

**ADVANCES IN CARDIAC
ARRHYTHMIAS
and
GREAT INNOVATIONS
IN CARDIOLOGY**

Directors

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Sebastiano Marra

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Turin

September 27-28, 2013

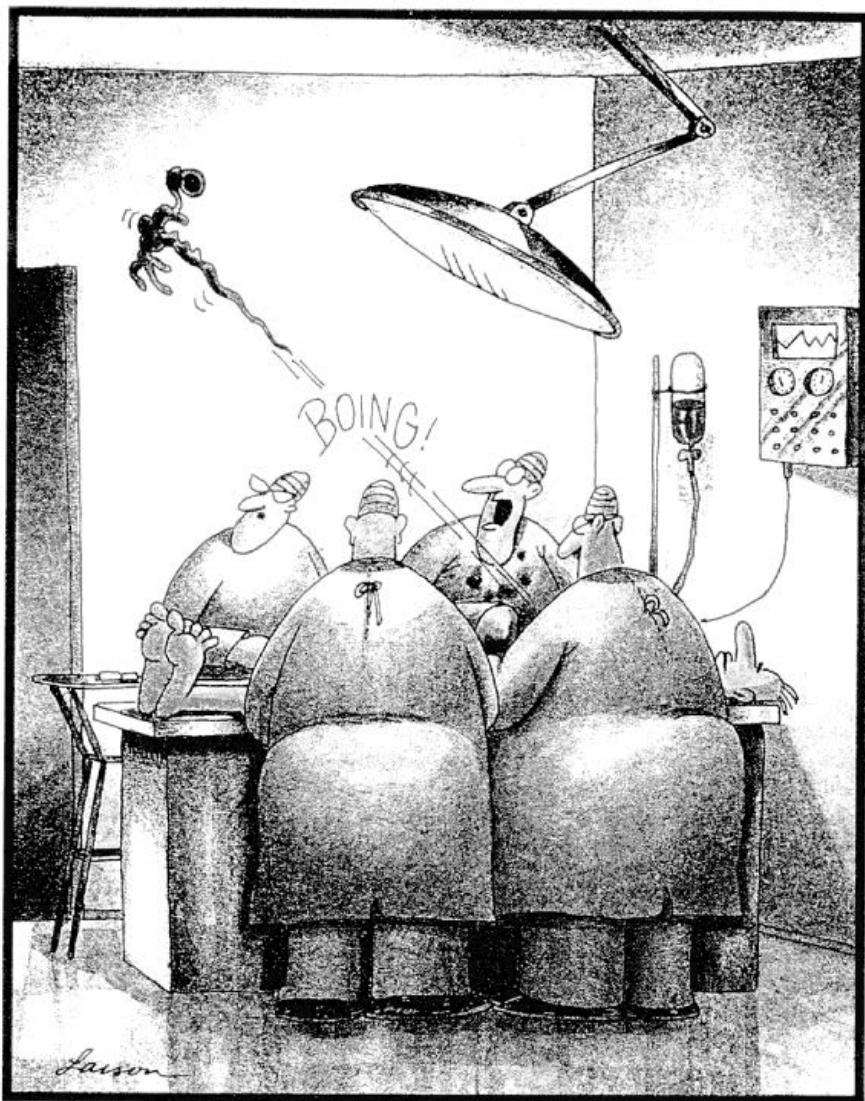
**Centro Congressi
Unione Industriale**



Disappearing stent: the Città della Salute e della Scienza experience

Federico Conrotto





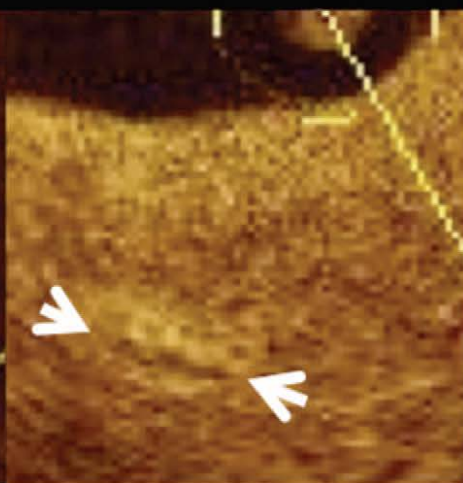
What are we
talking
about when
we talk
about BVS?

*"Whoa! Watch where that thing lands -
We'll probably need it."*

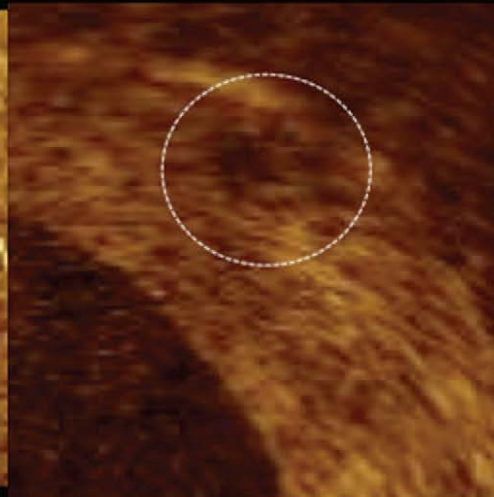
Classification with OCT



Preserved Box



Open box



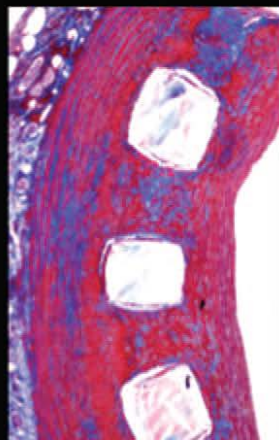
Dissolved black box



Dissolved bright box

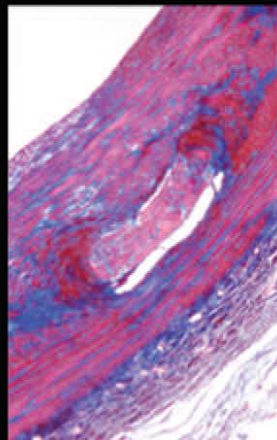
Classification with Histology

Category 1



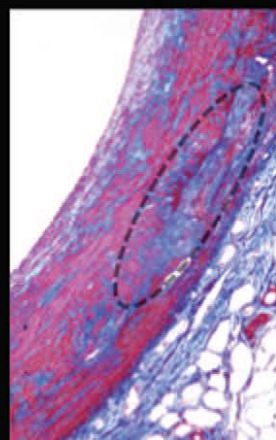
Openacellular regions with well defined borders, filled with hyaline material (2 years)

Category 2



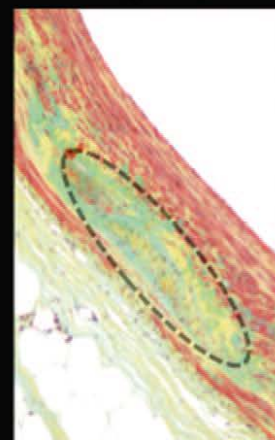
Defined accretion of hyaline, material separated by extracellular matrix and cell

Category 3



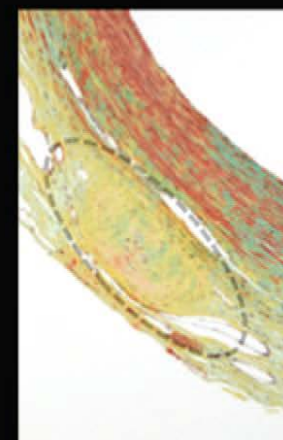
Region of low to moderately cellular connective tissue, cells poorly arranged, lacking hyaline material

Category 4



Poorly circumscribed regions of dense connective tissue with moderate to low cellularity, cells not regularly arranged

Category 5

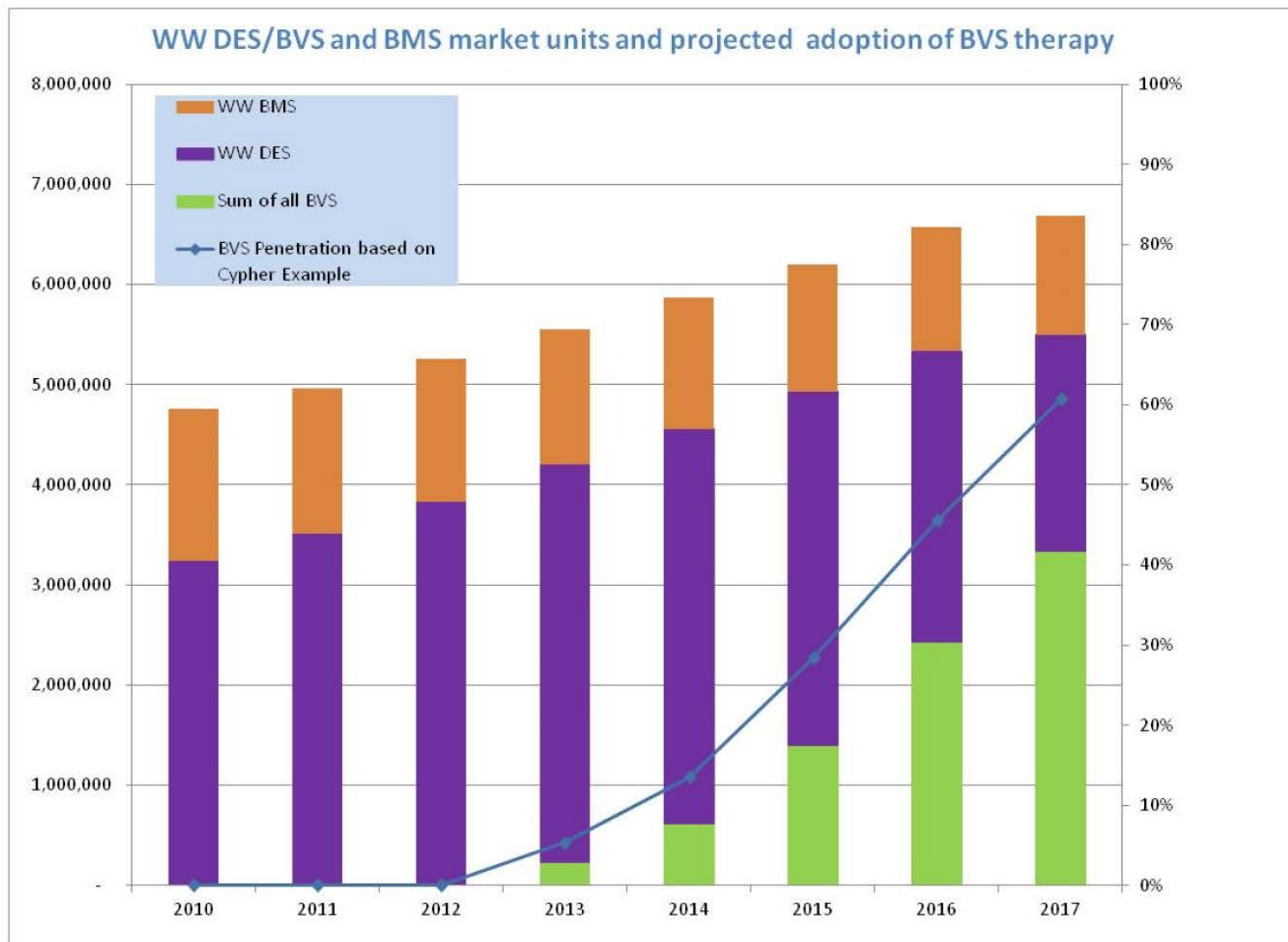


Circumscribed area of dense connective tissue with low cellularity, cells typically arranged in circumferential pattern

