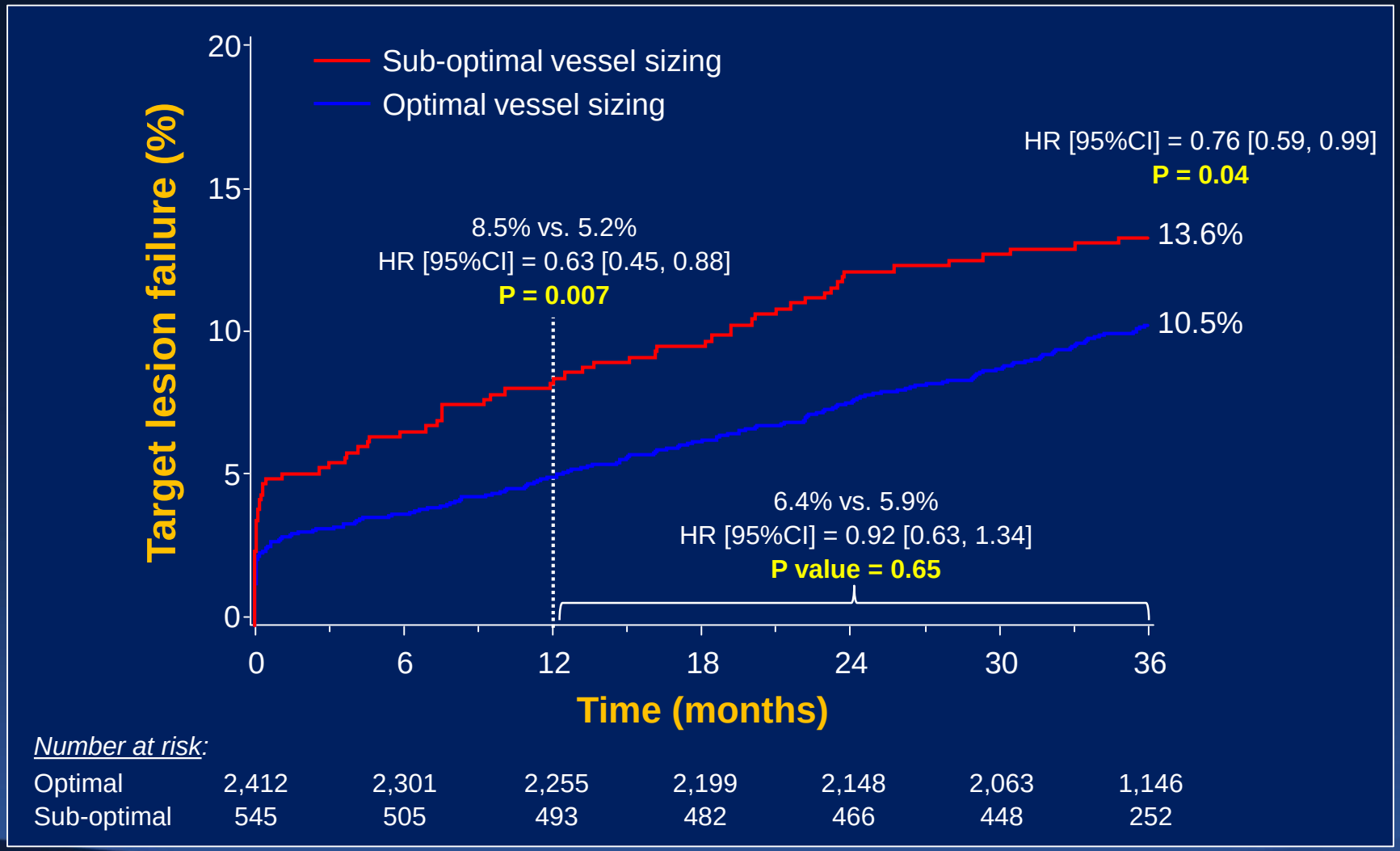
Performance of Optimal PSP Technique in 5 ABSORB studies

	Lesions (n=3,149)	Patients (n=2,973)
• Pre-dilatation:[1]	60.1%	59.2%
• Sizing:[2]	82.3%	81.6%
• Post-dilatation:[3]	12.7%	12.4%
• All PSP	5.0%	4.9%

