

BVS in Bifur. and CTOs

-Milan-Tokyo-Asia-

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FACC, FAHA, FESC, FSCAI

What should we consider?

– BVS implantation to bifurcation lesions –

1. Thicker and wider struts

Side branch occlusion, Peri-procedural MI
Too much Intimal Hyperplasia

2. Strut fracture

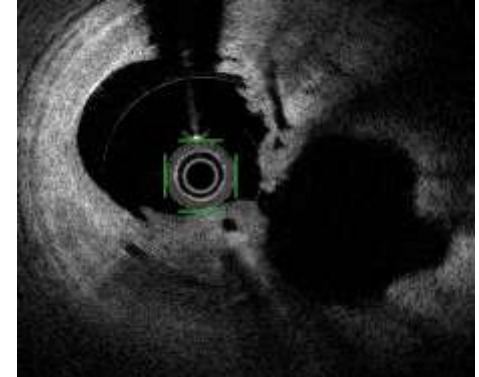
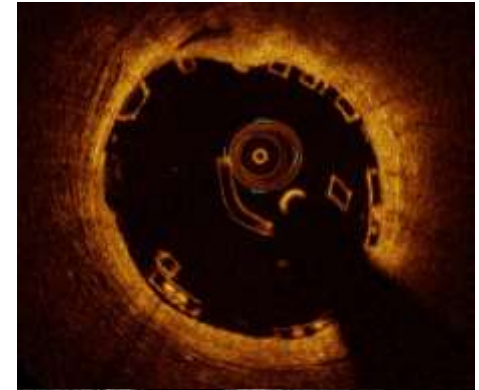
Side branch intervention through BVS strut
NO Full KBT ??

3. Neointimal proliferation at SB ostium

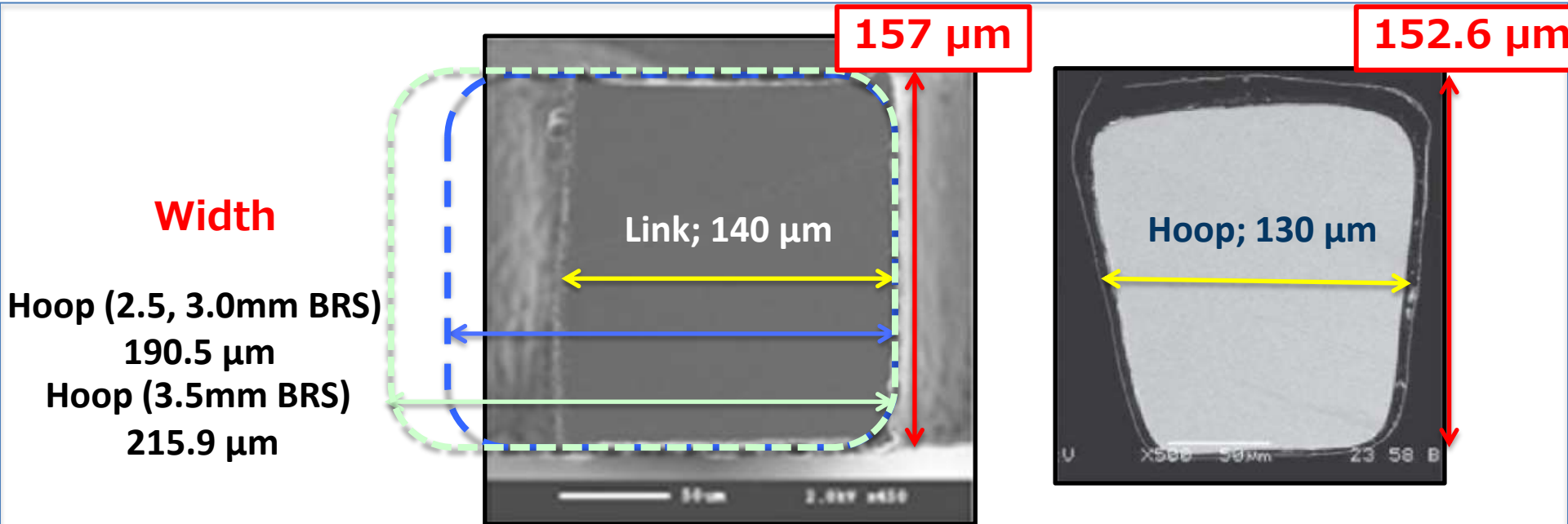
When SB ballooning ??
Minimize strut protrusion

4. Scaffold optimization

IVUS and / or OCT



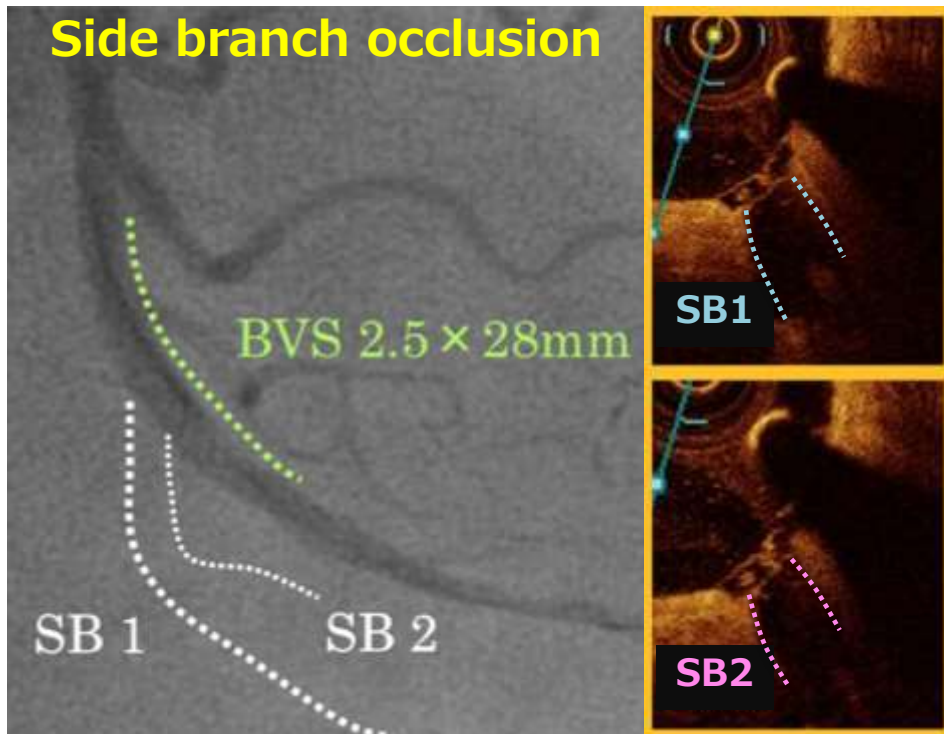
1. Thicker and wider struts



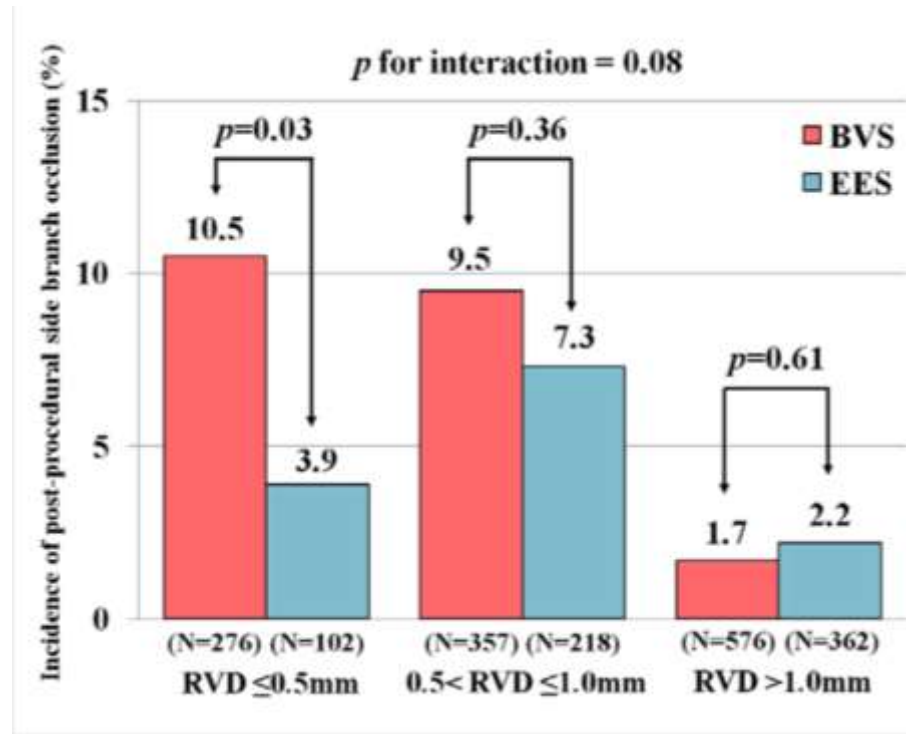
	Absorb	Cypher
Strut thickness	157μm	152.6μm
Strut width (link)	140μm	60μm
Strut width (hoop)	2.5, 3.0mm; 190.5μm	130μm
	3.5mm; 215.9μm	
Stent or Scaffold/vessel surface area (%)	2.5mm; 32%	2.5–3.0mm (6 cells); 12-15%
	3.0mm; 27%	3.5–4.0mm (7 cells); 12-15%
	3.5mm; 26%	

1. Thicker and wider struts

- Side branch occlusion -



Sato K et al. JACC Intv 2015;8(1 Pt A):116-8.

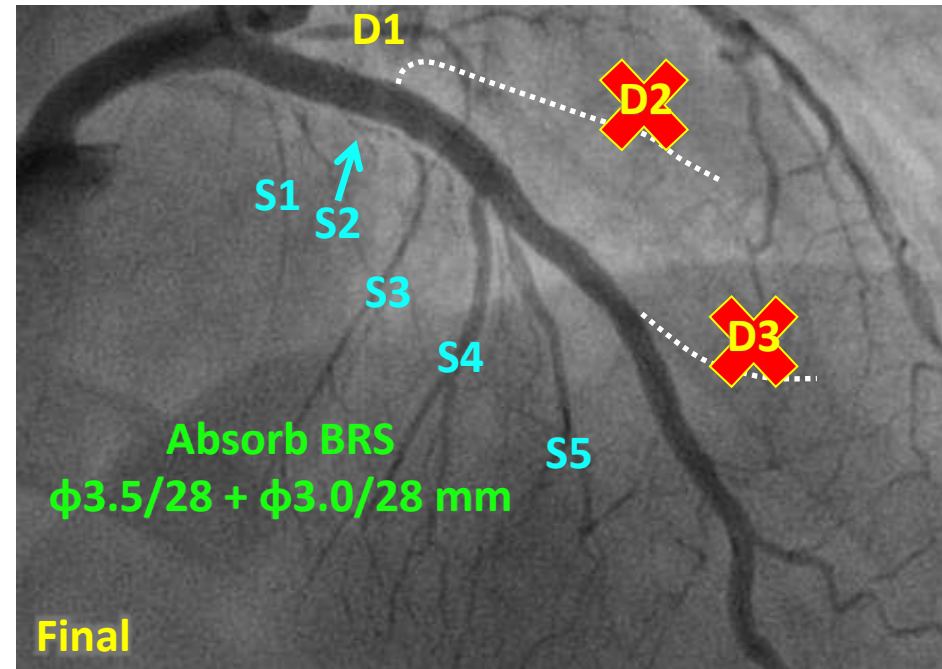
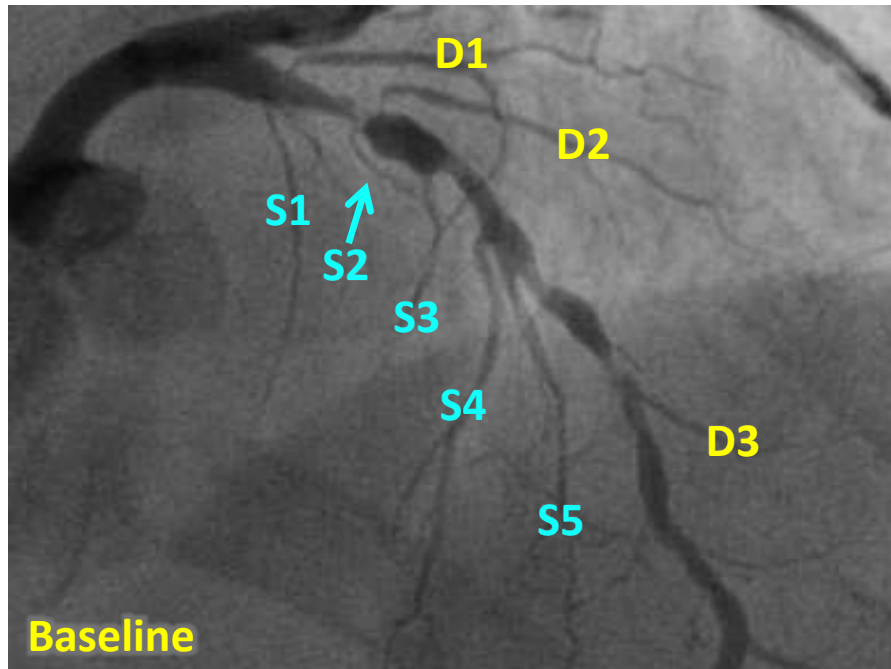


Muramatsu T et al. JACC Intv 2013;6:247-57.

BVS implantation seems to be associated with a higher incidence of side branch occlusion

1. Thicker and wider struts

- Side branch occlusion -
- Peri-procedural MI -



**Operators should have a
Low threshold to protect side branches
'if' side branches are large enough**

Guide Post 1

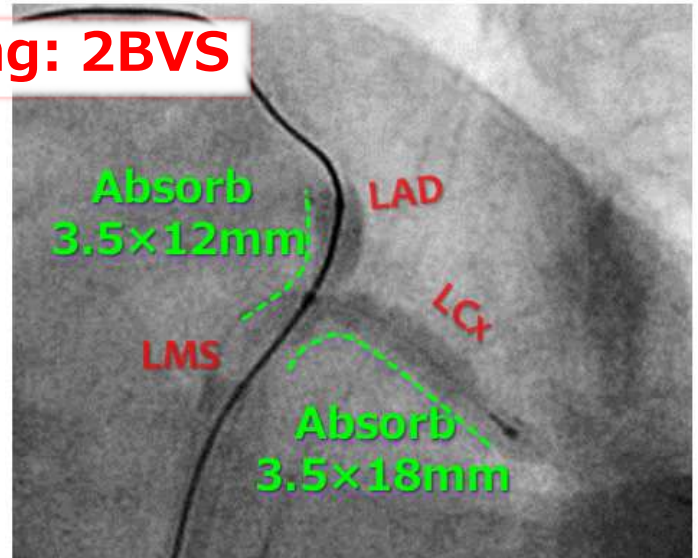
It should be well understood that when BVS is used in treating bifurcation lesion, there is higher possibility to lose side branches in the lesion than in using DES.

Therefore guide wire protection of major side branches becomes more important.