Extensive publications



Learning from the Past for Future Projection: Potential BVS Future based on Cypher Past



JP Morgan Model

**Bioresorbable scaffolds
have been called
“the Fourth Revolution”
in PCI**



FIRST

**Balloon
angioplasty
1977**

SECOND

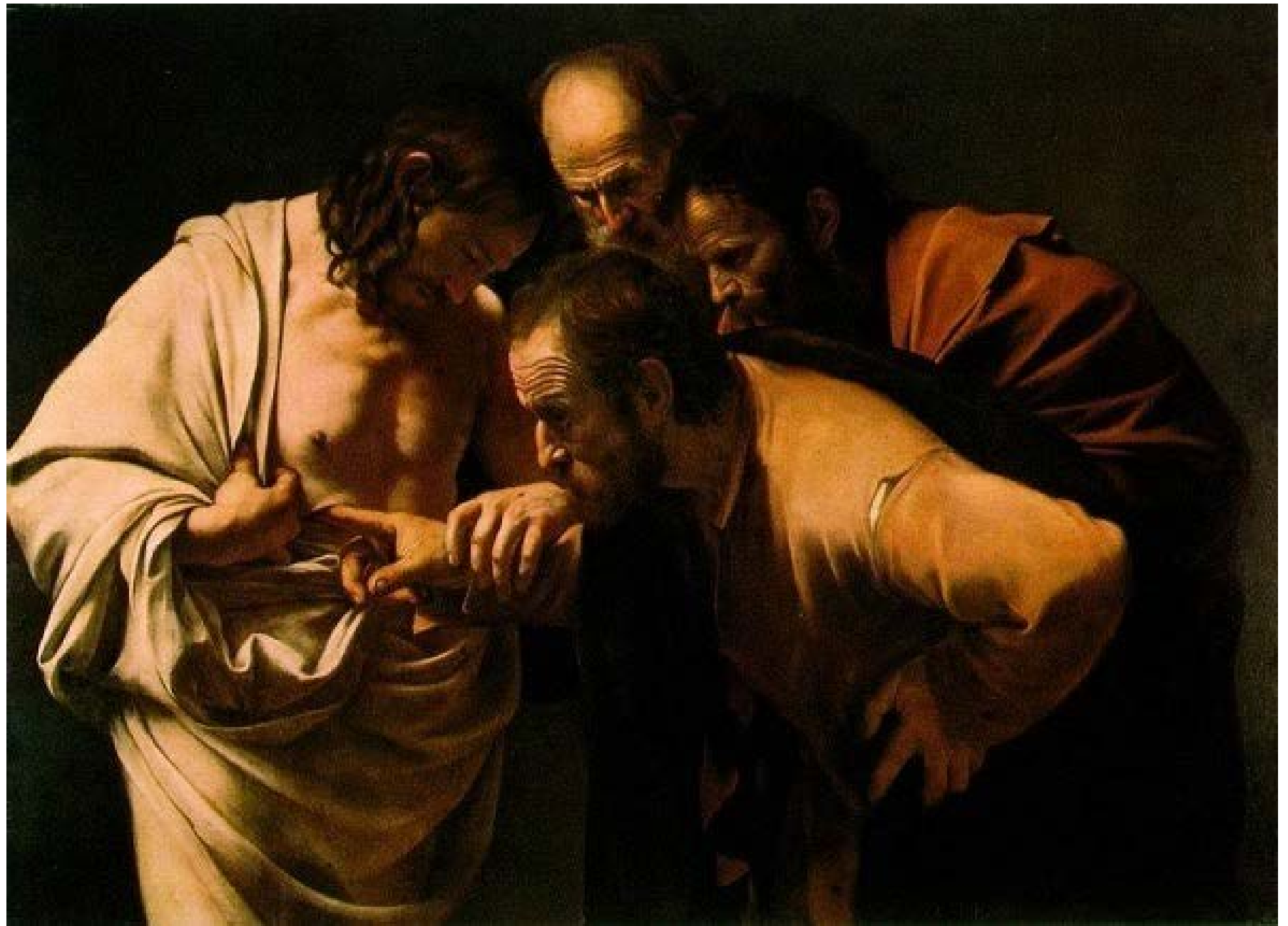
**Bare metal
stents 1990s**

THIRD

**Drug-eluting
stents 2000's**

FOURTH

**Bioresorbable
Drug-eluting
stents 2006**



A bioabsorbable everolimus-eluting coronary stent system (ABSORB): 2-year outcomes and results from multiple imaging methods



Patrick W Serruys, John A Ormiston, Yoshinobu Onuma, Evelyn Regar, Nieves Gonzalo, Hector M Garcia-Garcia, Koen Nieman, Nico Bruining, Cécile Dorange, Karine Miquel-Hébert, Susan Veldhof, Mark Webster, Leif Thuesen, Dariusz Dudek

Summary

Background Drug-eluting metallic coronary stents predispose to late stent thrombosis, prevent late lumen vessel enlargement, hinder surgical revascularisation, and impair imaging with multislice CT. We assessed the safety of the bioabsorbable everolimus-eluting stent (BVS).

Methods 30 patients with a single de-novo coronary artery lesion were followed up for 2 years clinically and with multiple imaging methods: multislice CT, angiography, intravascular ultrasound, derived morphology parameters (virtual histology, palpography, and echogenicity), and optical coherence tomography (OCT).

Findings Clinical data were obtained from 29 of 30 patients. At 2 years, the device was safe with no cardiac deaths, ischaemia-driven target lesion revascularisations, or stent thromboses recorded, and only one myocardial infarction (non-Q wave). 18-month multislice CT (assessed in 25 patients) showed a mean diameter stenosis of 19% (SD 9). At 2-year angiography, the in-stent late loss of 0.48 mm (SD 0.28) and the diameter stenosis of 27% (11) did not differ from the findings at 6 months. The luminal area enlargement on OCT and intravascular ultrasound between 6 months and 2 years was due to a decrease in plaque size without change in vessel size. At 2 years, 34.5% of strut locations presented no discernible features by OCT, confirming decreases in echogenicity and in radiofrequency backscattering; the remaining apparent struts were fully apposed. Additionally, vasomotion occurred at the stented site and adjacent coronary artery in response to vasoactive agents.

Interpretation At 2 years after implantation the stent was bioabsorbed, had vasomotion restored and restenosis prevented, and was clinically safe, suggesting freedom from late thrombosis. Late luminal enlargement due to plaque reduction without vessel remodelling needs confirmation.

Lancet 2009; 373: 897-910

See [Comment](#) page 869

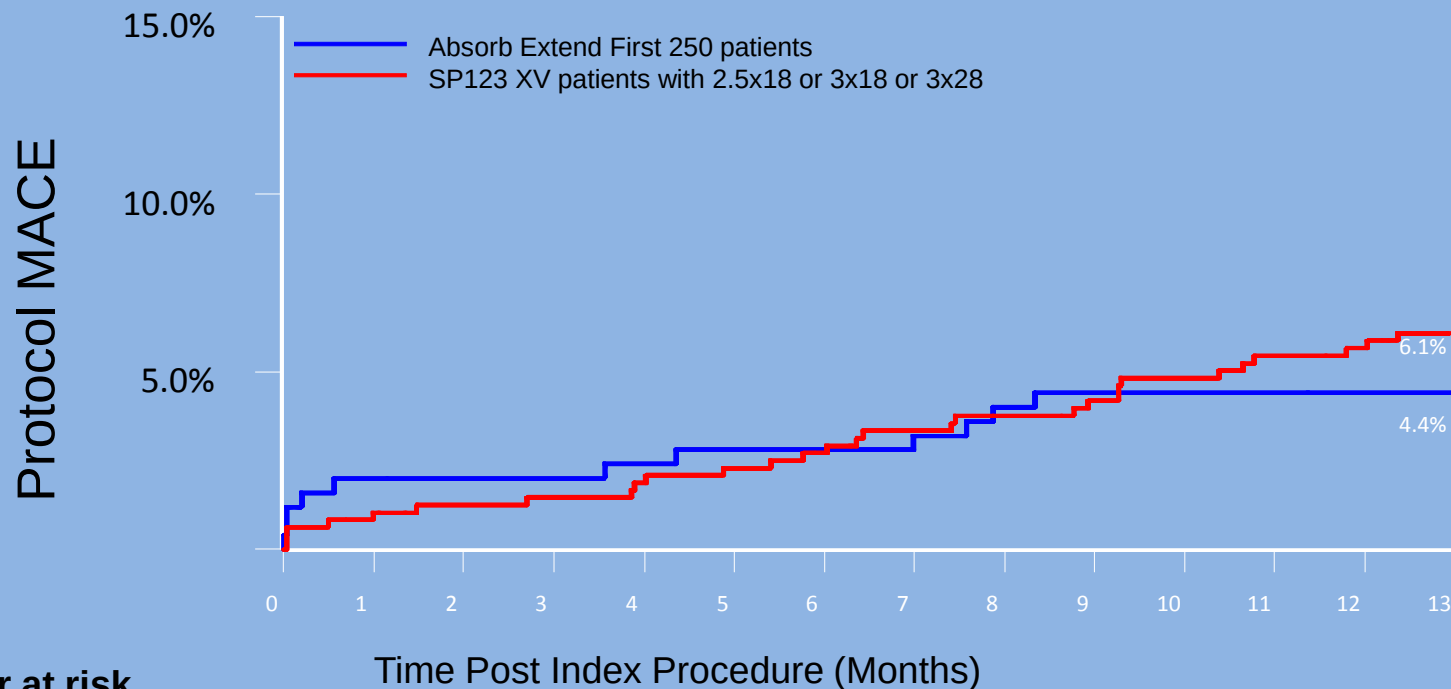
See [Perspectives](#) page 887

Thorax Center

(Prof P W Serruys MD, Y Onuma MD, E Regar MD, N Gonzalo MD, K Nieman MD, N Bruining PhD) and
Department of Radiology
(K Nieman MD), Erasmus
Medical Center, Rotterdam, Netherlands; Auckland City Hospital, Auckland, New Zealand (Prof J A Ormiston MB, M Webster MB); **Cardialysis BV, Rotterdam, Netherlands** (H M Garcia-Garcia MD); **Abbott Vascular, Diegem, Belgium** (C Dorange MSc, K Miquel-Hébert PhD, S Veldhof RN); **Skejby Sygehus, Aarhus University Hospital, Skejby, Denmark** (L Thuesen MD); and **Jagiellonian University, Krakow, Poland** (D Dudek MD)

ABSORB EXTEND/SPIRIT MACE

(Through 12 Months)



Number at risk

Time after index procedure (days)

	0	37	194	393
SPIRIT Pooled	482	475	462	435
EXTEND	250	244	242	237

Note: MACE is defined as the composite of cardiac death, MI, and ischemia-driven TLR

Note: The datasets are from different trials, and displayed for descriptive purposes only

ABSORB BVS and XIENCE – Clinical Outcomes

Through 12 Months

Non-Hierarchical % (n)	EXTEND/CoB* (N=551)	SPIRIT Pooled* (N=879)	p value
Cardiac Death % (n)	0.2 (1)	0.6 (5)	0.42
Myocardial Infarction % (n)	2.9 (16)	2.3 (20)	0.49
Q-wave MI	0.7 (4)	0.2 (2)	0.21
Non Q-wave MI	2.2 (12)	2.0 (18)	0.85
Ischemia driven TLR % (n)	2.2 (12)	3.2 (28)	0.32
CABG	0.2 (1)	0.2 (2)	1.00
PCI	2.0 (11)	3.0 (26)	0.31
Hierarchical MACE % (n)	4.7 (26)	5.3 (47)	0.62
Scaffold Thrombosis (ARC Def/Prob) % (n)	0.7 (4)	0.7 (6)	1.00