[1]Performed in all lesions with a balloon to QCA-RVD ratio ≥1:1; [2]QCA-RVD ≥2.25 mm - ≤3.75 mm for all treated lesions; [3]Performed with a non-compliant balloon at ≥18 atm. and with nominal diameter larger than the nominal scaffold diameter, but not >0.5 mm larger

Target Lesion Failure

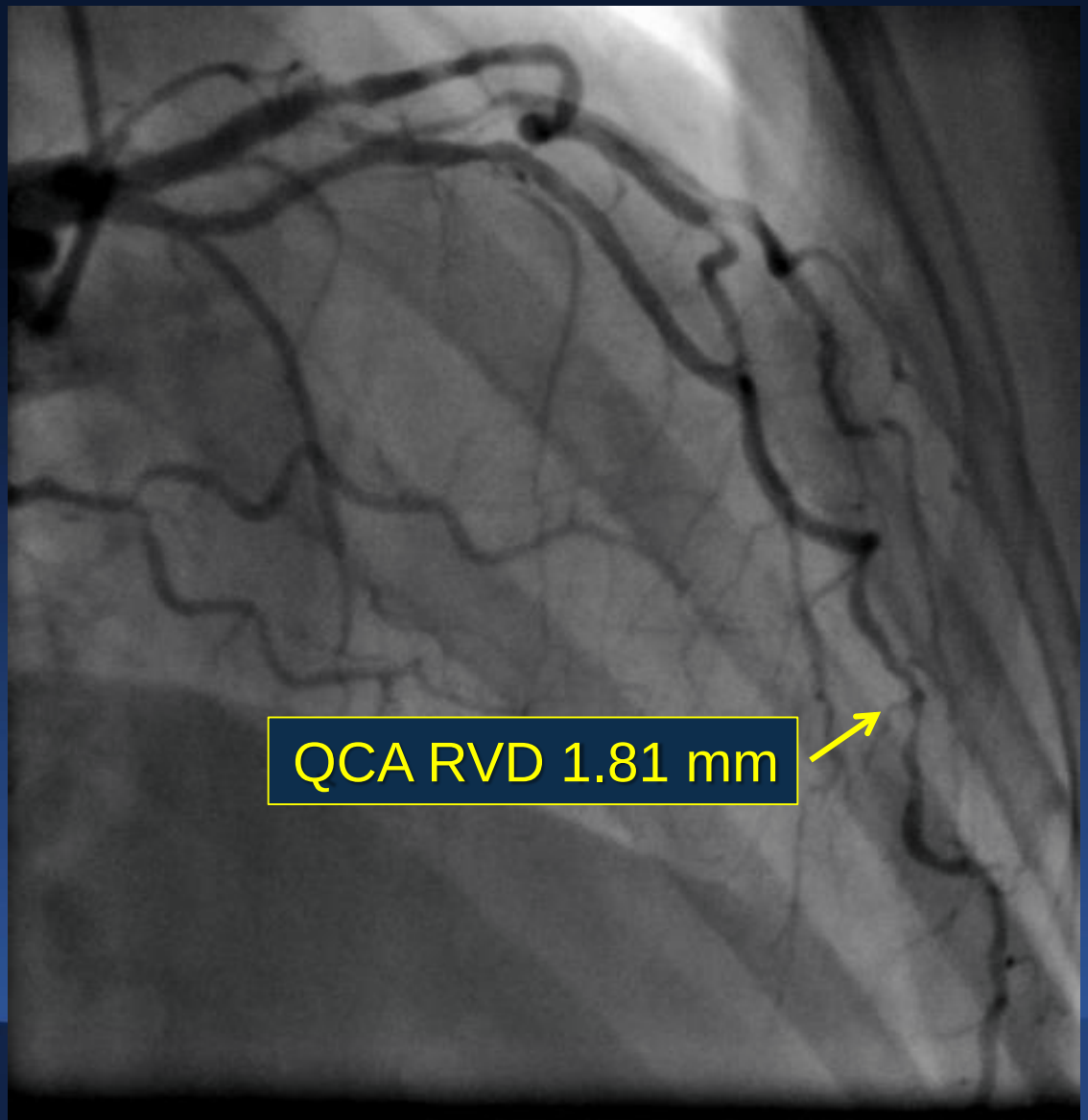
Impact of Optimal Vessel Sizing



Number at risk:

Optimal	2,412	2,301	2,255	2,199	2,148	2,063	1,146
Sub-optimal	545	505	493	482	466	448	252

Example: Very small vessel enrolled in ABSORB III



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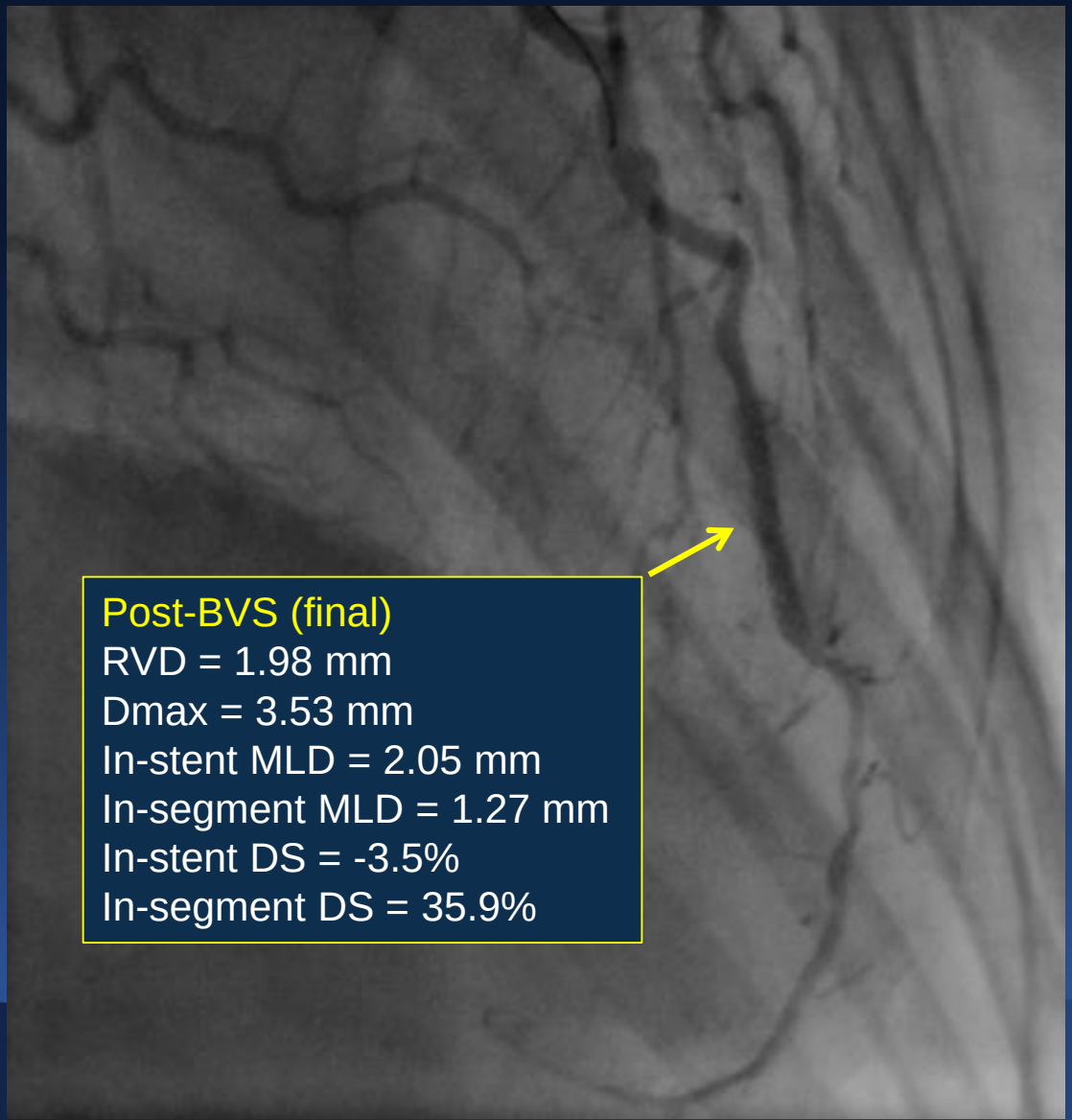
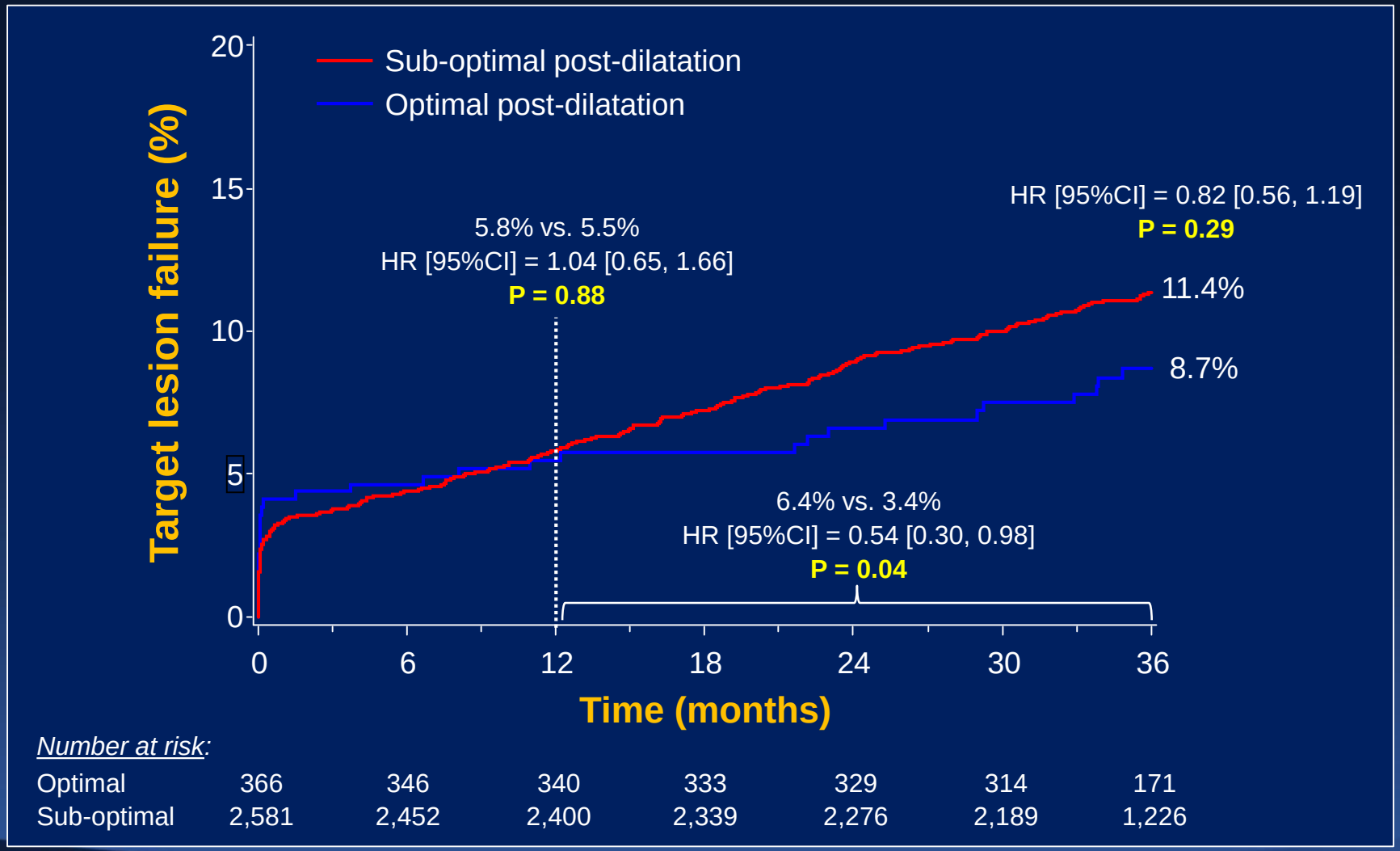