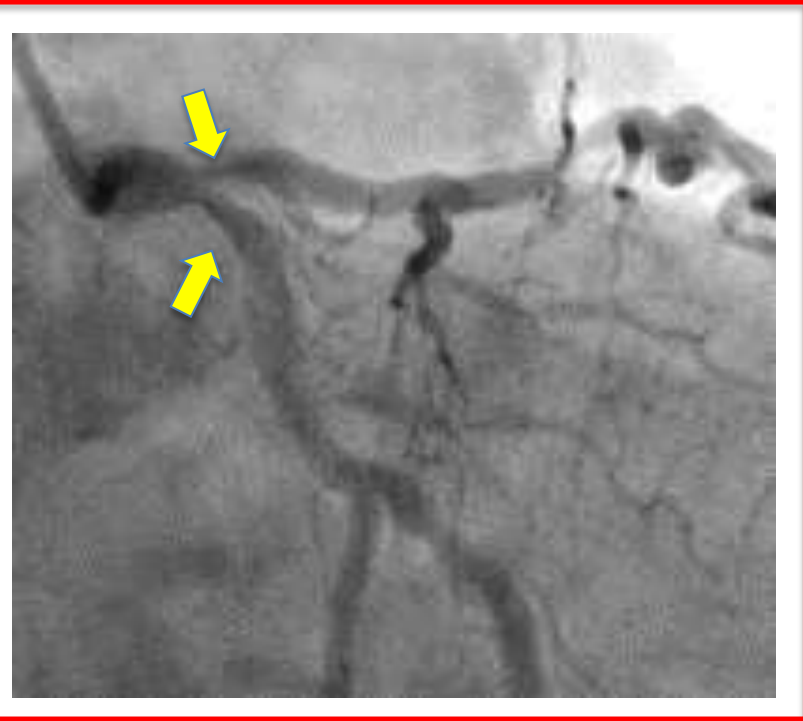
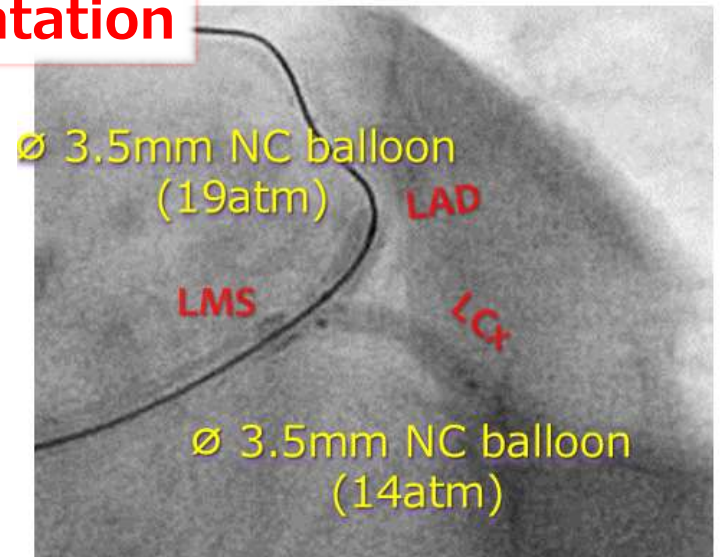
1. Thicker and wider struts

- CASE: V stenting in LMT -

V-Stenting: 2BVS



Post Dilatation

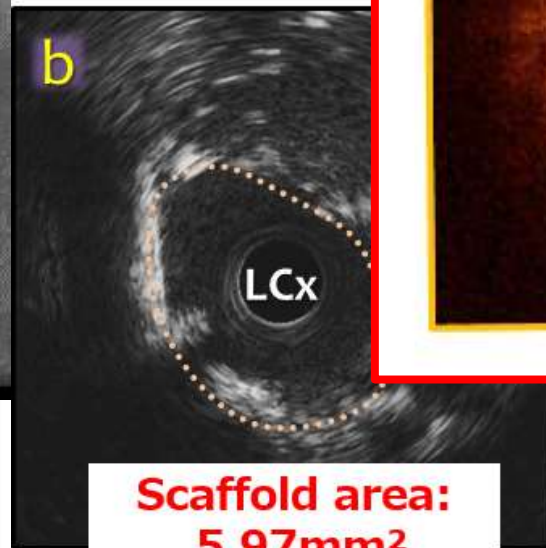
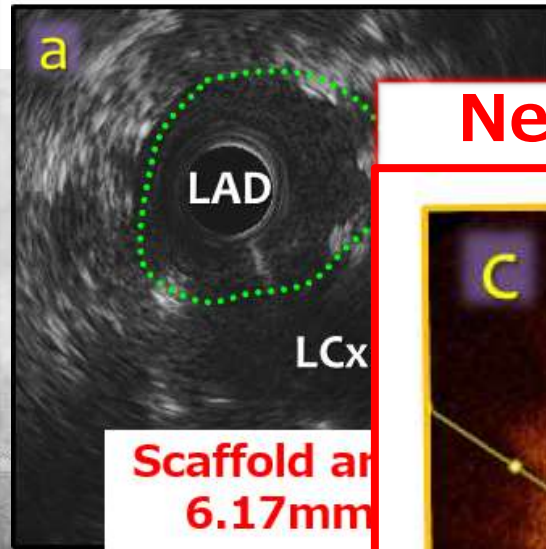


**Distal LM Stenosis
: os. LAD / os. LCx**

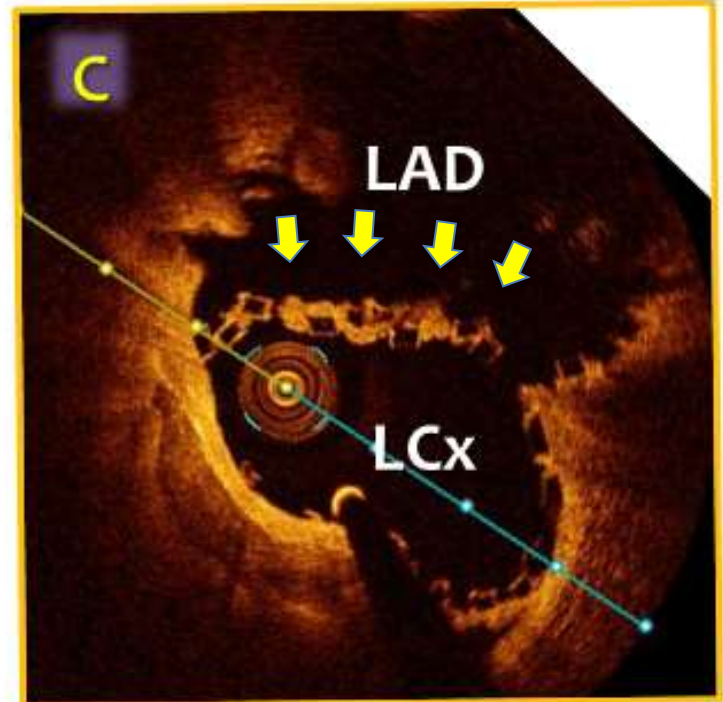
Courtesy of A. Colombo MD

1. Thicker and wider struts

- Post V-Stenting with 2 BVS -

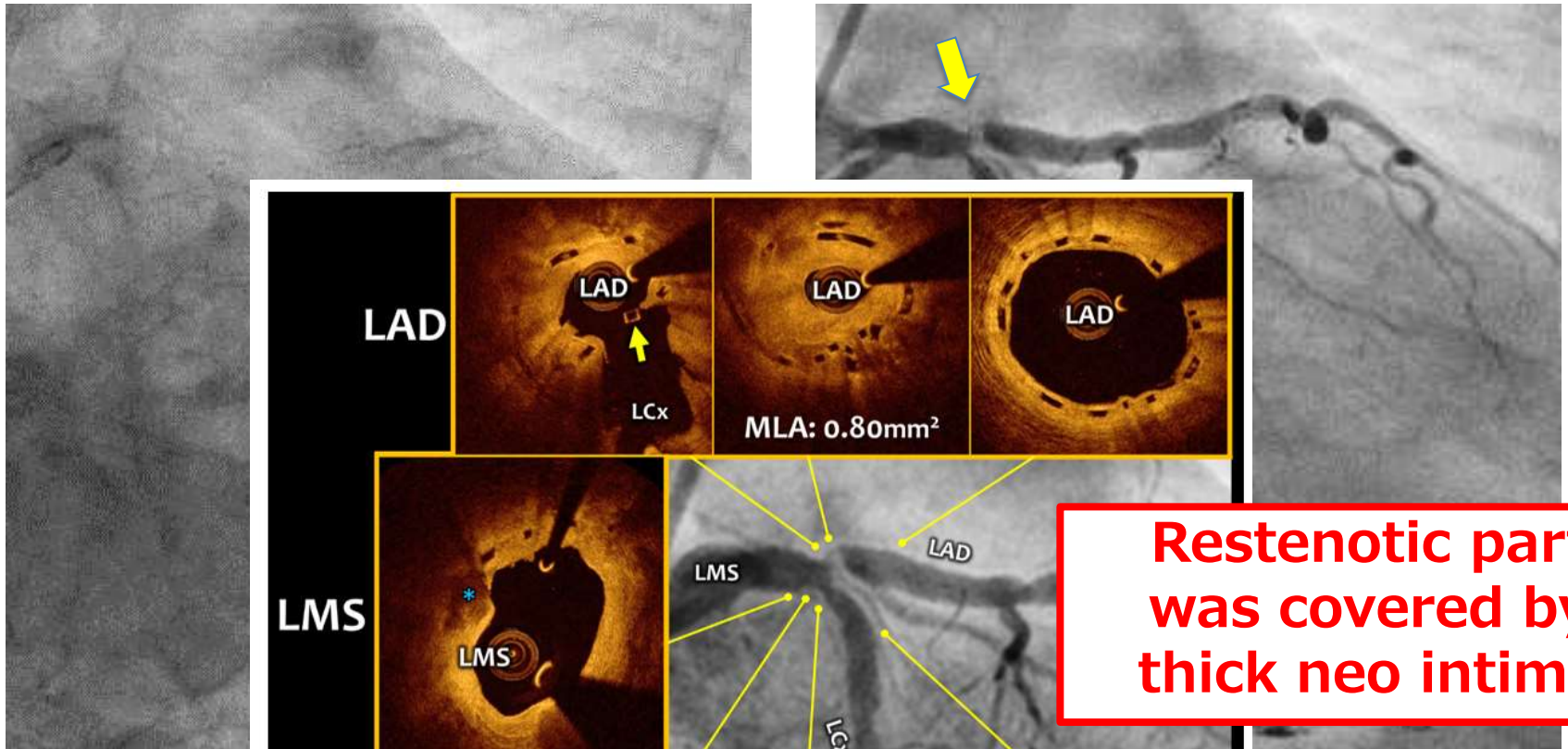


New Plastic Carina



1. Thicker and wider struts

- After 5 months, Pts. Backed to the HP. Because of recurrent angina -



**Restenotic part
was covered by
thick neo intima**

LAD

LAD

LAD

LAD

LCx

MLA: 0.80mm²

LMS

LMS

LMS

LAD

LCx

LCx

LAD

LCx

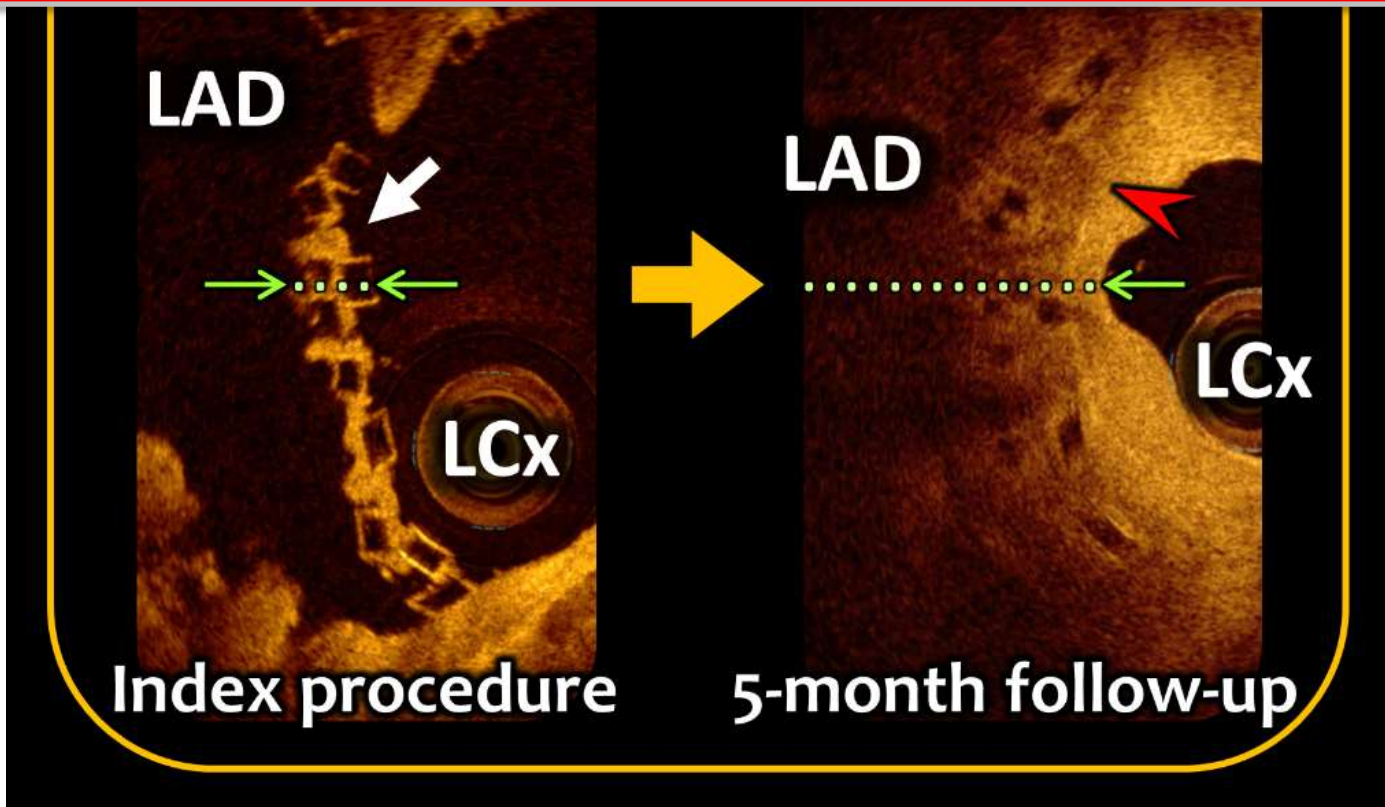
*

MLA: 1.82mm²

1. Thicker and wider struts

-Detailed Comparison -

“Double Layered Thicker Strut “ is a strong risk factor of Restenosis.