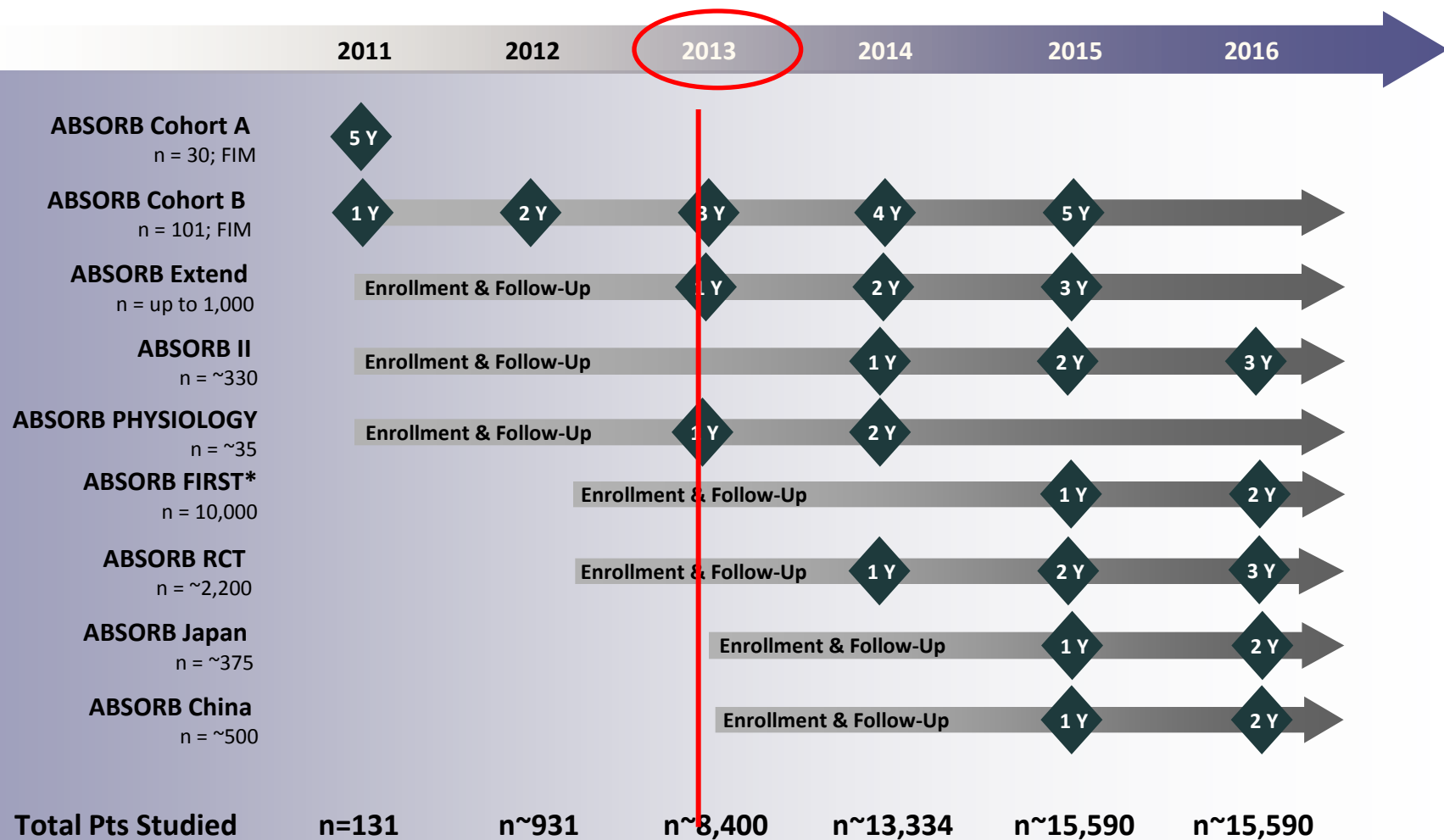
*Absorb BVS data are from ABSORB Cohort B Intent-to-Treat and ABSORB EXTEND All Subjects Registered (Subjects with 1-year follow-up based on the data from data cut off date of December 3, 2012). XIENCE data are from SPIRIT II and III studies (Intent-to-Treat population).

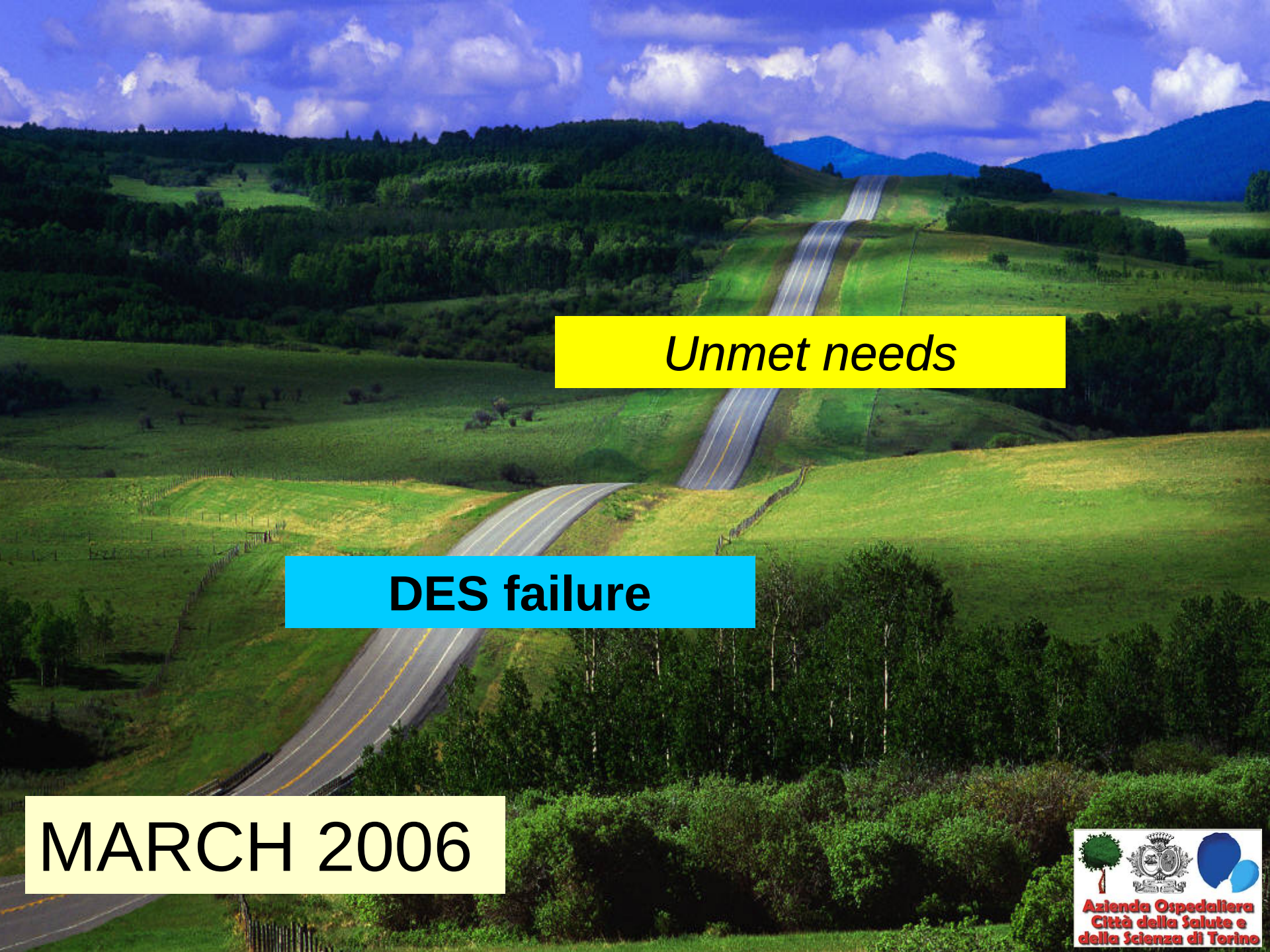
Note: The datasets are from different trials, and displayed for descriptive purposes only

Absorb is authorized for sale in CE Mark and certain independently regulated countries outside the United States. Please check the regulatory status of the device in your geographical location before distribution. Information contained herein for presentation outside the U.S. and Japan only. AP2938281-OUS Rev. A 03/13