Target Lesion Failure

Impact of Optimal Post-dilatation

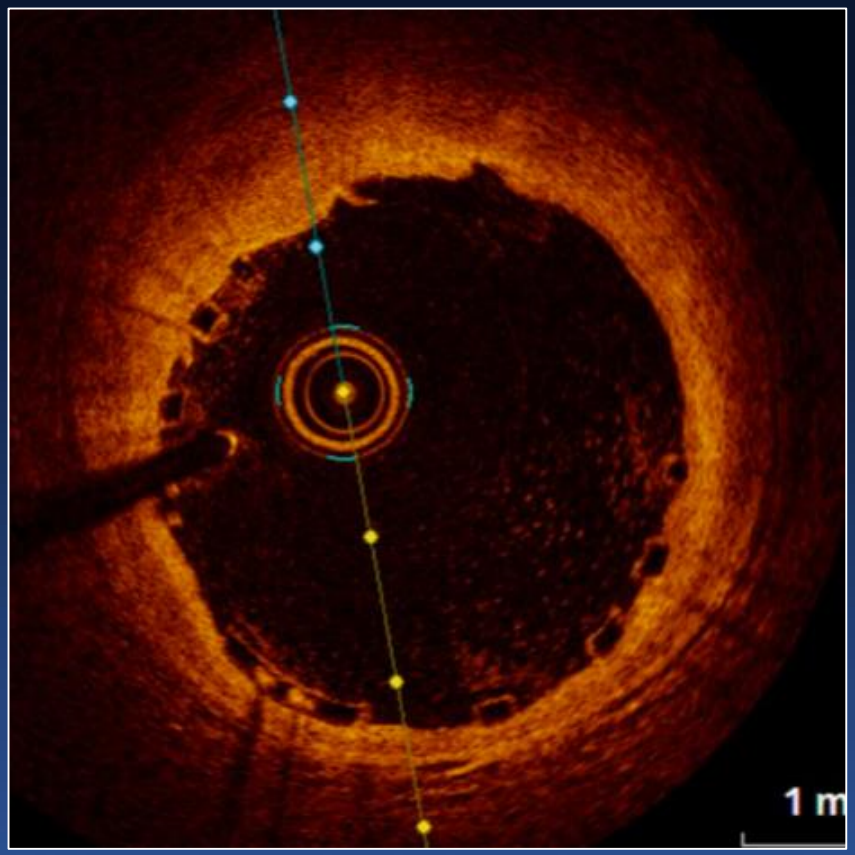


Number at risk:

Optimal	366	346	340	333	329	314	171
Sub-optimal	2,581	2,452	2,400	2,339	2,276	2,189	1,226

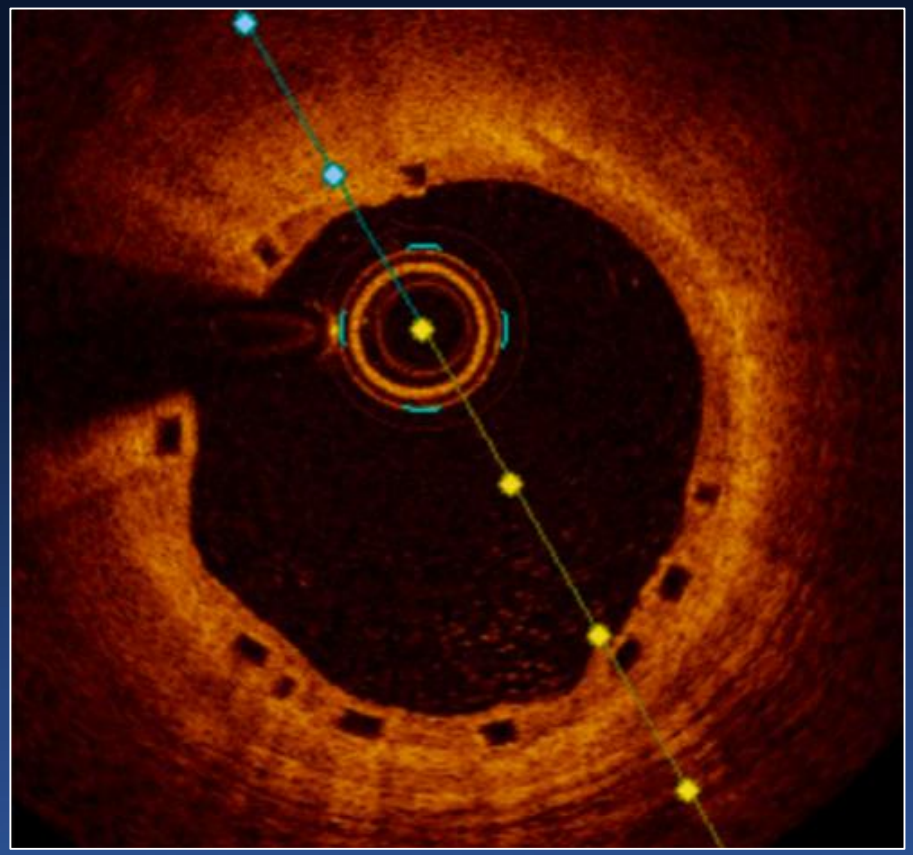
Preventing Acute Malapposition by Proper Sizing and High-Pressure Post-Dilatation Should Reduce Very Late Scaffold Thrombosis