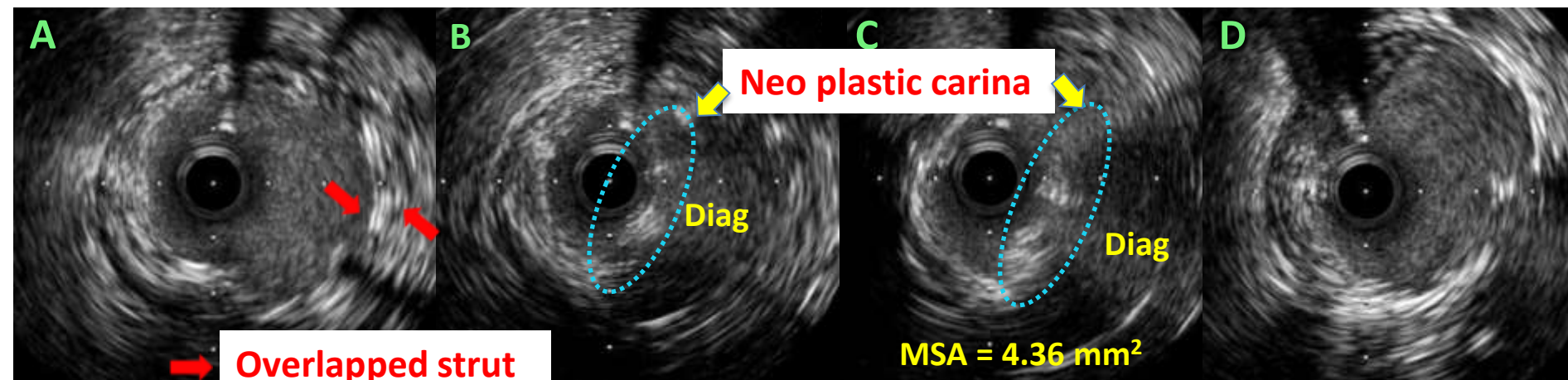
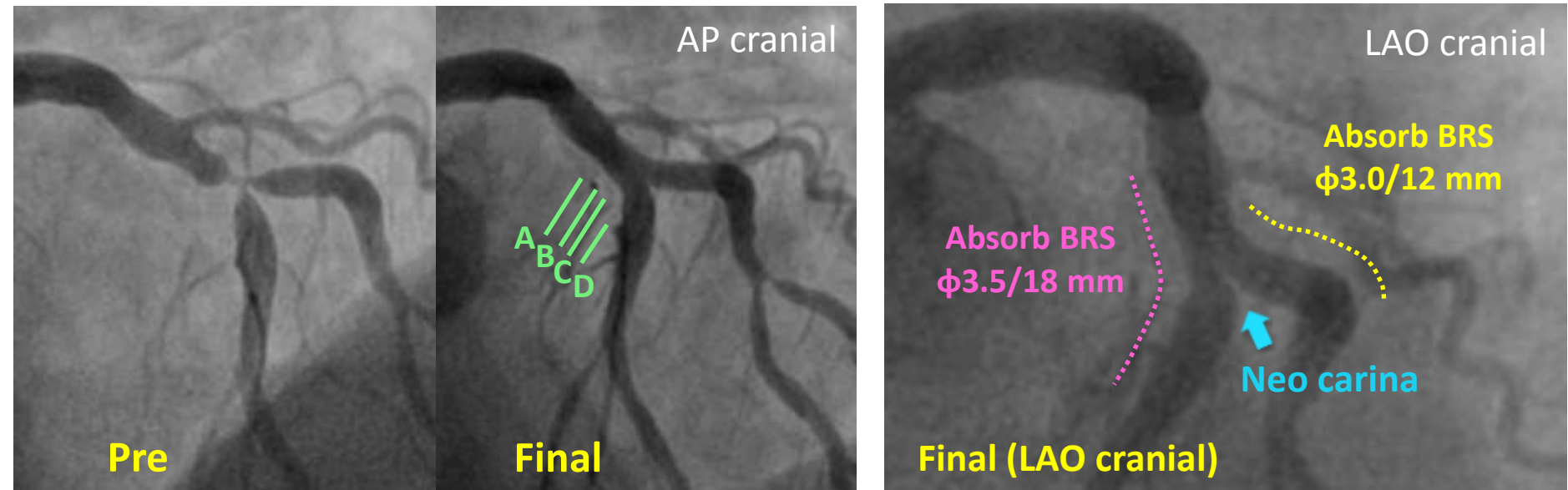


- Neo scaffold carina (↙) was covered by extremely thick neo intima at follow-up.
- Suspicious thrombus (↗) was found adjacent to buried neo scaffold carina.

V-Stenting.... NO !!

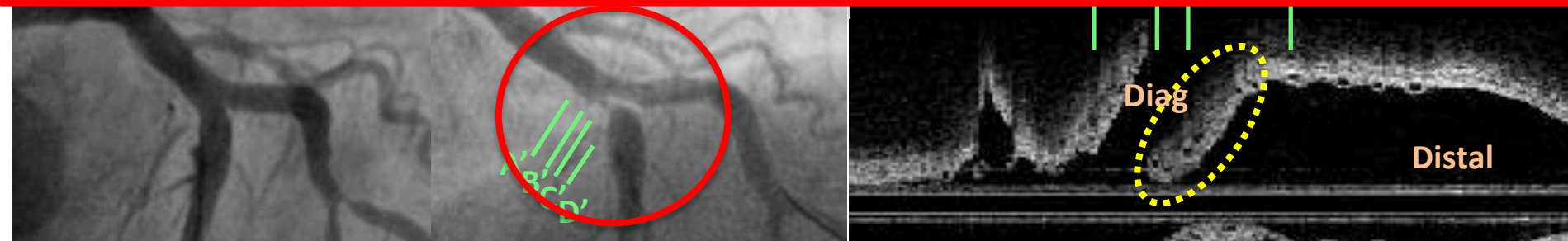
**What's about
TAP stenting ??**

- Case: TAP stenting with 2 BVS... - To much plastic carina ?? -

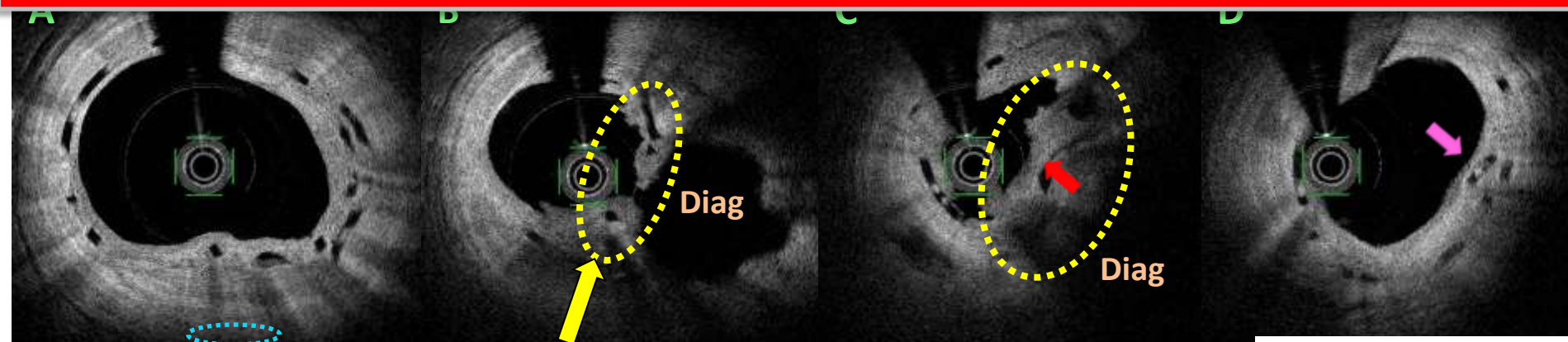


- Case: TAP stenting with 2 BVS...
 - To much plastic carina ?? -

Neo-plastic carina may accelerate hyperplasia at bifurcation



“Double Layered Thicker Strut” is a strong risk factor of Restenosis.



Neo-carina with thick neointima

➡ Deformed strut

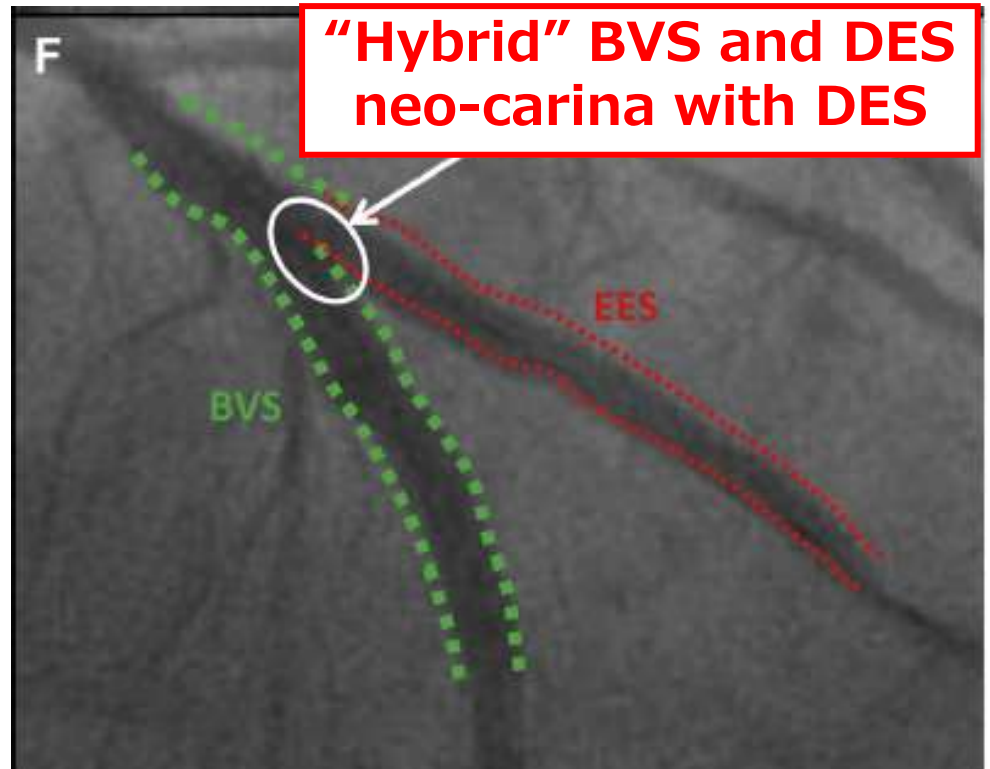
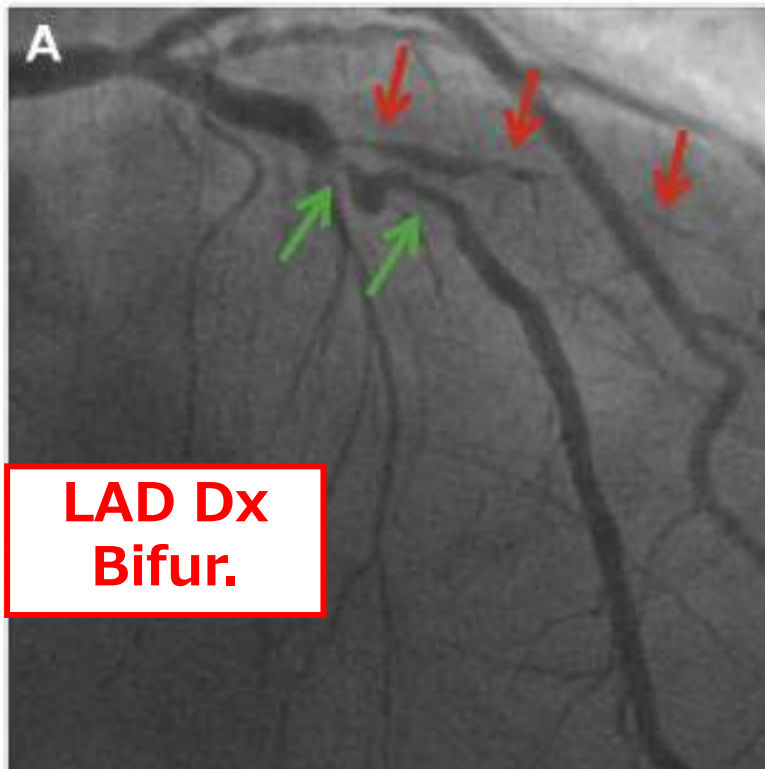
➡ Disrupted strut

Guide Post 2

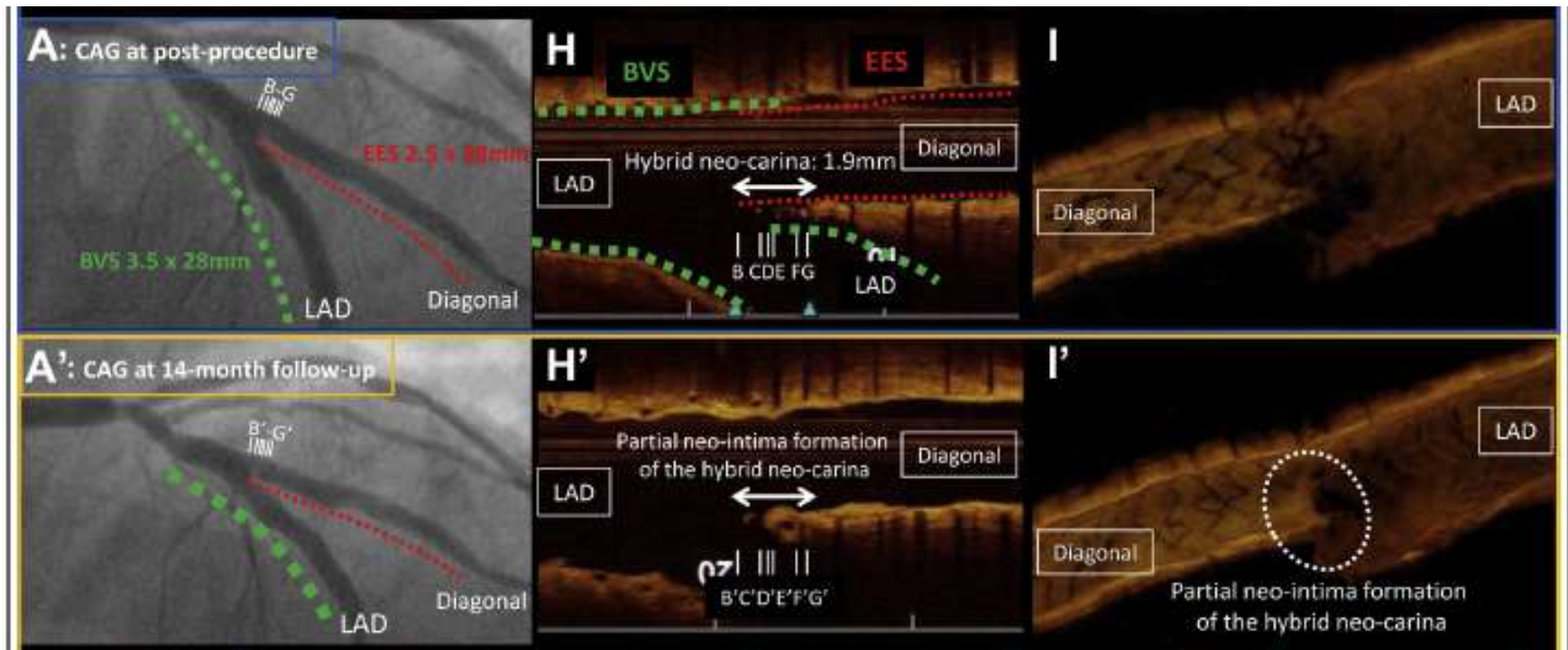
When 2 BVS is necessary in bifurcation lesion,
it is advisable to avoid overlapping 2 BVS
as restenosis rate is expected much higher
than single layer.