The ABSORB Clinical Trial Program



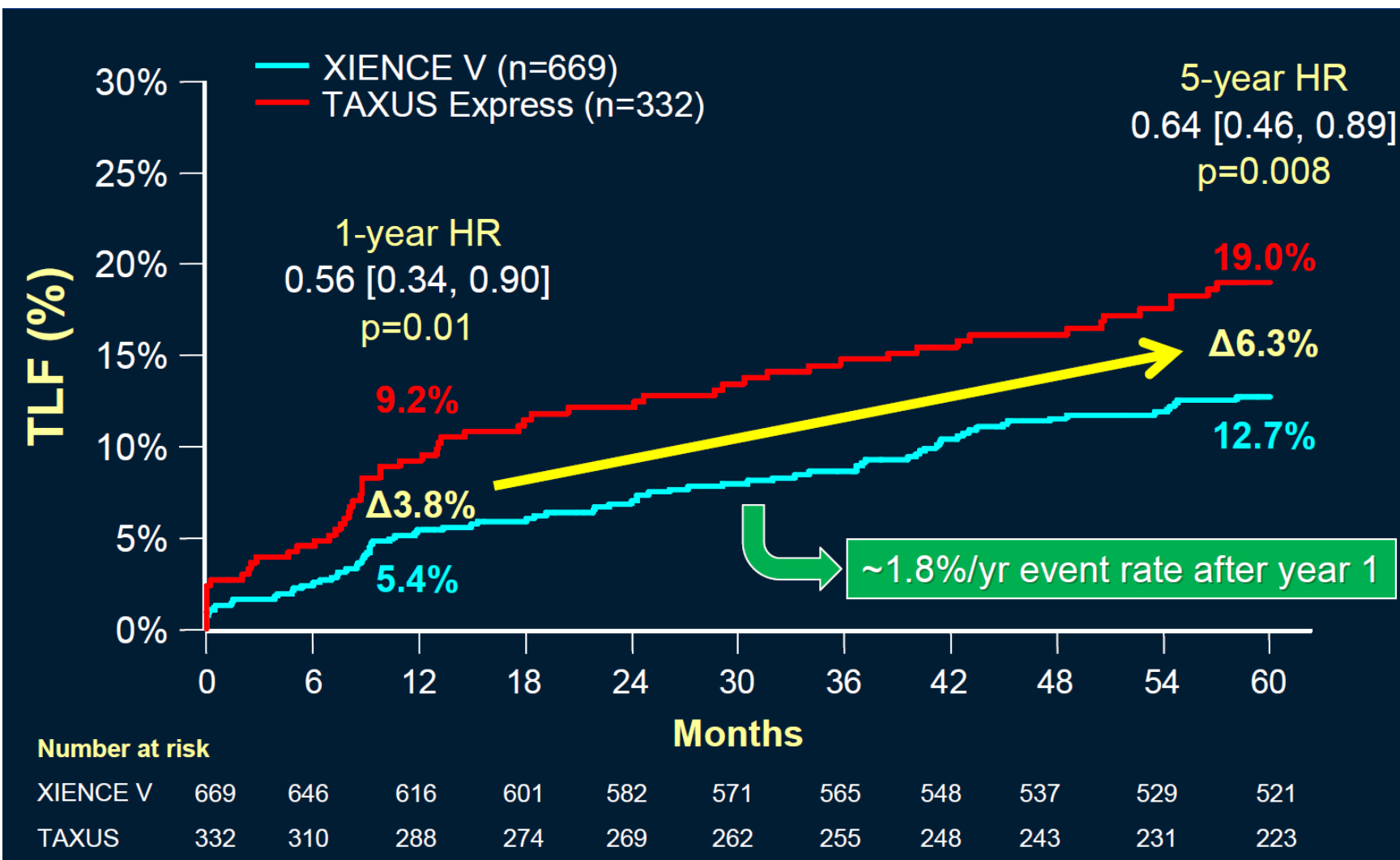


Unmet needs

DES failure

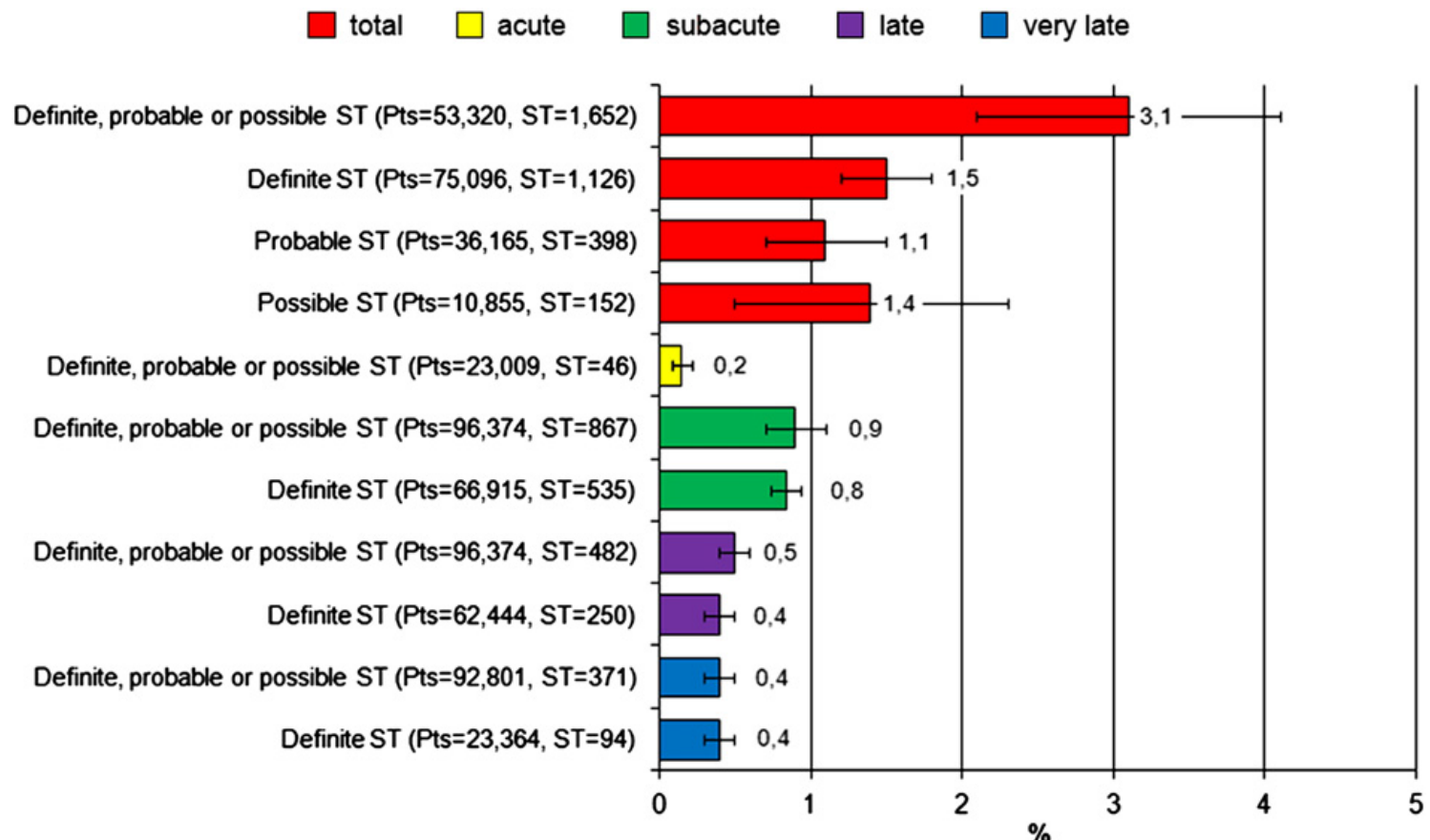
MARCH 2006

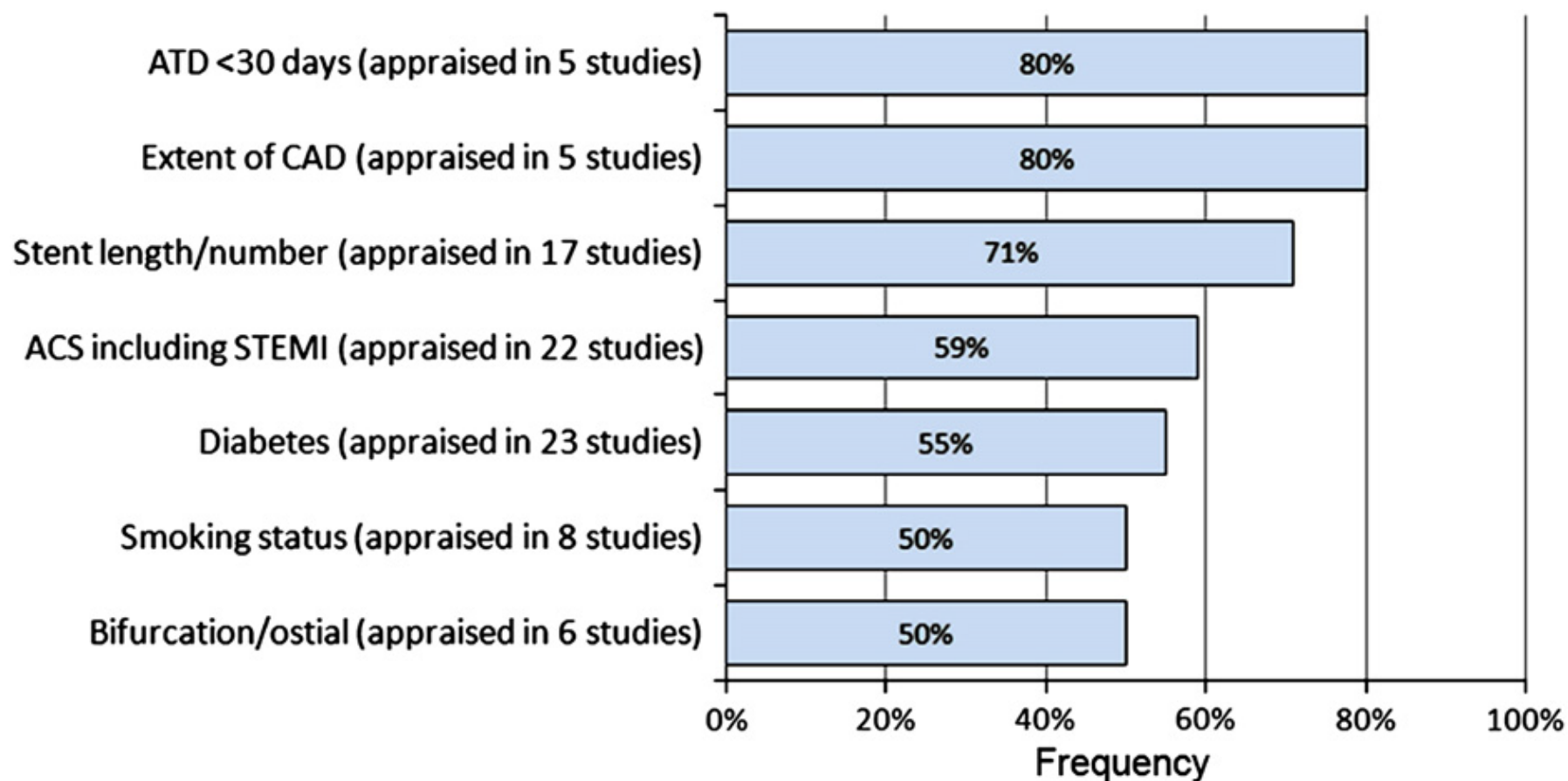
SPIRIT III: target lesion failure @5 years



Incidence and predictors of coronary stent thrombosis: Evidence from an international collaborative meta-analysis including 30 studies, 221,066 patients, and 4276 thromboses

Fabrizio D'Ascenzo ^{a,1}, Mario Bollati ^a, Fabrizio Clementi ^b, Davide Castagno ^a, Bo Lagerqvist ^c, Jose M. de la Torre Hernandez ^d, Juriën M. ten Berg ^e, Bruce R. Brodie ^f, Philip Urban ^g, Lisette Okkels Jensen ^h, Gabriel Sardi ⁱ, Ron Waksman ⁱ, John M. Lasala ^j, Stefanie Schulz ^k, Gregg W. Stone ^l, Flavio Airoldi ^m, Antonio Colombo ⁿ, Gilles Lemesle ^o, Robert J. Applegate ^p, Piergiorgio Buonamici ^q, Ajay J. Kirtane ^l, Anetta Undas ^r, Imad Sheiban ^a, Fiorenzo Gaita ^a, Giuseppe Sangiorgi ^b, Maria Grazia Modena ^s, Giacomo Frati ^t, Giuseppe Biondi-Zoccai ^{t,*,1}