Immediate post-implant



Complete apposition

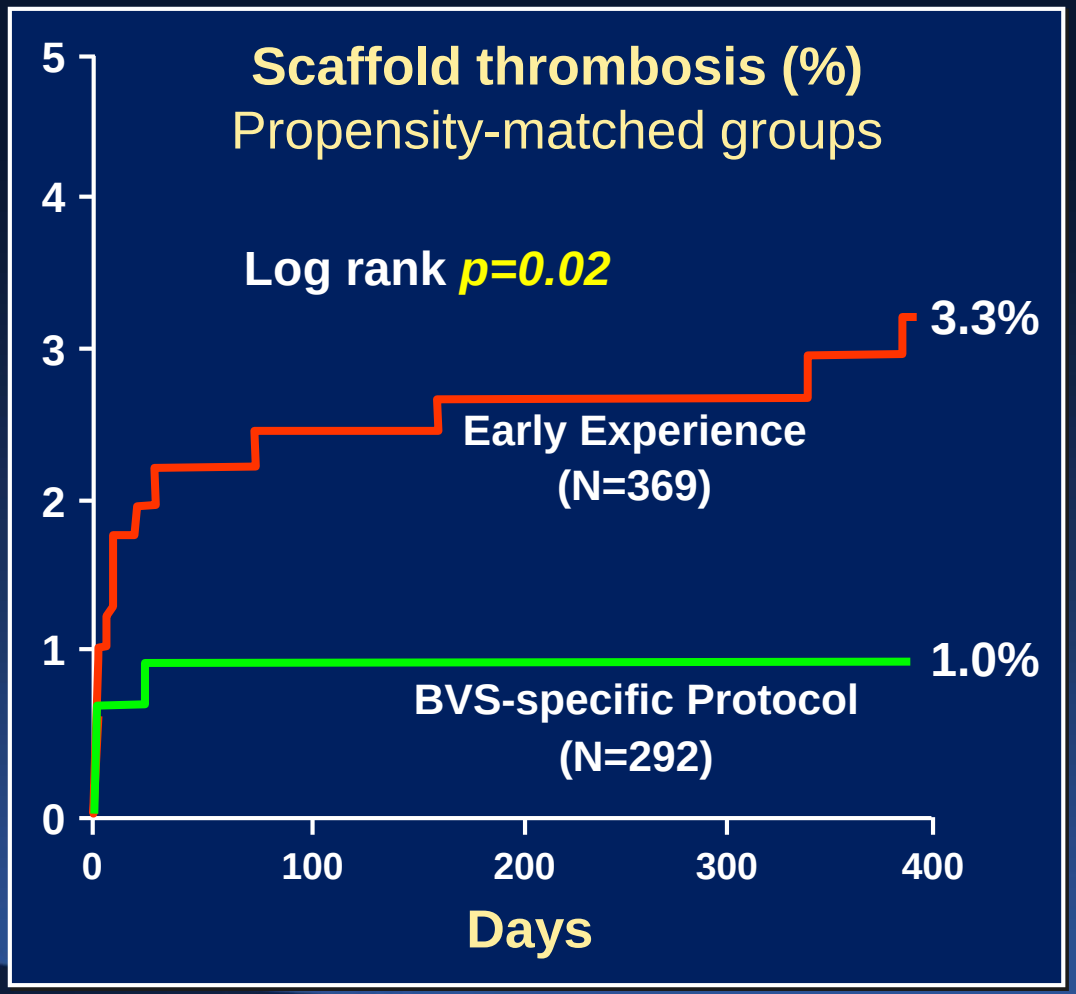
69 days post-implant



Complete strut coverage

Reduction in Absorb Scaffold Thrombosis with Improved Technique

At 4 German and Swiss centers



BVS specific protocol

- Nitrates
- Sizing with balloon (1:1:1)
  2 angiographic planes
- Low threshold for OCT
- Implant following IFU
- NC postdilation (+0.5mm)

Do not accept MLD <2.5/2.9mm*
MLA <4.9/6.6mm^2*

*For a 2.5-3.0 mm and 3.5 mm scaffold respectively

Puricel S et al. JACC 2016;67:921–31

Absorb Milan Experience*

May 2012 - August 2016: 340 pts, 518 lesions

1.5 target lesions/pt
B2/C lesions 76.1%
Bifurcation lesions 46.1%; severely calcified lesions 22.6%
1.5 scaffolds/lesion
BVS length 35 ± 19 mm/lesion, 54 ± 34 mm/pt
Use of 2.5 mm BVS 33.0%/lesion, 44.7%/pt

Technique

Pre-dilatation	97.1%
- Scoring/cutting/RB	16.4%
Post-dilatation with NC balloon	99.8%
- Pressure, atm mean	21.0 ± 4.3
- Balloon/scaffold diameter ratio	1.03 ± 0.09
IVUS or OCT	86.1%
- Further interventions based on imaging	23.6%

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Updated from Tanaka A et al. EuroInt 2017;12:1730-1737

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Absorb Milan Experience

May 2012 - August 2016: 340 pts, 518 lesions

FU 98.2% of pts at median 665 days (IQR 340 - 1017)

Scaffold thrombosis (def/prob):

4 cases (1.2%)

1 Acute	(day 0)
1 Subacute	(day 3)
2 Late	(day 63, day 146)
0 Very late	

All definite, no probable
All on DAPT except 1 case (day 146)

ABSORB IV: Trial Design

NCT01751906

Compared to ABSORB III:
Troponin pos ACS, thrombus and 3 lesions included