Hybrid... ??
(BVS+DES)

One-Year Follow-Up Optical Coherence Tomography of a “Hybrid” Neocarina After T-Stenting With Small Protrusion Technique Using a Bioresorbable Vascular Scaffold and a Metallic Stent



**For bifurcation lesion,
it is fine to combine BVS and DES
as hybrid stenting.**



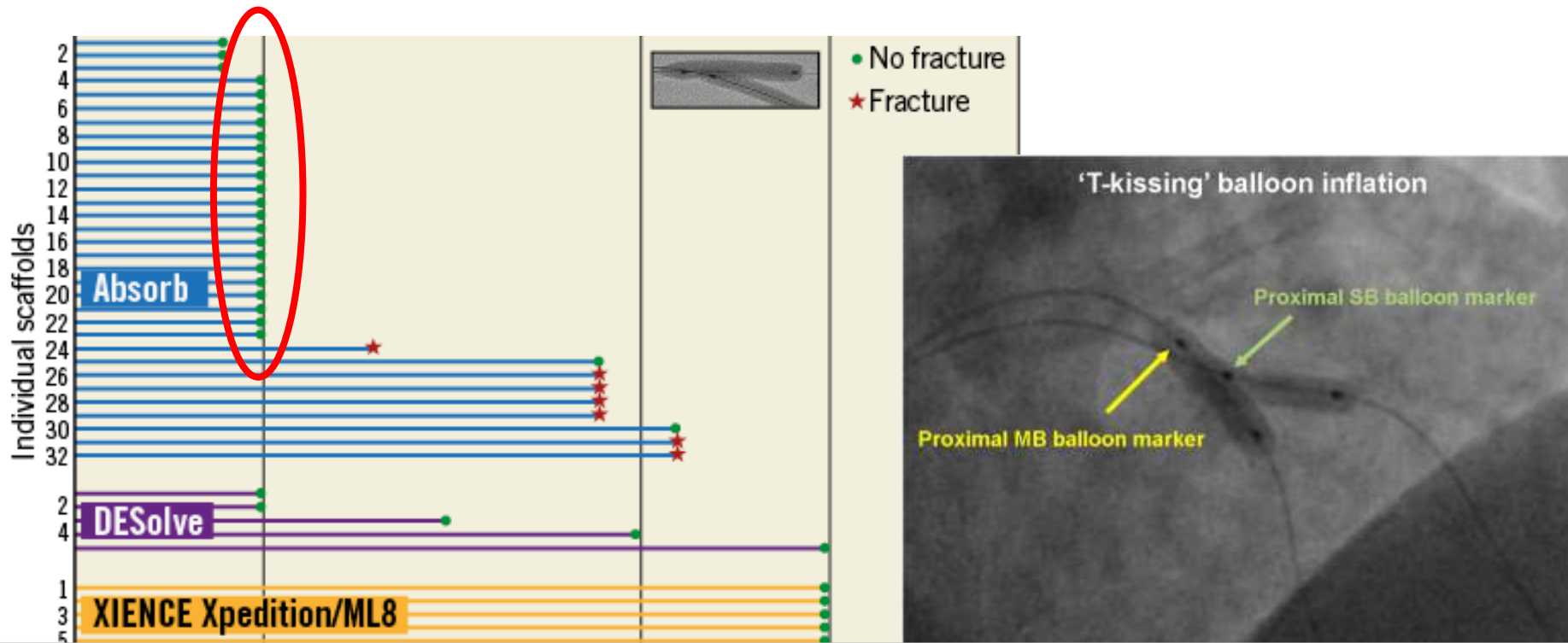
Guide Post 3

It is quite feasible that both BVS and DES are used in treating bifurcation lesion.

About Stent Fracture

2. Strut Fracture

- kissing balloon inflation -



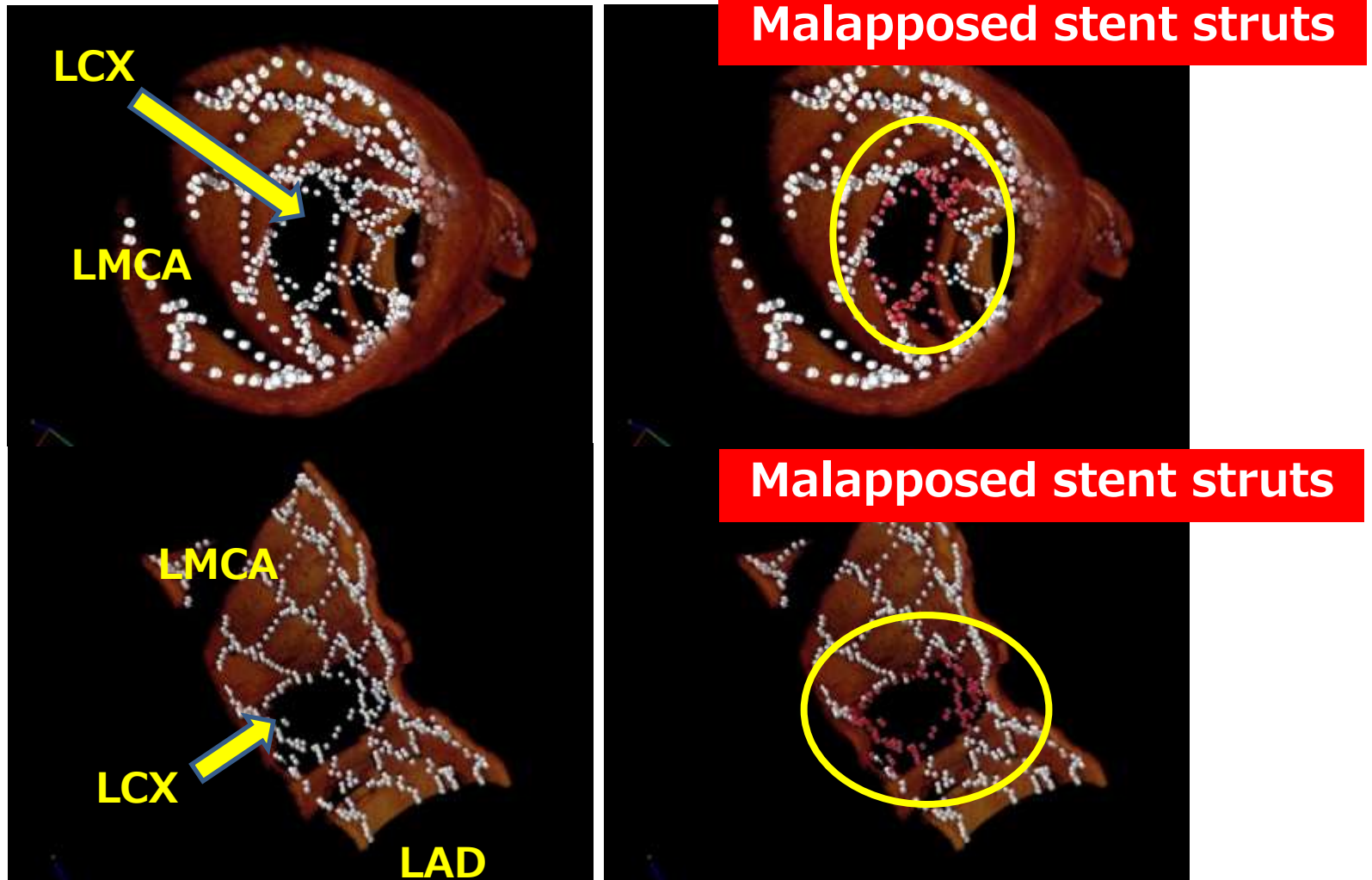
**In 3.0mm Absorb BRS
The safe threshold for mini-KBT
with 3.0mm NC balloons was 5atm.**

Guide Post 4

When kissing balloon technique is deployed after implanting BVS at bifurcation lesion, mini-KBT with gentle inflation and low pressure is recommendable.

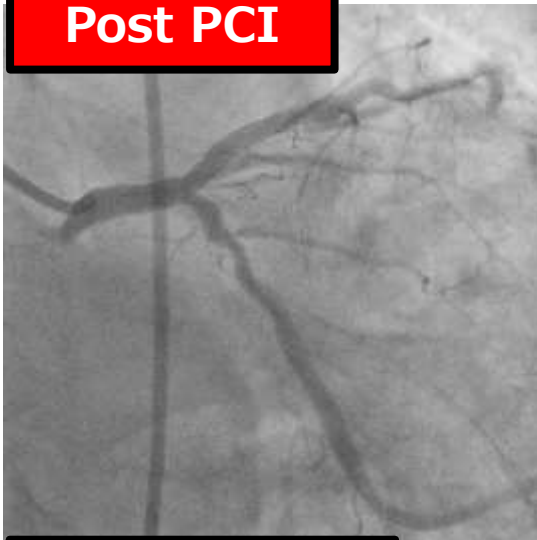
**About Jailed Strut
In side branch
with DES or BVS**

3D OCT Image After SES Implantation with inappropriate KBT



OCT Assessment of LCX ostium at F/U

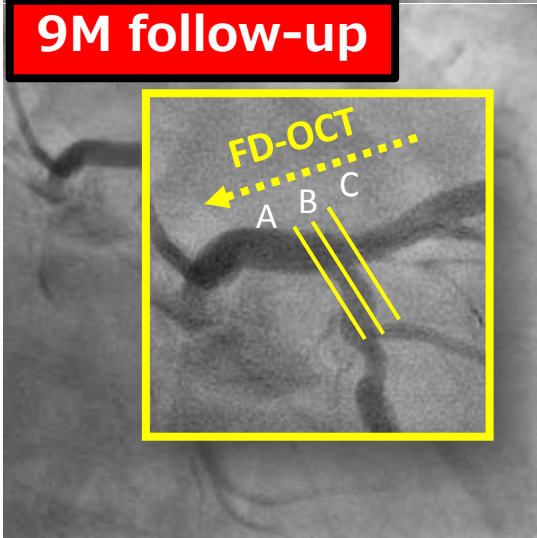
Post PCI



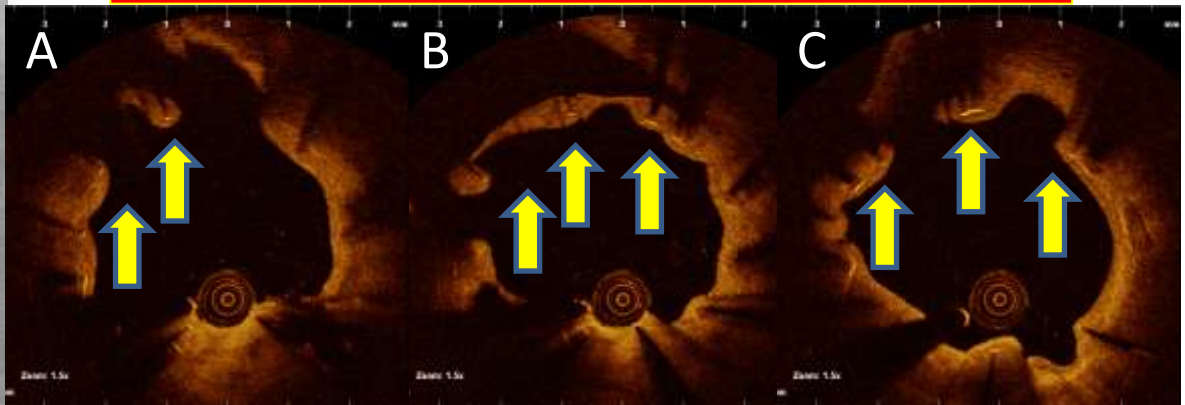
malapposed stent struts



9M follow-up

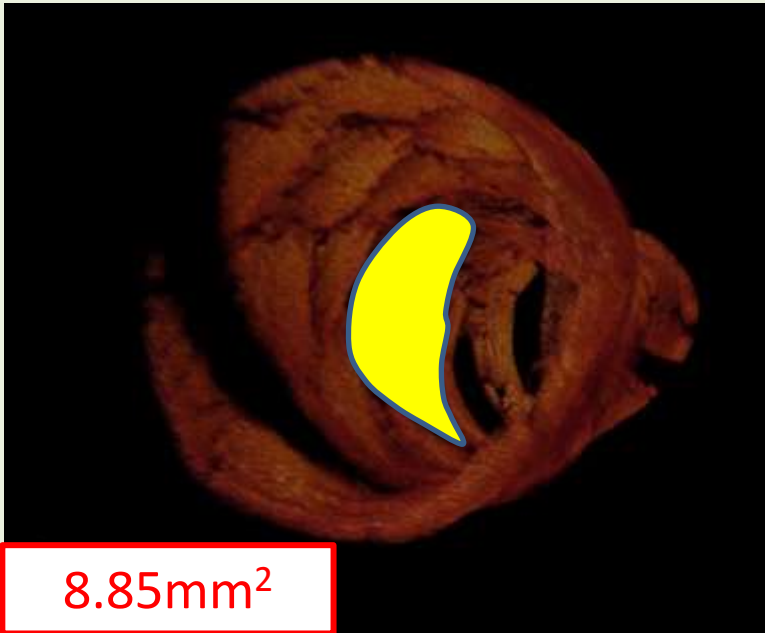


Neointimal proliferation over the malapposed stent struts

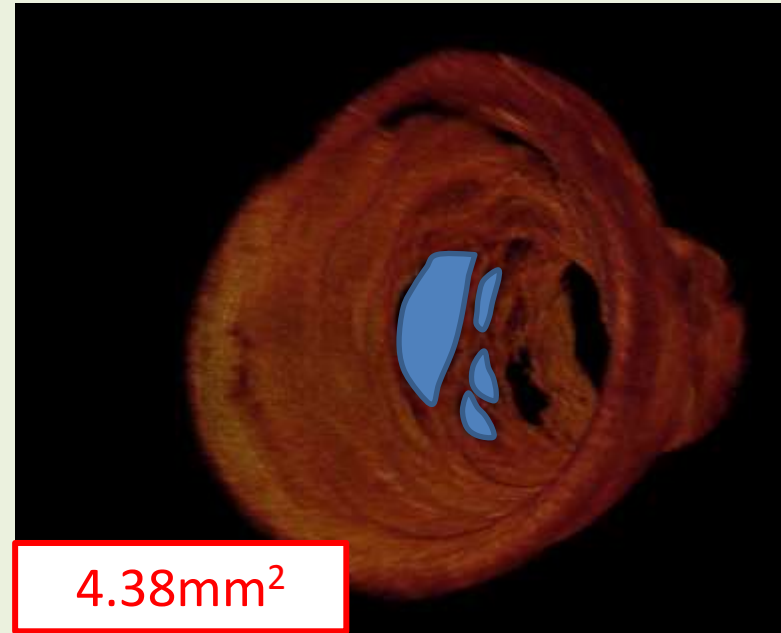


Area Narrowing of LCX ostium by 3D-OCT

Post PCI



Follow-up

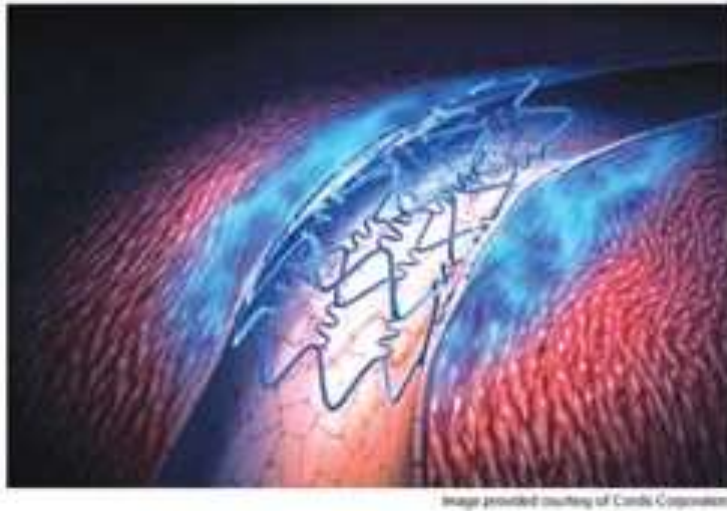


We calculated area narrowing(%) with this formula

$$\text{Area Narrowing (\%)} = \frac{\text{Area (post)} - \text{Area (follow-up)}}{\text{Area (post)}} \times 100$$