Etiology of DES events beyond 1 year

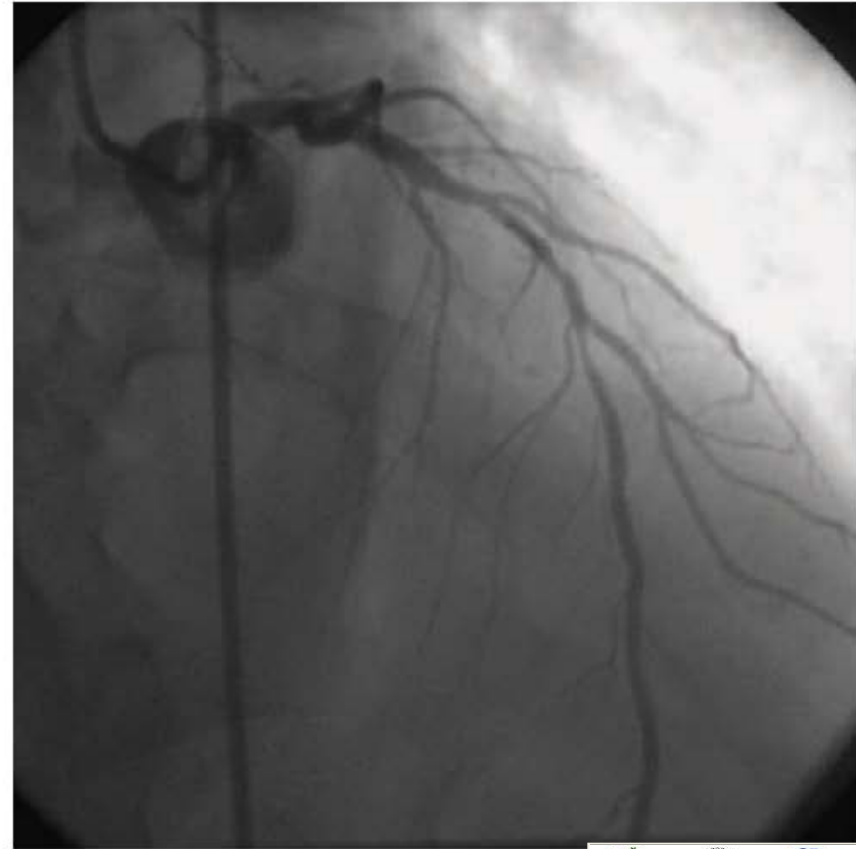
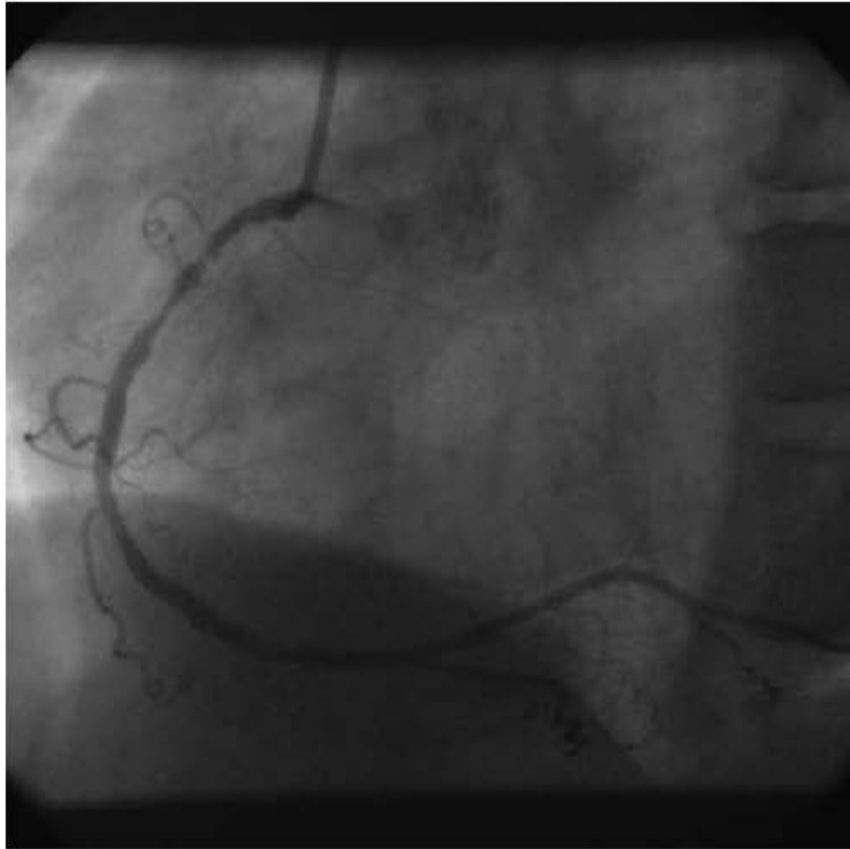
Very Late Thrombosis and restenosis

1. Uncovered stent struts (thrombosis)
2. Persistent stimulation of SMCs, from adherent fibrin and/or loss of normal vessel curvature
3. Abnormal shear stress from protruding struts and/or loss of cyclic strain relief (compliance mismatch)
4. Chronic inflammation due to late foreign body reactions and polymer hypersensitivity
5. Positive remodeling with strut malapposition
6. Strut fracture
7. Neoatherosclerosis

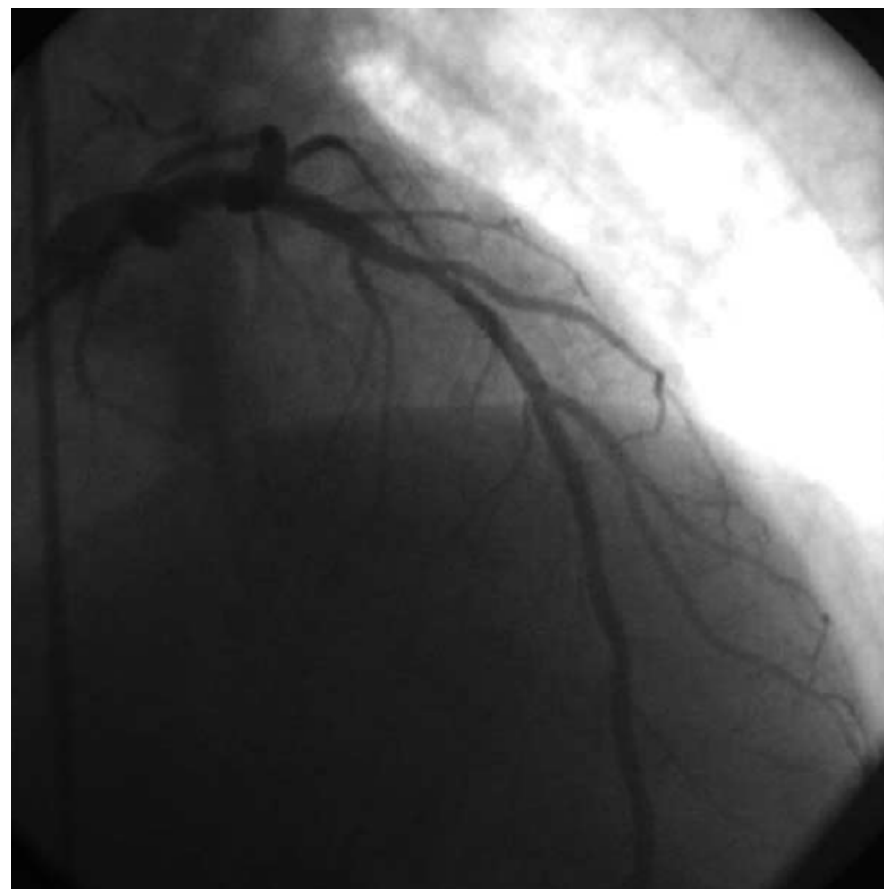
When I wanted to.....