2,604 pts with SIHD or ACS
1 - 3 target lesions w/RVD
2.5-3.75 mm and LL ≤24 mm

Randomize 1:1
Stratified by diabetes and ABSORB III-like vs. not

ABSORB BVS
N=1,296

Xience EES
N=1,308

BVS technique:
Pre-dil: 1:1; NC balloon recommended
Sizing: IV TNG; QCA/IVUS/OCT strongly recommended if visually estimated RVD ≤2.75 mm and 2.5 mm device intended; <2.5 mm ineligible!
Post-dil: 1:1, NC balloon, ≥16 atm strongly recommended

DAPT for ≥12 months
Clinical/angina follow-up: 1, 3, 6, 9, 12 months, yearly through 7-10 years
SAQ-7 and EQ-5D: 1, 6, 12 months and 3 and 5 years
Cost-effectiveness: 1, 2, and 3 years

Primary endpoints: TLF at 30 days; TLF between 3 and 7-10 yrs (pooled with AIII)
Secondary endpoints: TLF at 1 year; angina at 1 year

No routine angiographic follow-up

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Late Breaking Trial

Main Arena

Today 11:20 AM – 11:35 AM

No routine angiographic follow-up

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Conclusions

- In the randomized trials completed to date, ABSORB BVS resulted in increased rates of early and late adverse events compared to XIENCE CoCr-EES (in particular device thrombosis and TV-MI)
- This increased risk may be attributed to complications arising from limitations of the scaffold (some common to all DES, but some unique to BRS), as well as suboptimal technique
- Next generation BRS (thinner struts, enhanced expansion characteristics) implanted with optimal technique offer the potential for comparable early and intermediate-term outcomes compared to contemporary metallic DES (prior to complete bioresorption), with improved long-term event-free survival