Area Shrinkage of LCX Ostium

Sirolimus-Eluting Stent
Cypher: Johnson and Johnson



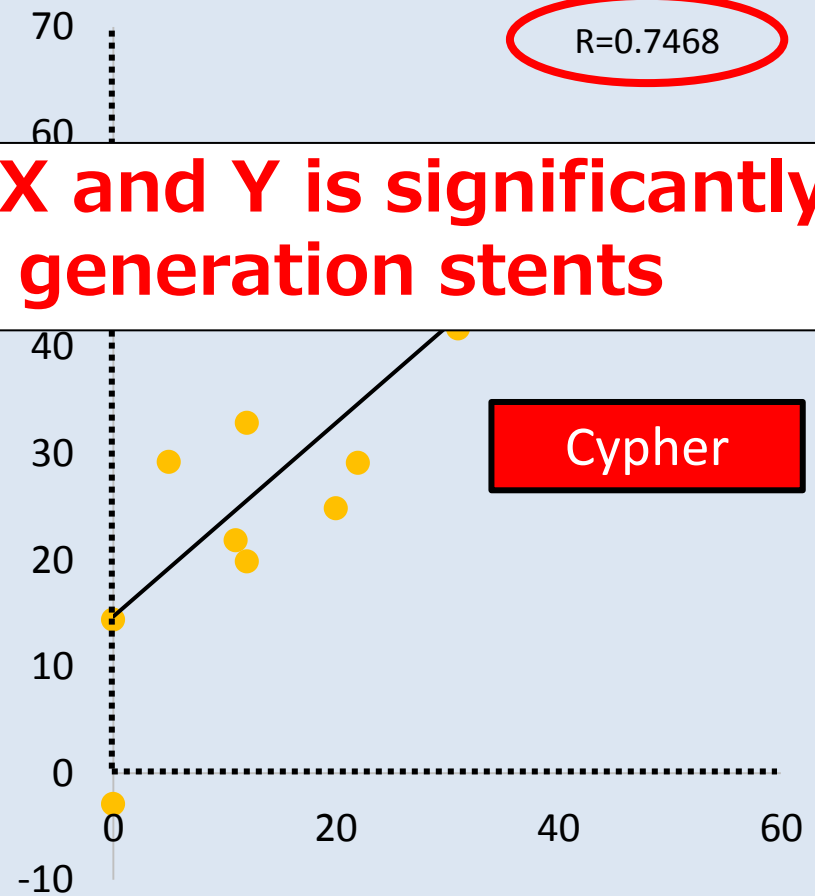
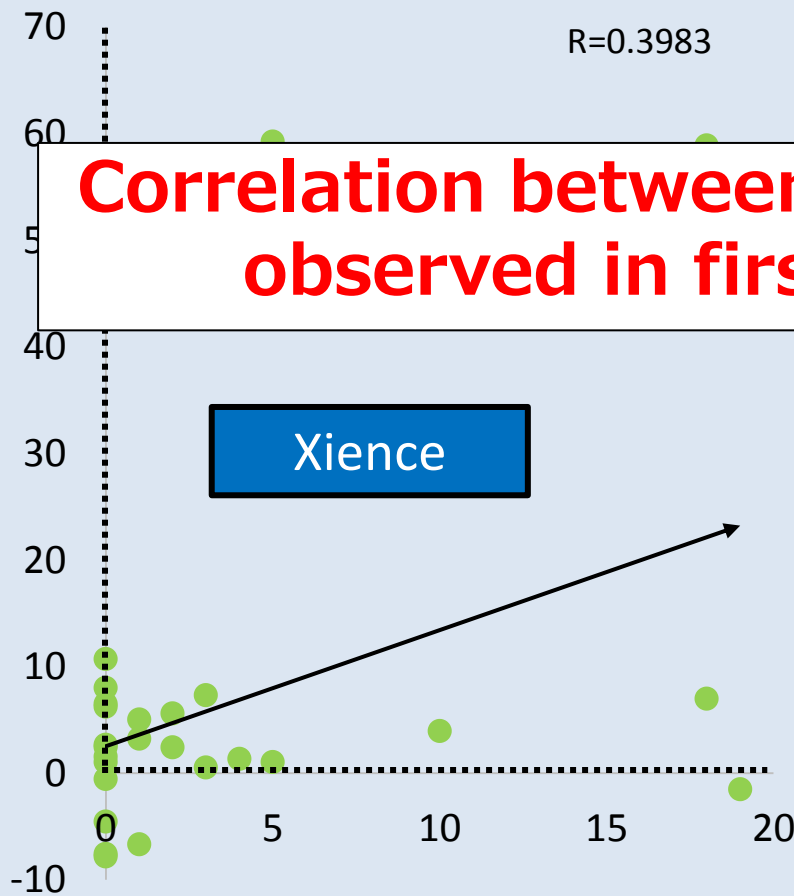
Everolimus-Eluting Stent
Xience V: abott vascular



	SES (n=10)	EES (n=15)	p Value
Post-PCI			
LCX ostium area, mm ²	5.41 ± 1.81	5.14 ± 2.59	0.785
9M follow-up			
LCX ostium area, mm ²	3.52 ± 1.03	4.46 ± 2.59	0.220
Area Shrinkage (%)	32.4 ± 15.73	9.78 ± 23.08	0.013

Relationship with number of residual struts and Area narrowing

LCX ostium area narrowing (%)



Correlation between X and Y is significantly observed in first generation stents

X axis indicates Number of malapposed stent struts

Lesson from MITO: DES

How many jailed struts, or how much area that jailed struts occupies in the area of ostium of LCX seems to be a determinant factor of **Future Endothelialization** for the coverage of these jailed struts.

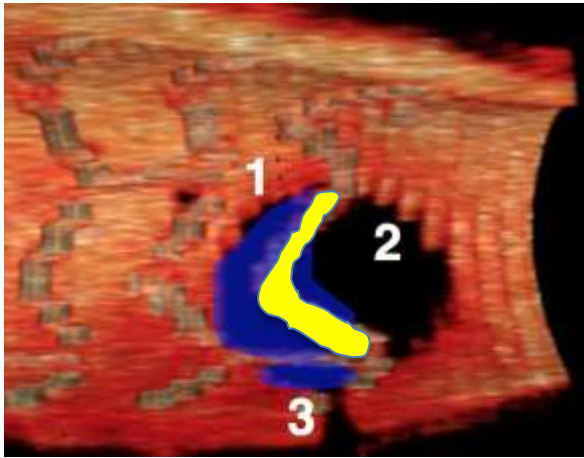
Finishing the case with optimum KBT is very indispensable for LMT bifurcation PCI

Jailed side branch with BVS

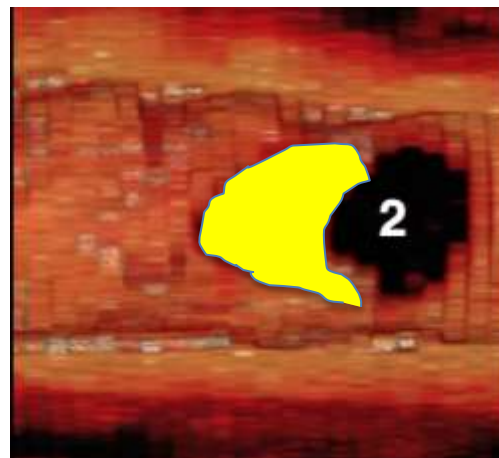
Neointimal proliferation at SB ostium

3D-OCT evaluation of jailed side branches

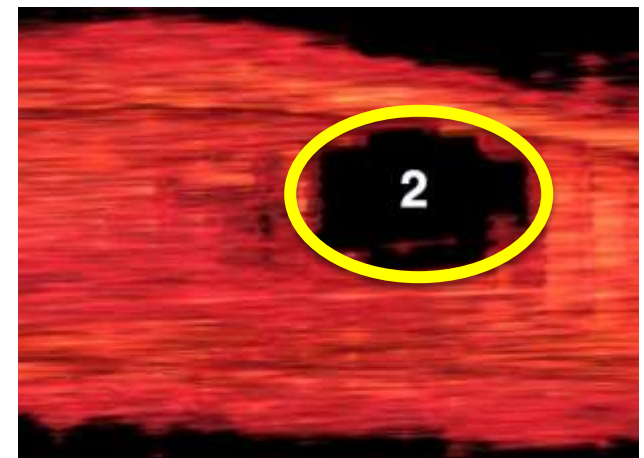
Baseline



1 year



3 years

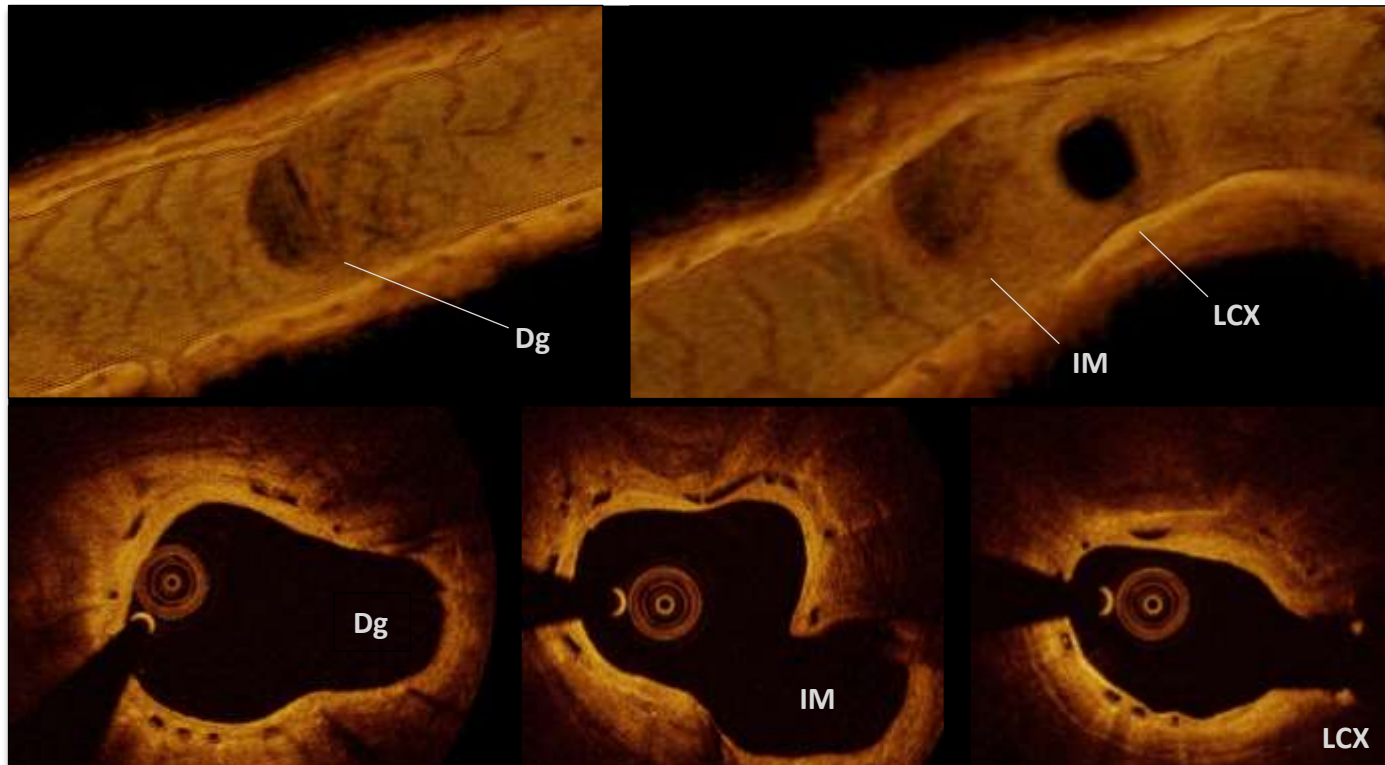


Onuma Y et al. TCT 2014

Ostium area was reduced due to the neointimal growth at 1 year. However, the ostium area increased due to the reduction of neointima and recreation of the bifurcation carina.

Jailed side branch with BVS -if No KBT-

Case: BVS implant main branch without touching SB
- No Final KISS ; 2Years Later OCT shows "beautiful Opening SB"-



If the side branch is not compromised, single cross-over stenting without any SB intervention could be considered.

Guide Post 5

When BVS is implanted at main branch, depending on the location of its struts over the ostium of side branch, without KBT, the ostium of side branch may keep cleanly open.