April 2007

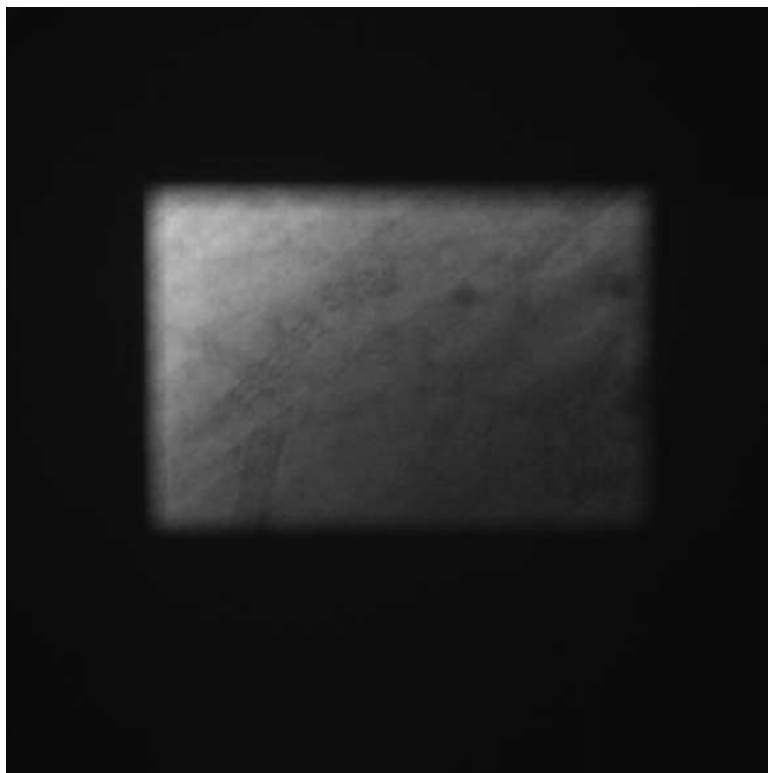
58y, Male, Acute Coronary Syndrome



2005 SES on LAD and RCA



2005 SES on LAD and RCA



Case report

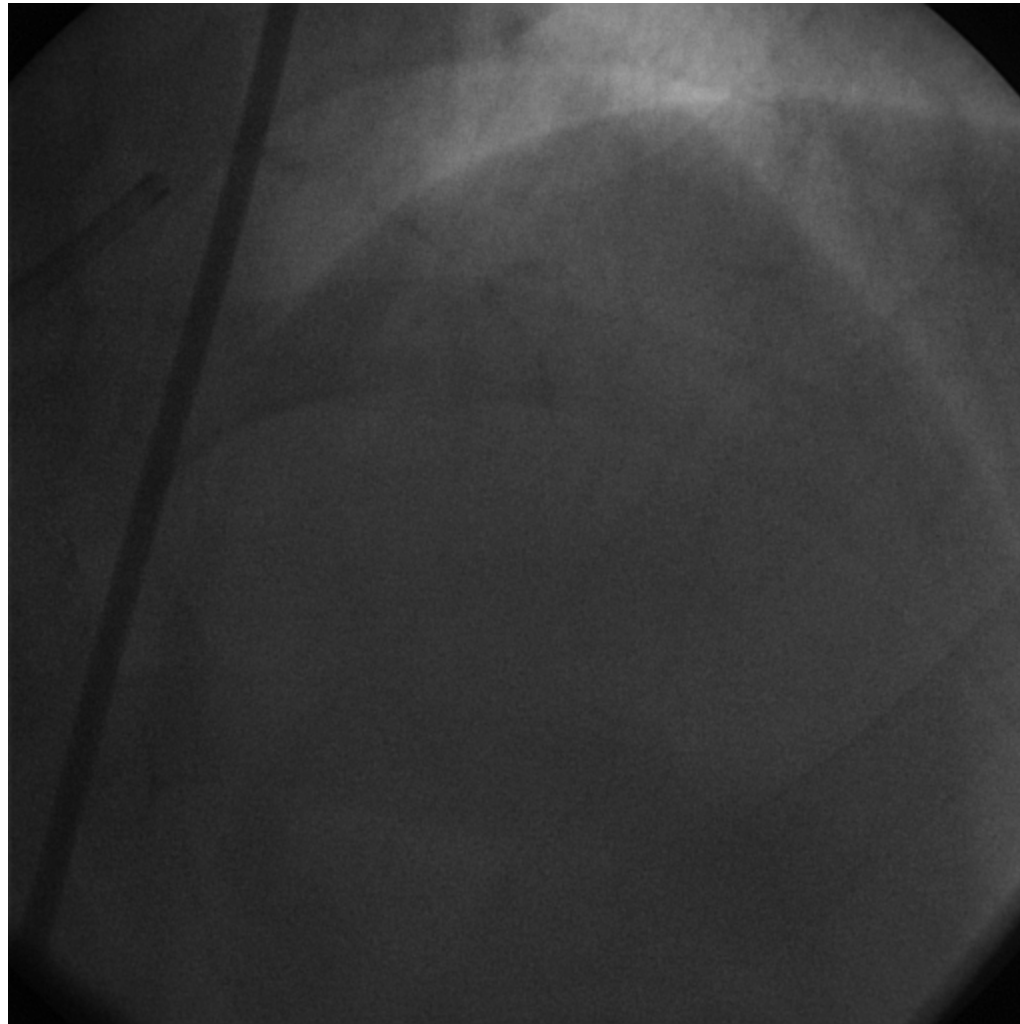


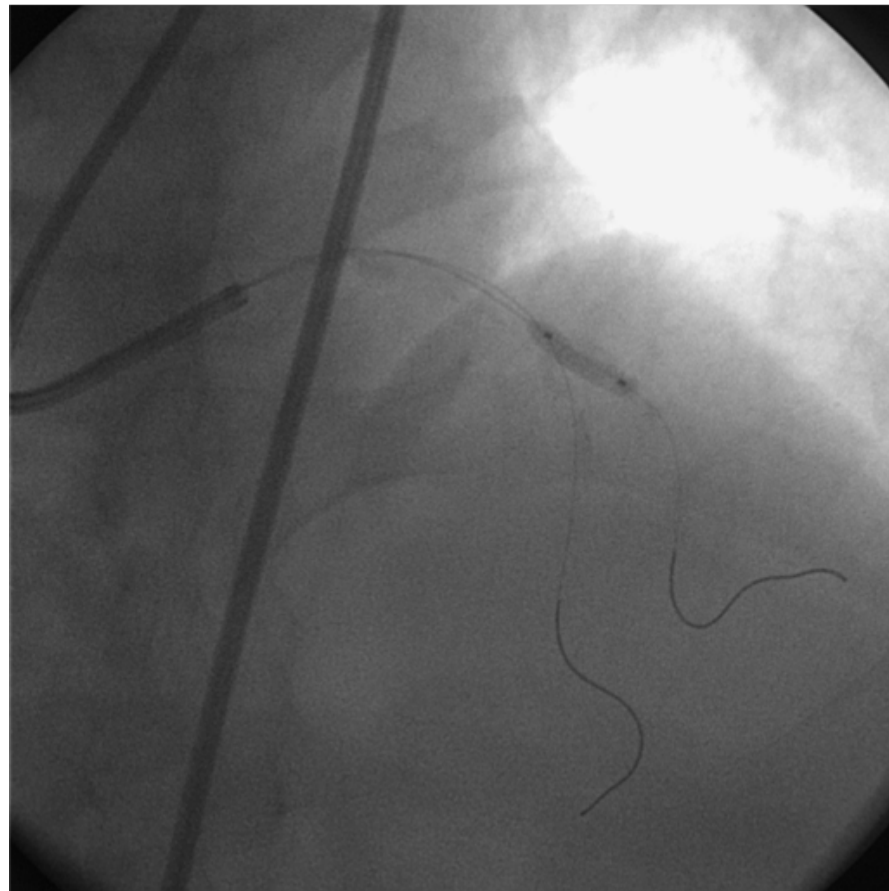
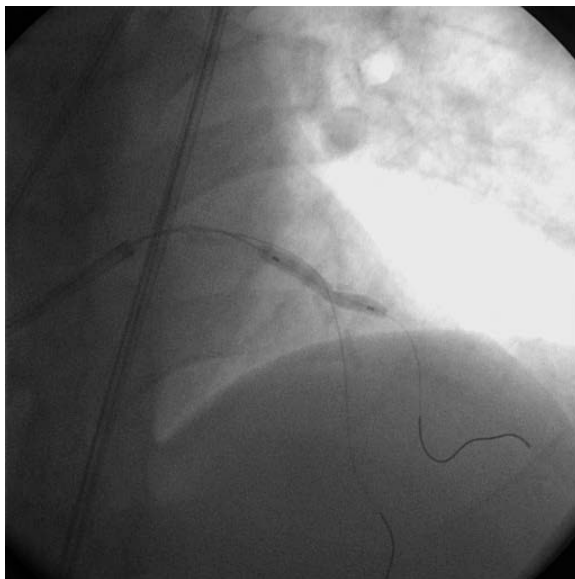
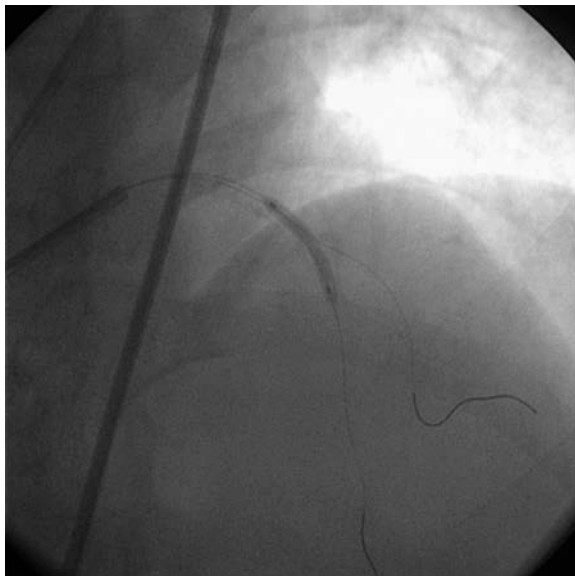
Fracture of coronary artery sirolimus eluting stent with formation of four aneurysms

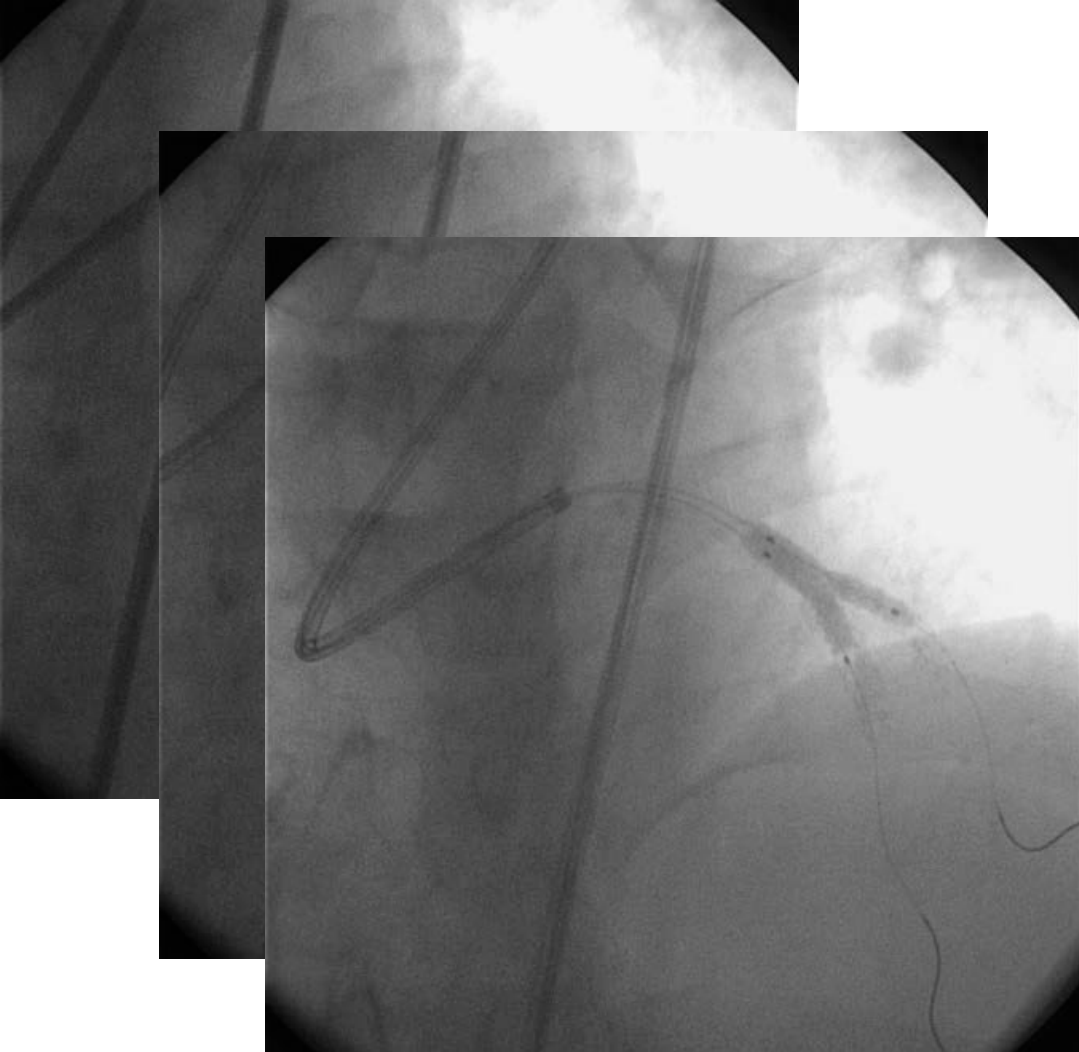
Maurizio D'Amico, Valeria Frisenda, Federico Conrotto, Mauro Pennone, Paolo Scacciatella and Sebastiano Marra



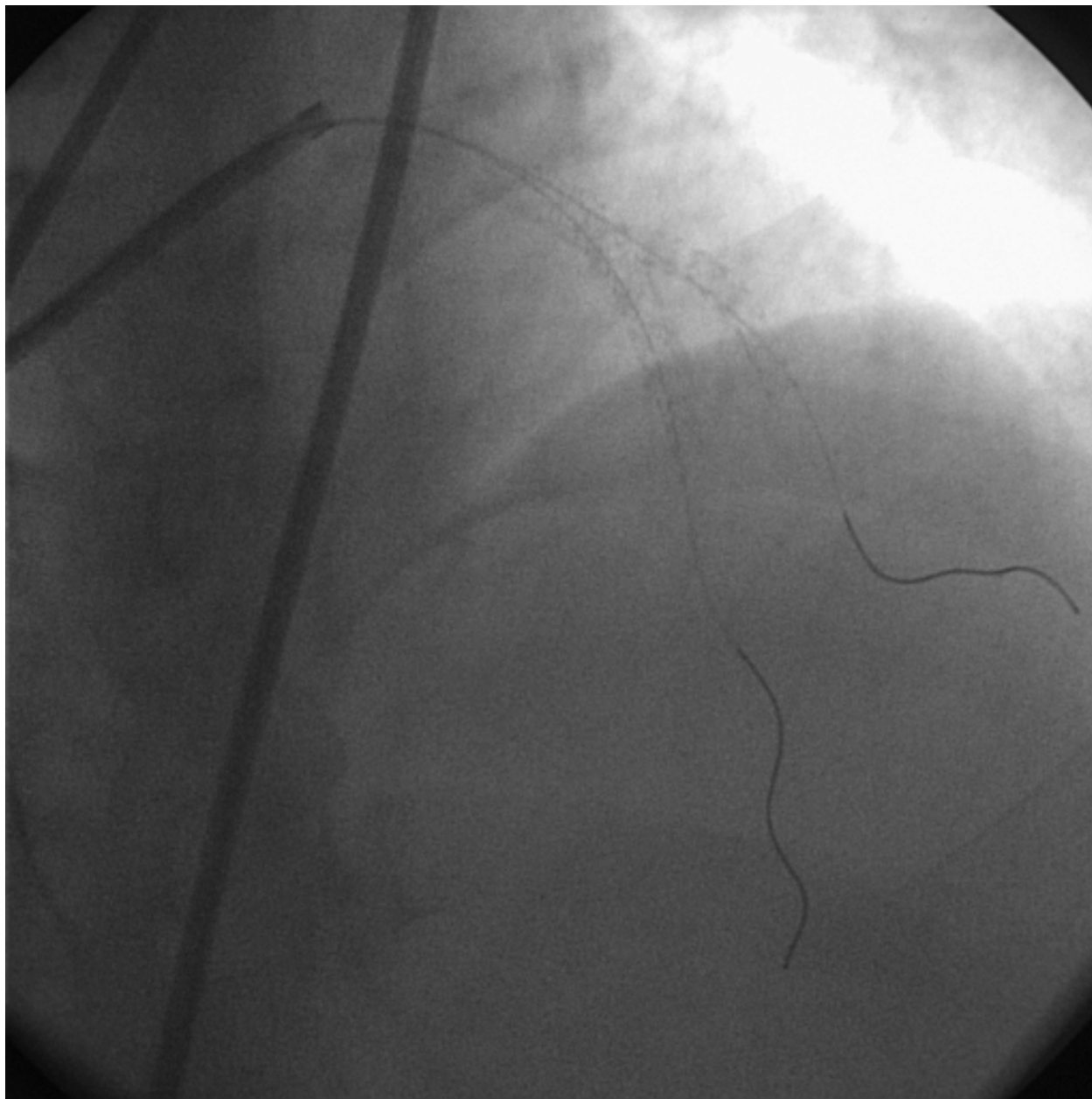
July 2008 37y, type 1 diabetes (Diabetic neuropathy,
nephropathy and retinopathy)
Dyspnea on exertion
Myocardial SPECT: antero-lateral and inferior ischemia