3. No-Neointimal proliferation at SB ostium

- Bright Side of BVS –

Case: Hybrid Stenting with BVS and DES in bifurcation lesion

Complex bifurcation Lesion

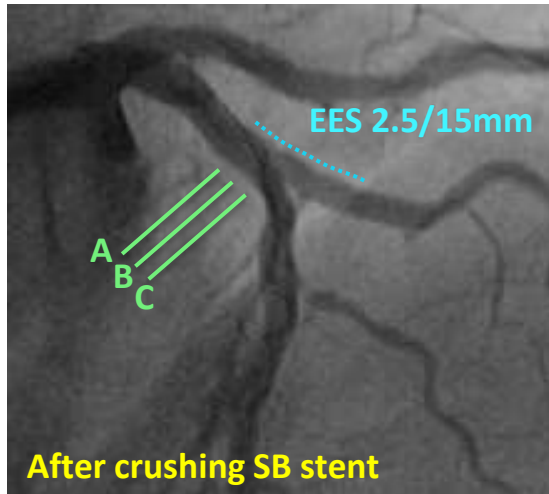
-diffuse SB disease, SB with difficulty to be wired, true bifurcation-



3. No-Neointimal proliferation at SB ostium

- Bright side of BVS -

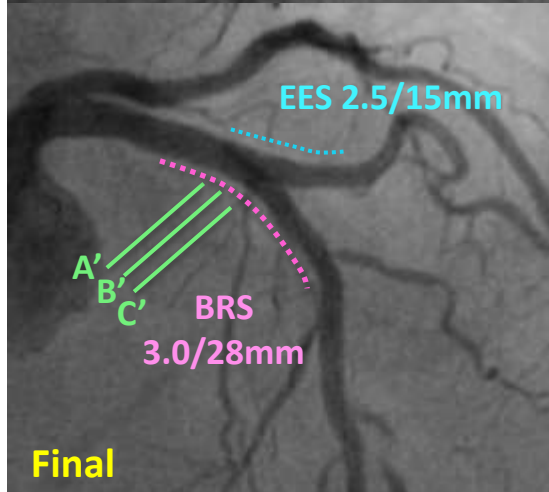
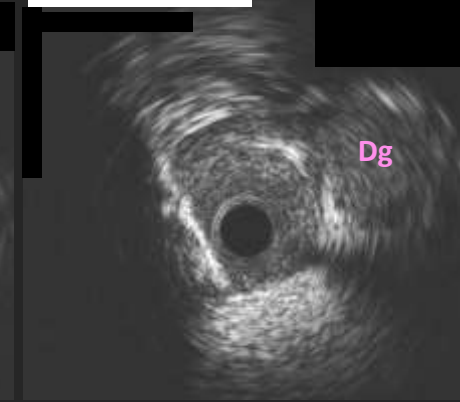
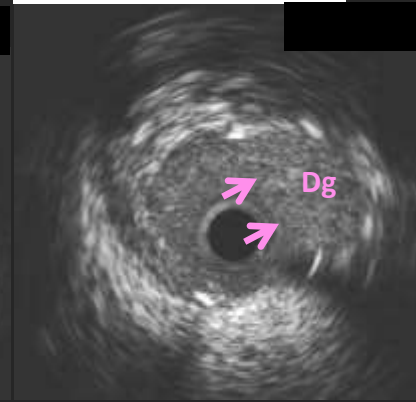
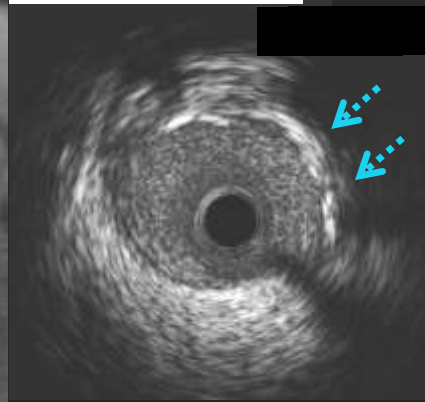
Hybrid mini-crush without KBT/SB dilatation



A (proximal)

B (bifurcation)

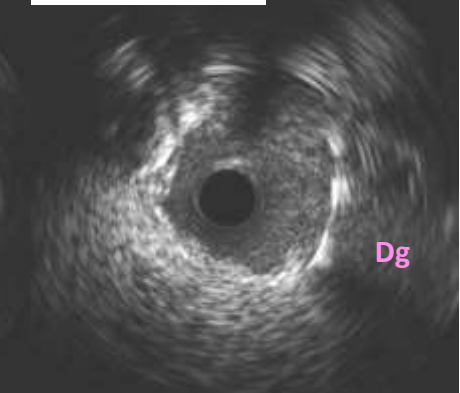
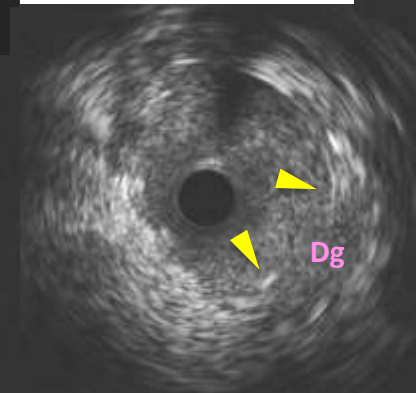
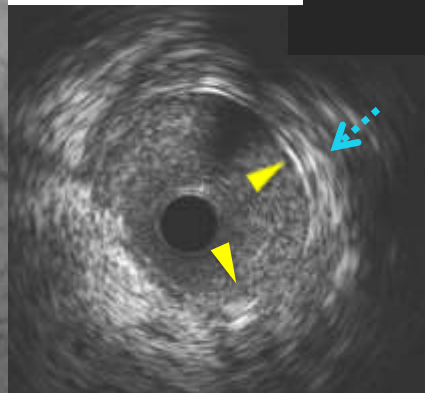
C (distal)



A' (proximal)

B' (bifurcation)

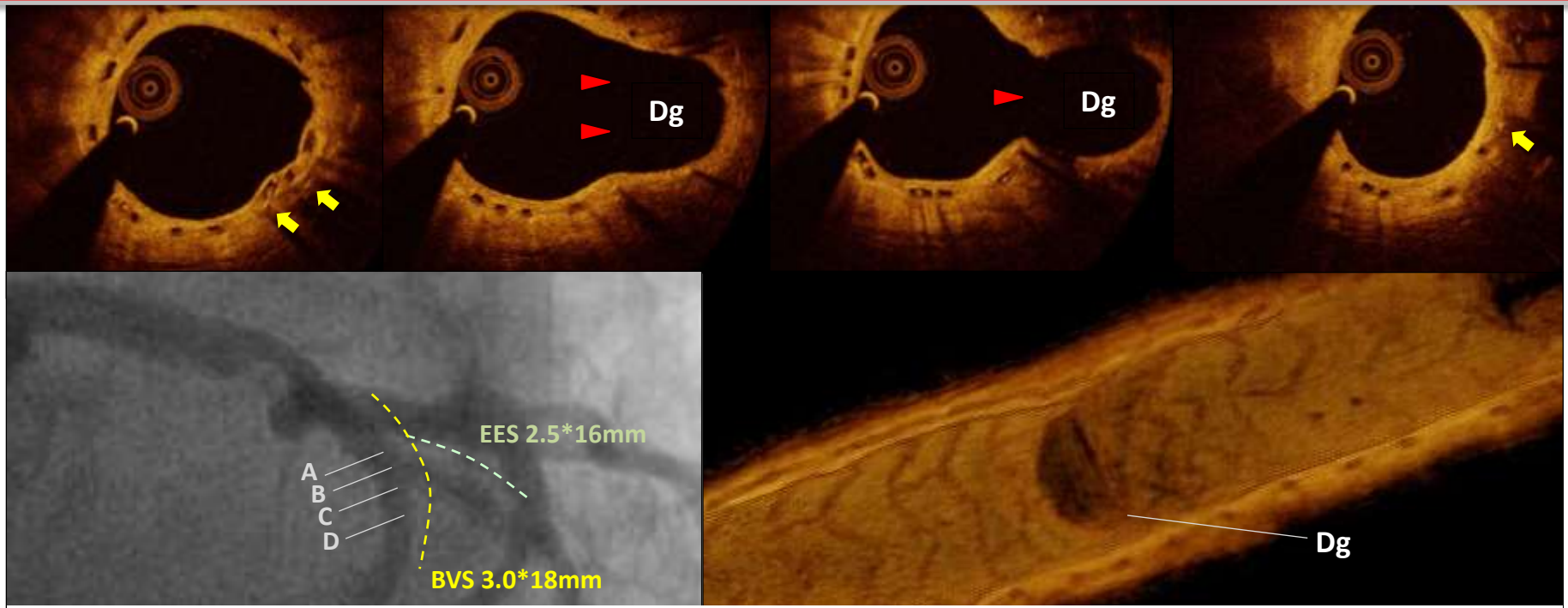
C' (distal)



3. No-Neointimal proliferation at SB ostium

Case: - Bright side of BVS -

**Hybrid stenting (BVS and DES)
“Without final KBT” could be considered.**



1. Scaffolds jailed Diagonal branch are completely discernible by OCT
2. BVS scaffolds on crushed EES struts are completely covered with homogeneous neo-hyperplasia.

Guide Post 6

It is quite feasible that both BVS and DES are used in treating bifurcation lesion. Depending on the location of BVS struts which is implanted at main branch (If struts do not interfere the opening of side branch ostium), KBT may not be necessary.



Elective 2 scaffold/stent

Angle $\cong 90^\circ$

$70^\circ < \text{Angle} < 90^\circ$

Angle $< 70^\circ$

**T stenting
with BRS or DES**

Mandated first KBT
No final KBT if possible

**Hybrid mini-crush
or Modified T
with DES**

Mandated first KBT
No final KBT if possible

**Hybrid mini-crush
with DES**

Mandated first KBT
No final KBT if possible

In case of 2 stenting, first KBT should be considered to reduce strut protrusion.

- **Culotte** - massive BRS overlap, strut disruption, strut protrusion...

**About
LCX ostium
-Very unique position-**

Delayed Disruption of a Bioresorbable Vascular Scaffold

JACC: CARDIOVASCULAR IMAGING, VOL. 7, NO. 8, 2014

AUGUST 2014:843-50

Toru Naganuma, MD

Antonio Colombo, MD*

*EMO-GVM Centro Cuore Columbus

Previous DES

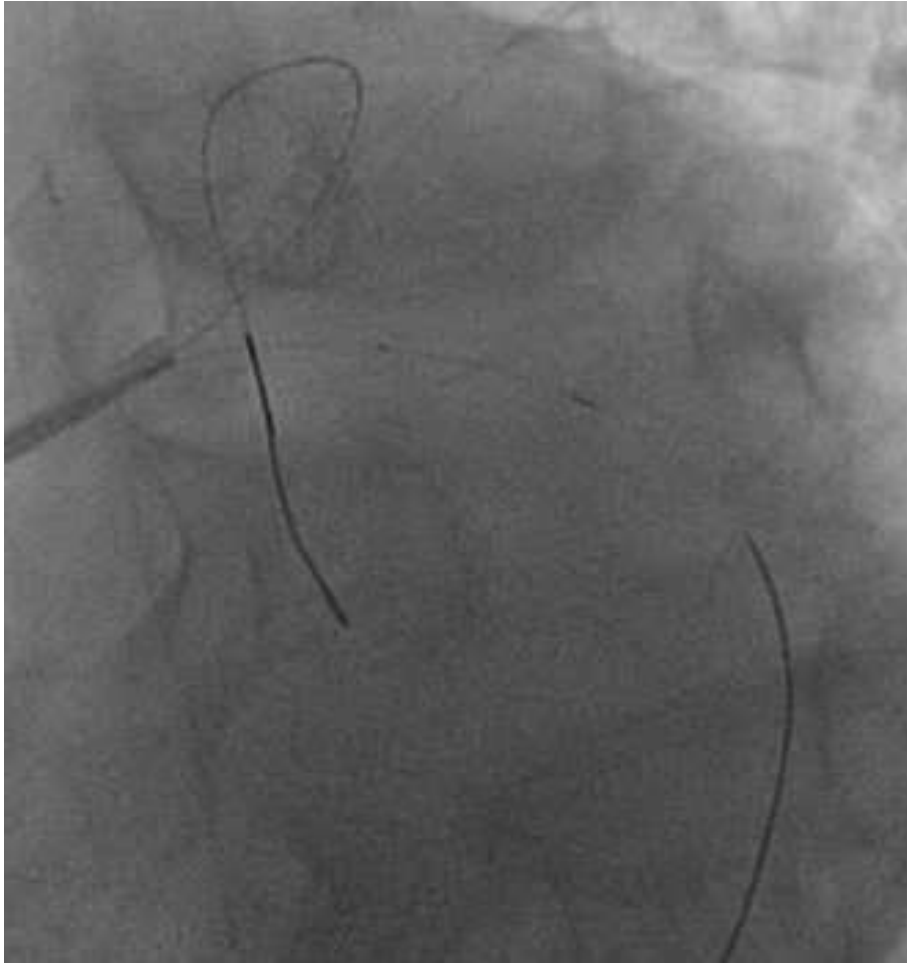
3.0 NC Balloon
pre Dilatation...

BVS 3.5 x 12mm

3.5mm NC balloon

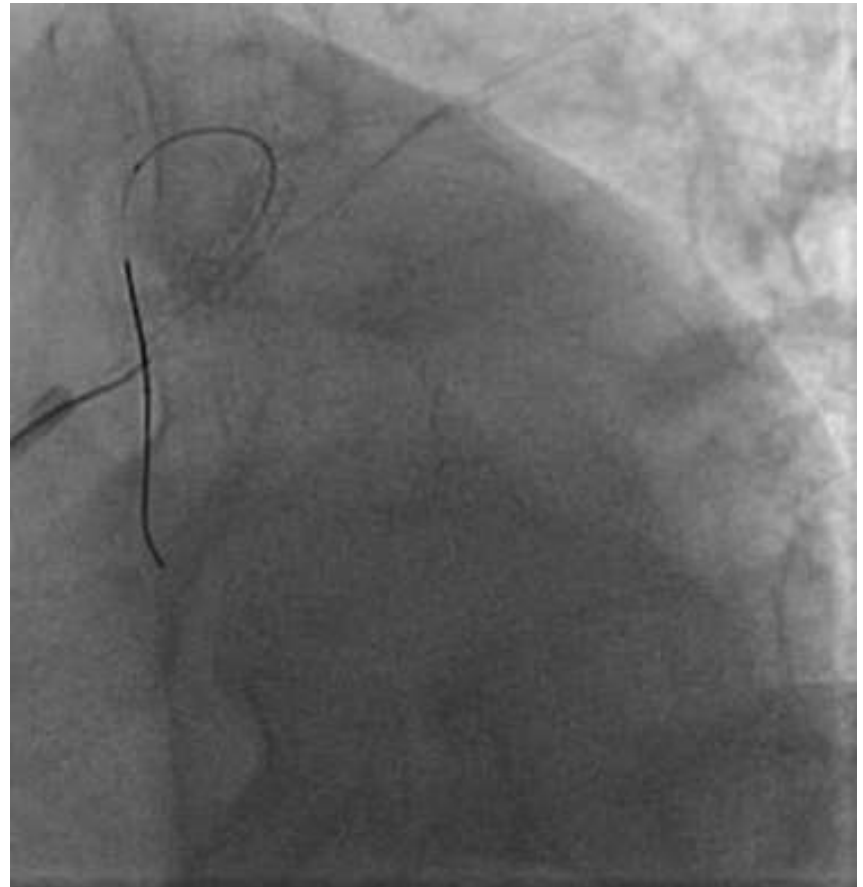
Delayed Disruption of a Bioresorbable Vascular Scaffold