Crush stent SES 3/3



Differential Response of Delayed Healing and Persistent Inflammation at Sites of Overlapping Sirolimus- or Paclitaxel-Eluting Stents

Aloke V. Finn, Frank D. Kolodgie, Jan Harnek, L.J. Guerrero, Eduardo Acampado, Kirubel Tefera, Kristi Skoriya, Deena K. Weber, Herman K. Gold and Renu Virmani



European Heart Journal (2007) 28, 961–967
doi:10.1093/eurheartj/ehl413

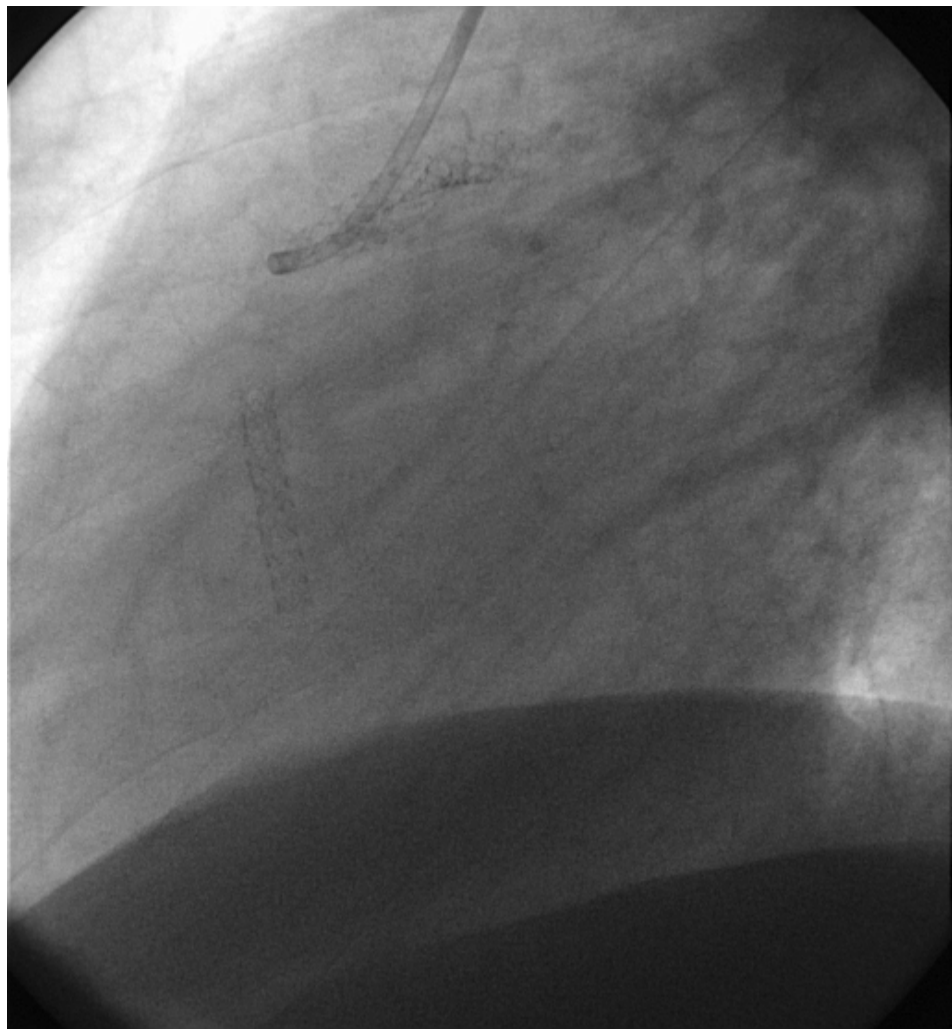
Clinical research
Interventional cardiology

Neointimal coverage of sirolimus-eluting stents at 6-month follow-up: evaluated by optical coherence tomography

Daisuke Matsumoto, Junya Shite*, Toshiro Shinke, Hiromasa Otake, Yusuke Tanino, Daisuke Ogasawara, Takahiro Sawada, Oscar Luis Paredes, Ken-ichi Hirata, and Mitsuhiro Yokoyama

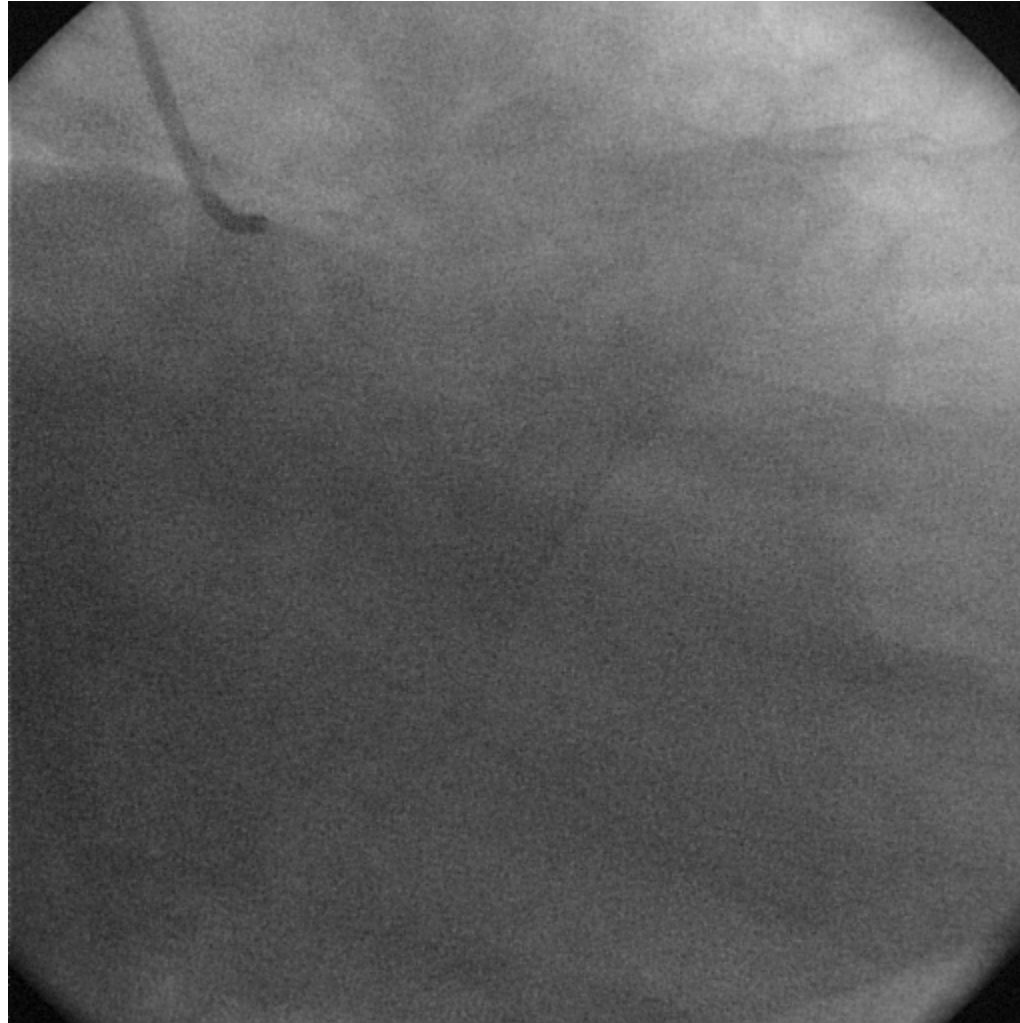
Delayed Coverage in Malapposed and Side-Branch Struts With Respect to Well-Apposed Struts in Drug-Eluting Stents: In Vivo Assessment With Optical Coherence Tomography

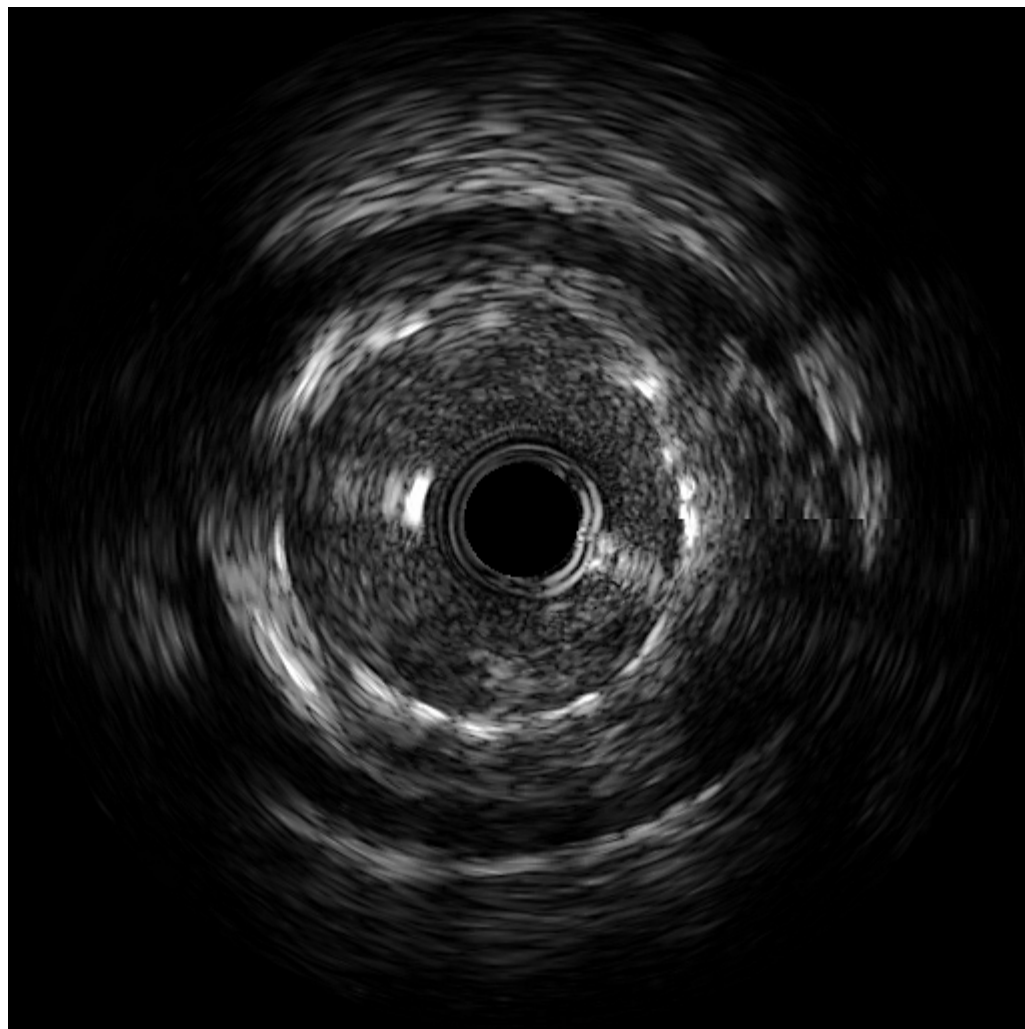
Juan Luis Gutiérrez-Chico, Evelyn Regar, Eveline Nüesch, Takayuki Okamura, Joanna Wykrzykowska, Carlo di Mario, Stephan Windecker, Gerrit-Anne van Es, Pierre Gobbens, Peter Jüni and Patrick W. Serruys