Final Angiogram



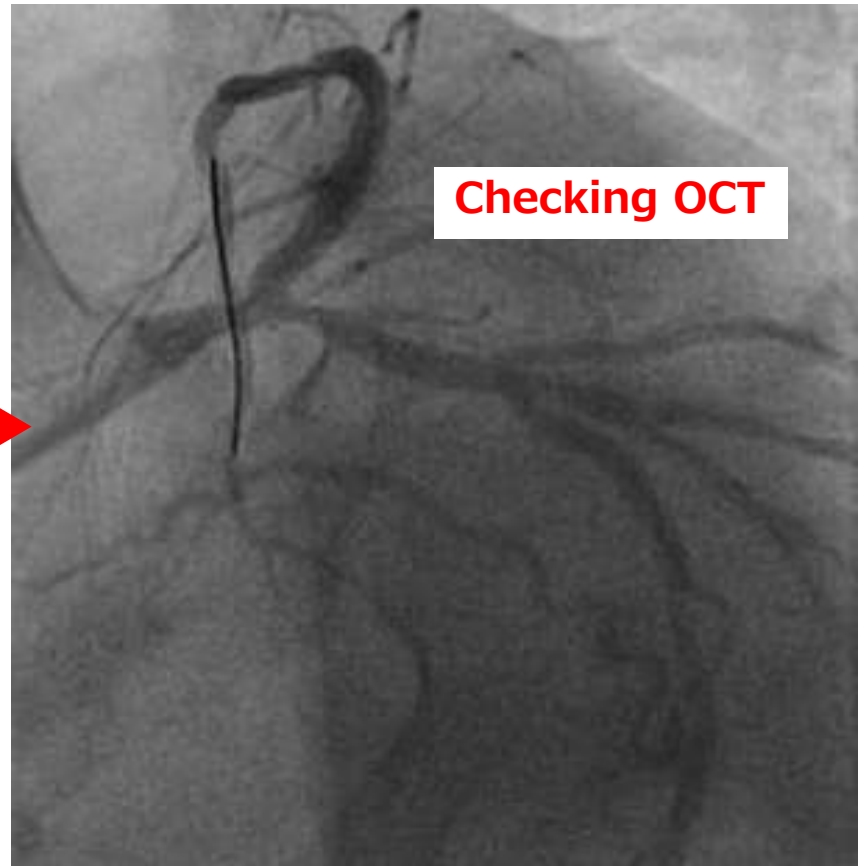
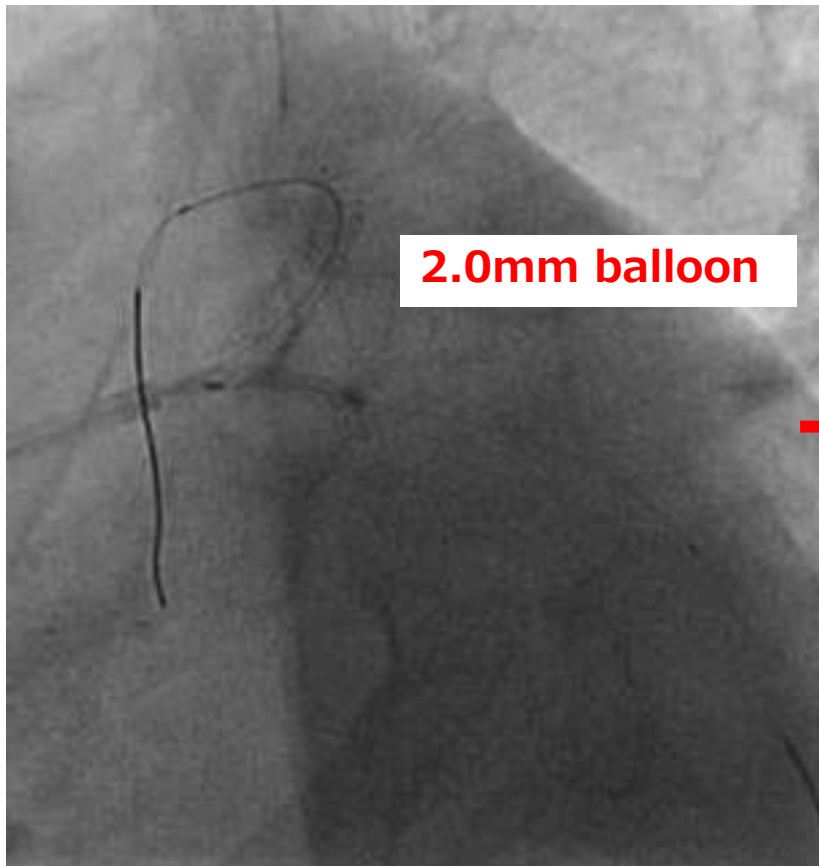
Delayed Disruption of a Bioresorbable Vascular Scaffold

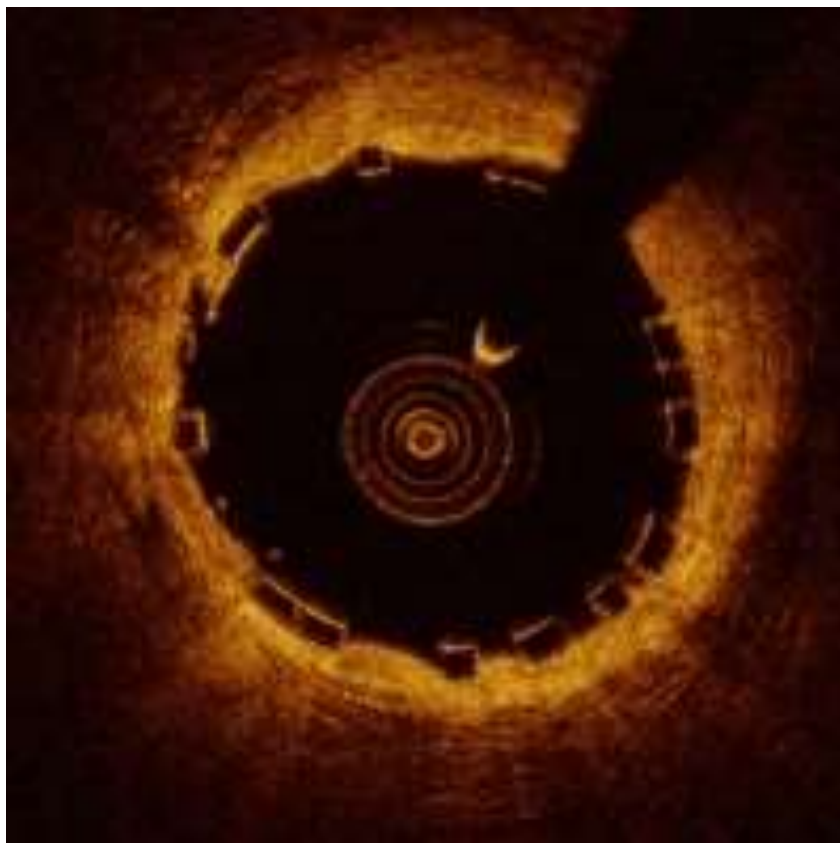
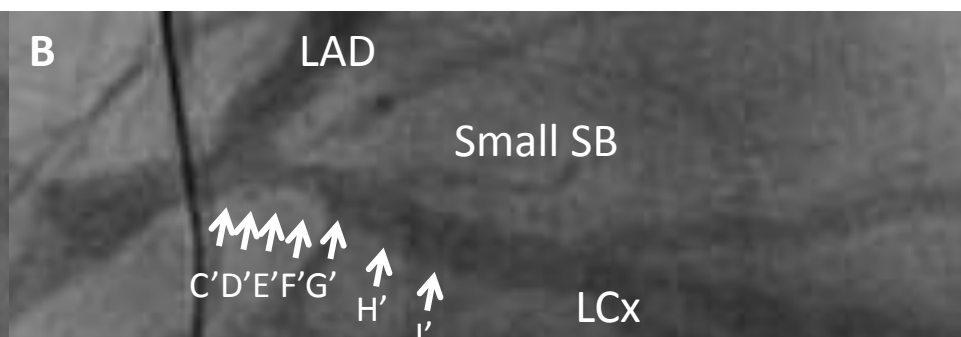
Only 6month later...Severe Restenosis in LCX ost.



Delayed Disruption of a Bioresorbable Vascular Scaffold

Checking OCT at LCX ost





Small SB

overlapping struts

Small SB

Guide Post 7

Implantation of BVS at ostium of LCX
may be problematic

BVS in CTOs

**At JIM ; I was a operator
(Dr. Colombo' meeting in 2012)**



Me

**Prof. Antonio
Colombo**

**Dr. Alaide
Chieffo**

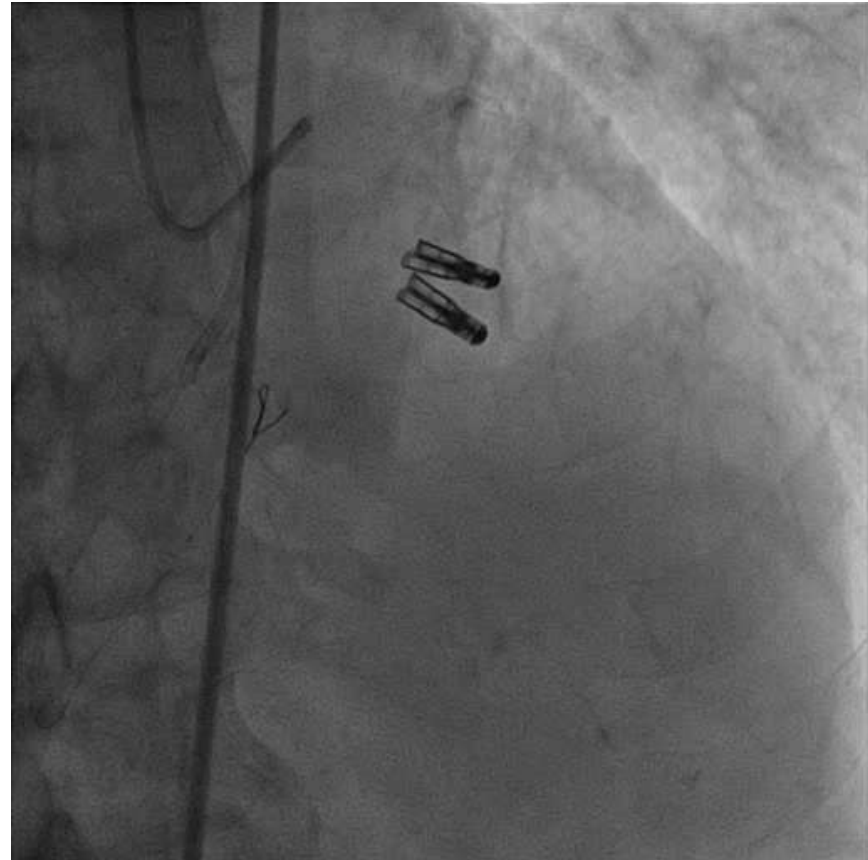
70's male LAD-CTO

**At Live Demo. In Milan
2012: I was a operator**

**70's male
EF: 44%
Normal renal function
Post Mitra-Clip**

**5th attempt LAD CTO
from prox. to mid LAD**

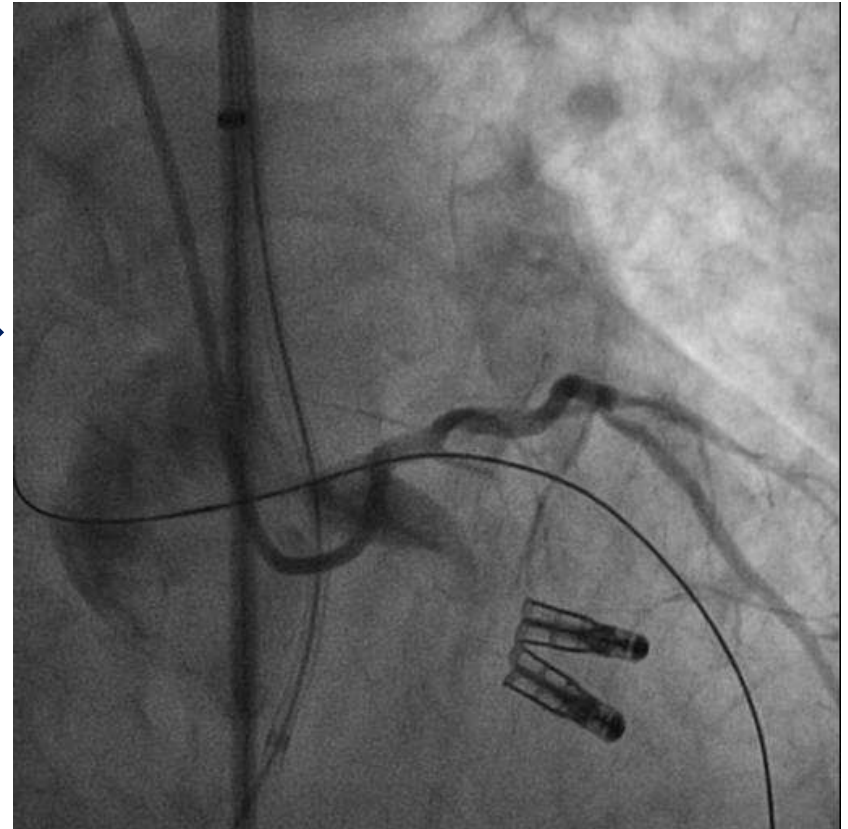
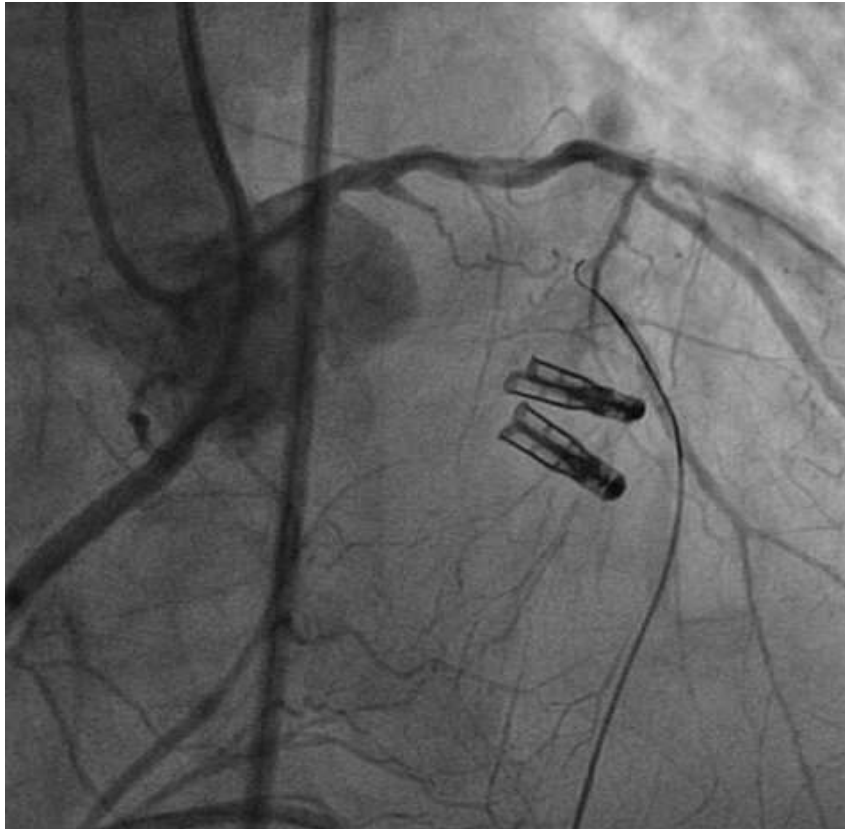
LAD CTO



collaterals from 1) distal RCA (PD) via small septal branches
2) conus branch and 3) antegrade small bridge c

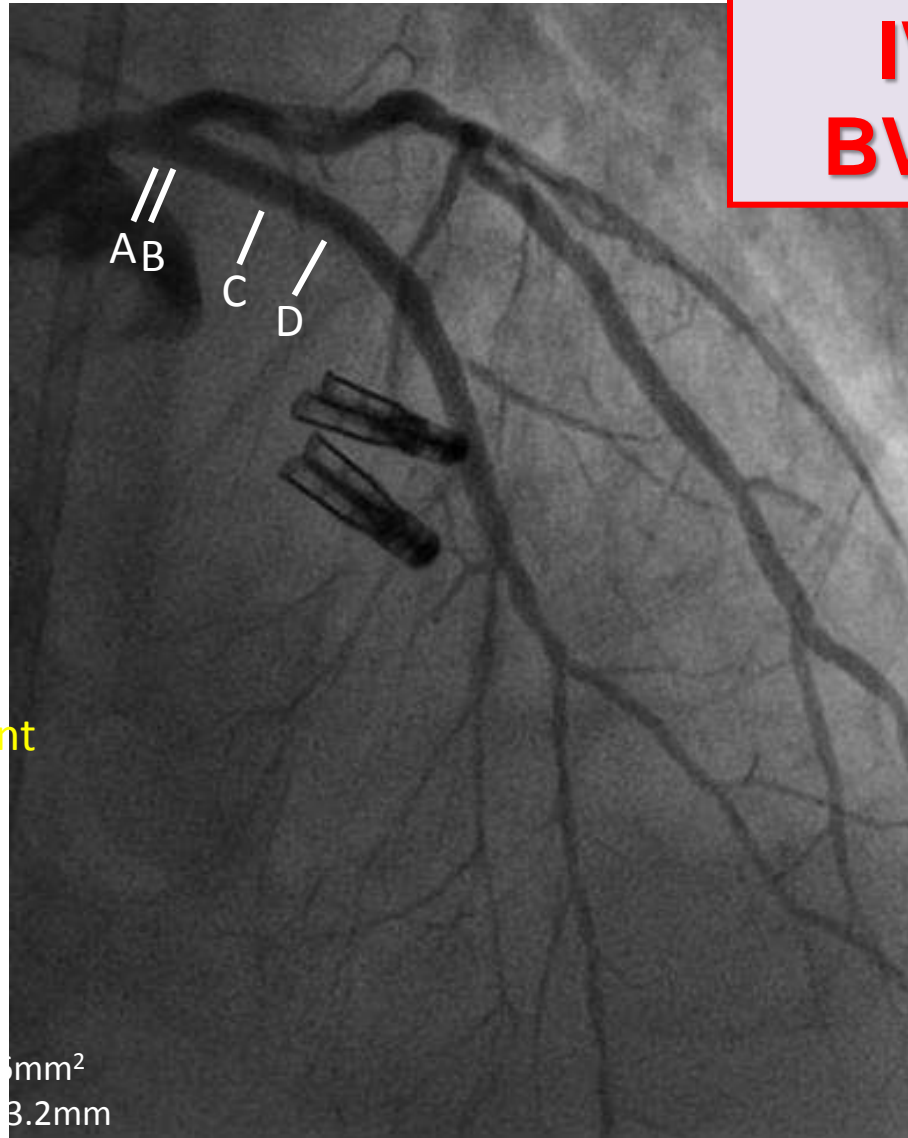
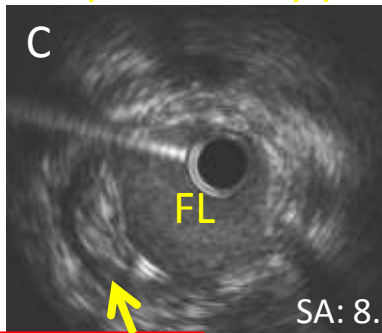
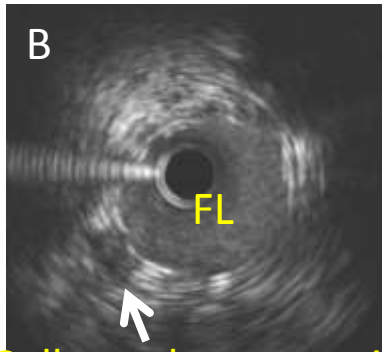
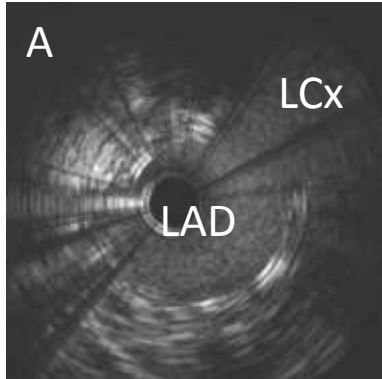
70's male LAD-CTO

Use Retrograde approach

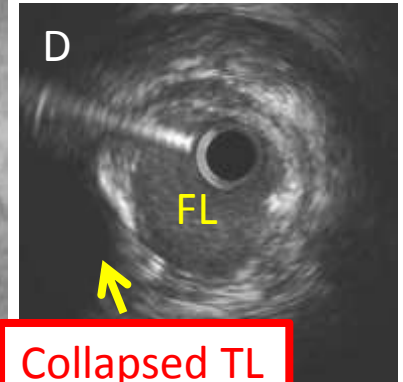


After crossing the GW, Dilated with 2.5mm Balloon and implanted 2BVS(3.0mm and 3.5mm×18mm)

70's male LAD-CTO



**IVUS after
BVS implant.**



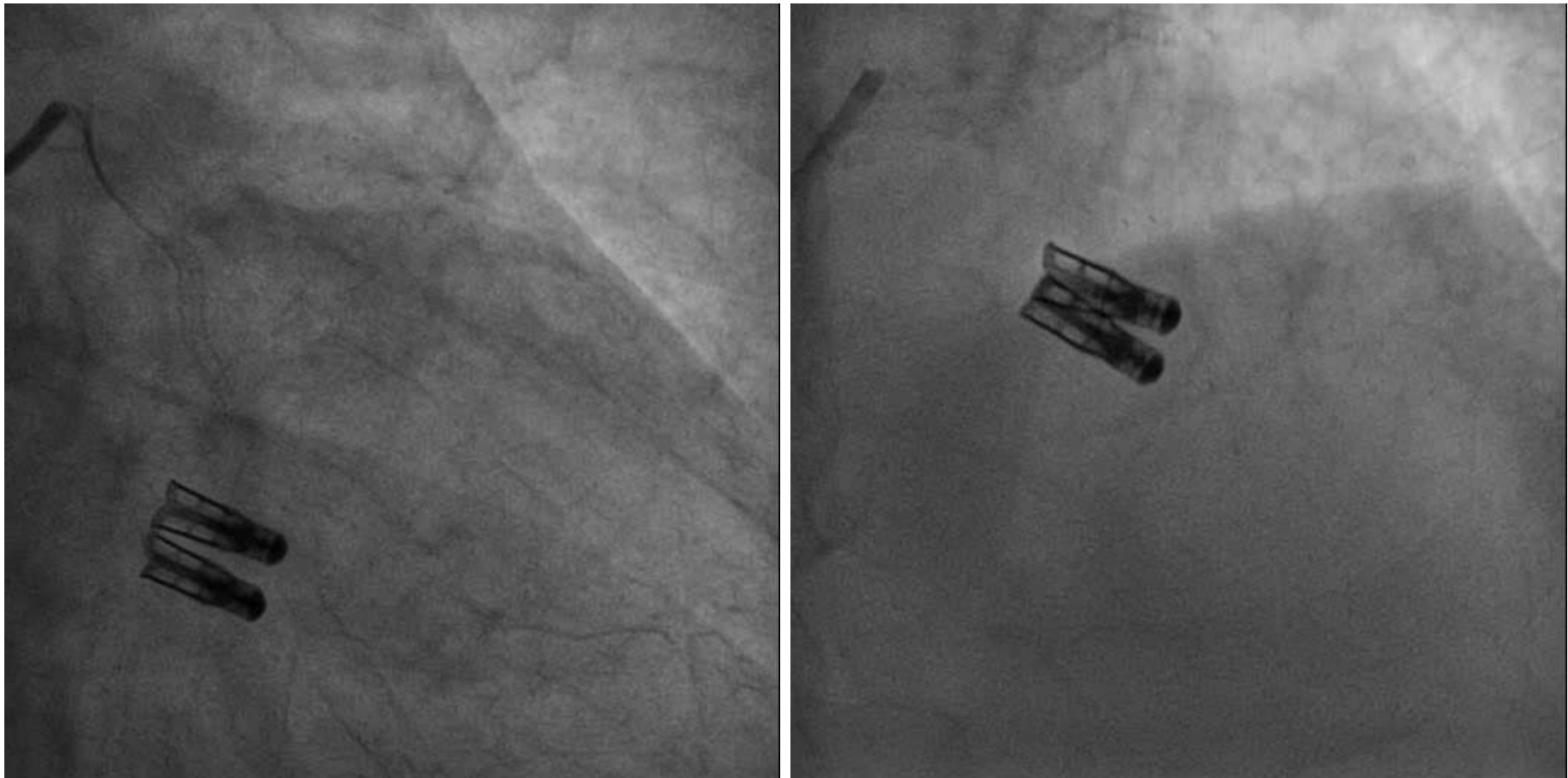
SA: 8.1mm²
SD: 3.5x2.8mm

Collapsed TL

One-year follow-up optical coherence tomography after implantation of bioresorbable vascular scaffolds for a chronic coronary total occlusion

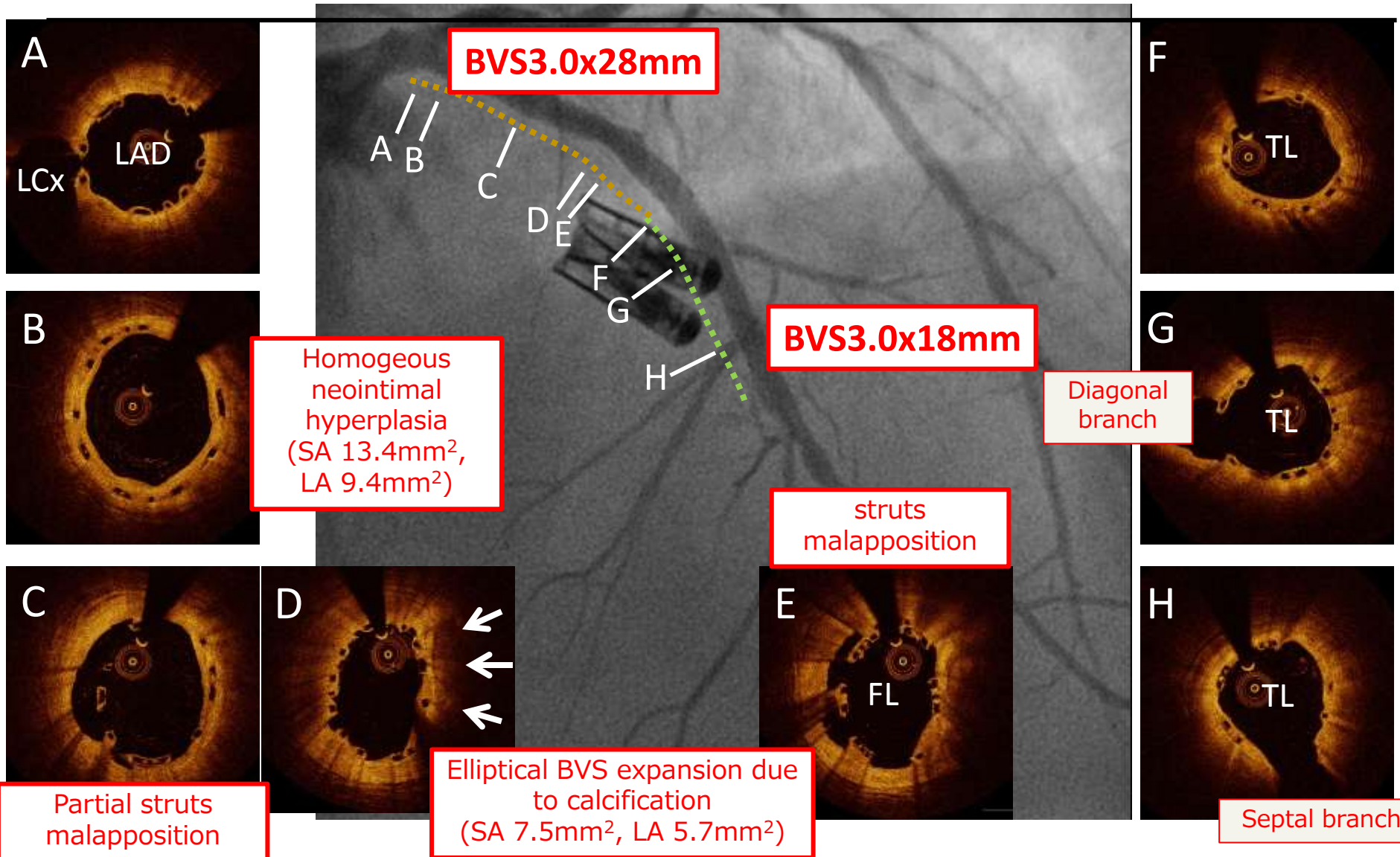
J Am Coll Cardiol Intv 2014 Toru Naganuma MD, Sunao Nakamura MD, Antonio Colombo MD et al

Angio. After 1 Year :Nicely Open !!!



OCT Findings 1 Year After Implant BVS

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International multicenter registry of BVS for CTO PCI



9 Institutions

Multicenter registry
September 2012 – November 2015

All cases with BVS implantation for
CTO lesion were included.

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Glenegles Hospital, Penang, Malaysia

HAS national Heart Center Johor Bahru, Malaysia

Clinical Outcome of Percutaneous Coronary Intervention For Chronic Total Occlusions with BVS:

Unpublished Data : Satoru Mitomo , Sunao Nakamura, Antonio Colombo, et al

1. Patients Demographics

91 patients with 3 cases of IDDM and 35 cases of CKD

2. Procedure Characteristics

total length of BVS > 45mm, pre-post dilatation 100%
Use IVUS or OCT 100%

3. Initial Clinical Outcome

No cardiac death, peri-procedural MI 2 cases

4. Mid-term Clinical Outcome

TVR up to 2 years 13.5 % , TLR 2 years 4%

Important Reminder 1

Technically...

1. IVUS or OCT is indispensable to check vessel size in treating CTO lesion with BVS for selection of appropriate size . (because...) Otherwise, BVS would be fractured if it is too small, Distal dissection is highly probable if it is too big.
2. Procedure should not be finished without high-pressure post- dilatation when BVS is implanted. Otherwise thrombosis would occur in high ratio.

Important Reminder 2

Technically...

3. In multiple BVS procedure, it is recommendable to implant the most proximal BVS first in order to minimize the overlap.
4. When BVS is implanted at proximal of the lesion, it should be expanded sufficiently. Then the 2nd BVS is difficult to deliver through the first one, Guide Liners(GL) are useful. Knowledge of which GL is compatible to which BVS is essential in using them. There is a table which shows size of GL. suitable for each size of BVS✳

✳ Which catheter should we choose to deliver a bulky bioresorbable vascular scaffold?
Toru Naganuma, Sunao Nakamura, Antonio Colombo et al Int J Cardiol 2016

Important Reminder 3

Future...

1. One year clinical data of BVS implanted in CTO lesion properly shows that BVS is acceptable in treating CTO lesion.
2. Not only 1-year clinical data after BVS implantation but also long-term result such as 2-year or 3-year data has to be monitored to identify benefit of BVS in clinical setting.

Thank You Very Much