June 2009, 73y

2007 STEMI>>SES LAD





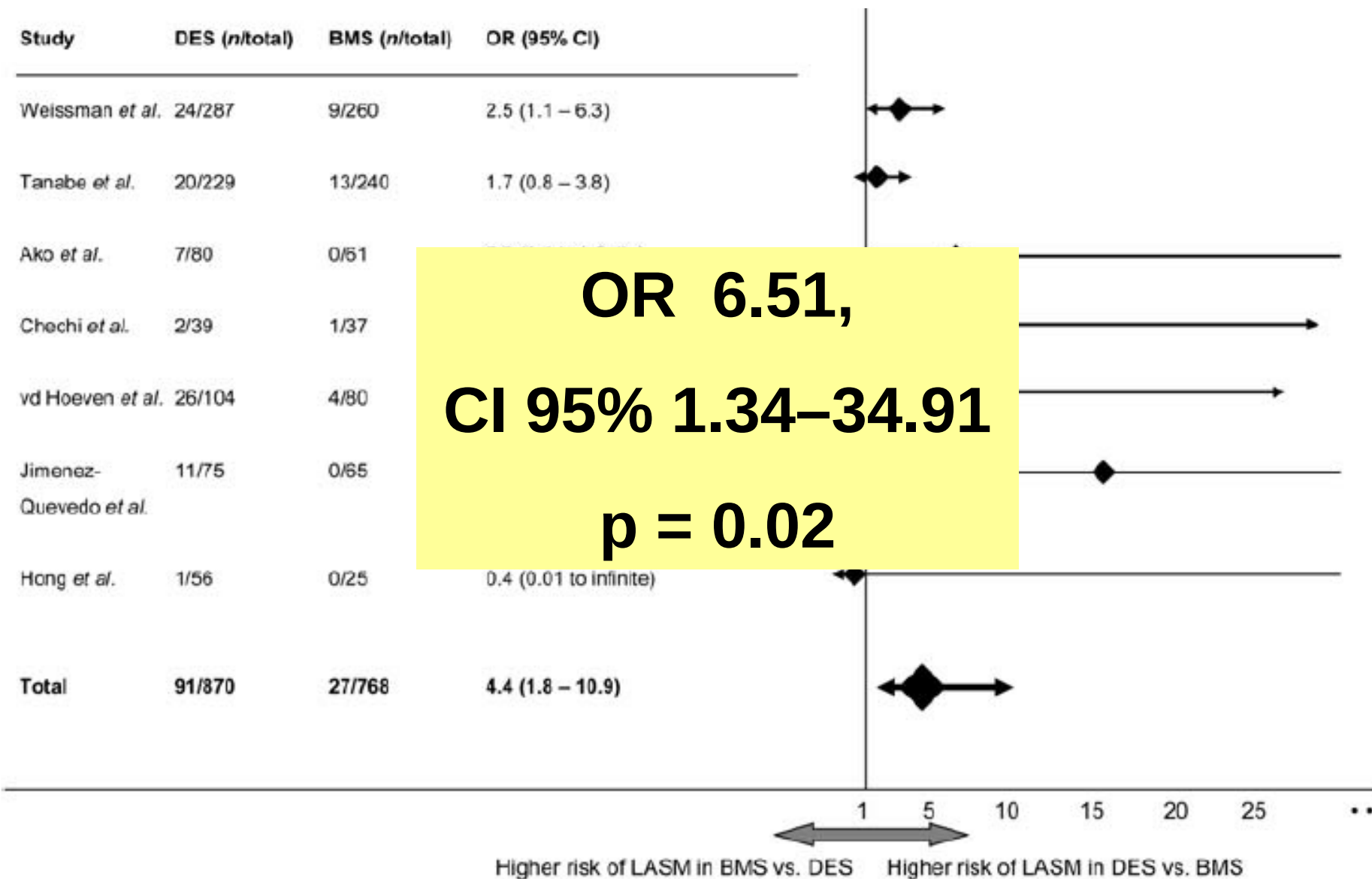
Late stent malapposition risk is higher after drug-eluting stent compared with bare-metal stent implantation and associates with late stent thrombosis

**Ayman K.M. Hassan^{1,2}, Sandrin C. Bergheanu^{1,3,4}, Theo Stijnen⁵,
Bas L. van der Hoeven¹, Jaapjan D. Snoep³, Josepha W.M. Plevier⁶,
Martin J. Schalij¹, and J. Wouter Jukema^{1*}**

¹Department of Cardiology CS-P, Leiden University Medical Center, PO Box 9600, 2300 RC Leiden, The Netherlands; ²Department of Cardiology, Assiut University, Assiut, Egypt;

³Department of Clinical Epidemiology, Leiden University Medical Center, Leiden, The Netherlands; ⁴Eindhoven Laboratory for Experimental Vascular Medicine, Leiden University Medical Center, Leiden, The Netherlands; ⁵Department of Medical Statistics, Leiden University Medical Center, Leiden, The Netherlands; and ⁶Information Specialist Walaeus Library, Leiden University Medical Center, Leiden, The Netherlands

Received 13 June 2008; revised 17 September 2008; accepted 19 November 2008; online publish-ahead-of-print 21 January 2009

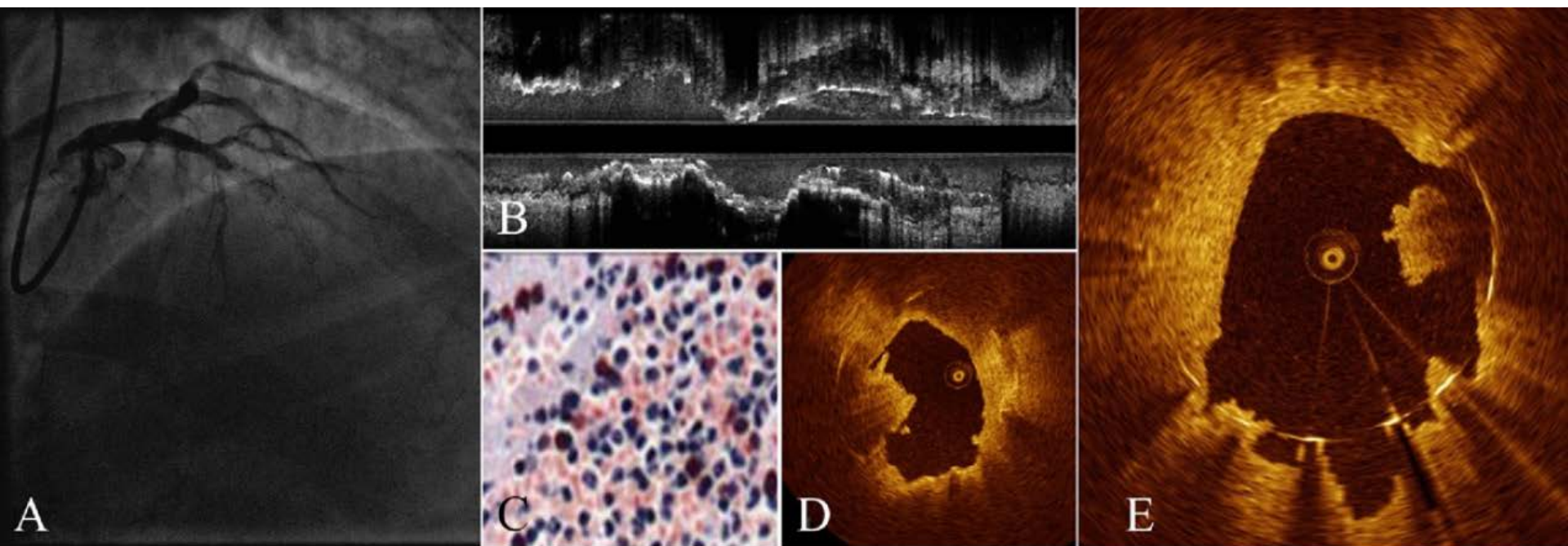


Examination of the In Vivo Mechanisms of Late Drug-Eluting Stent Thrombosis

Findings From Optical Coherence Tomography and Intravascular Ultrasound Imaging

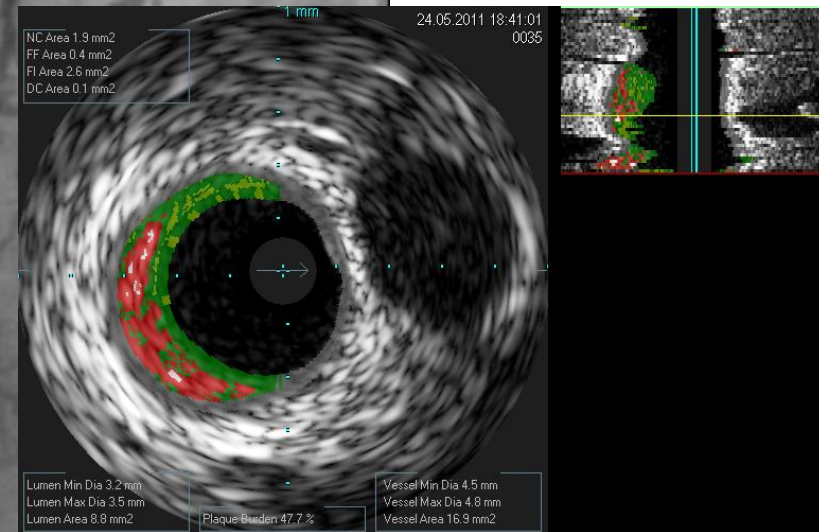
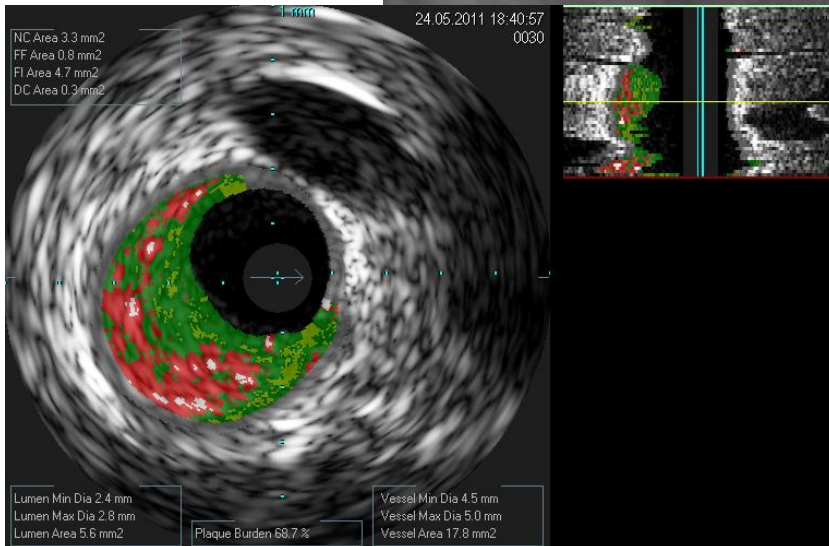
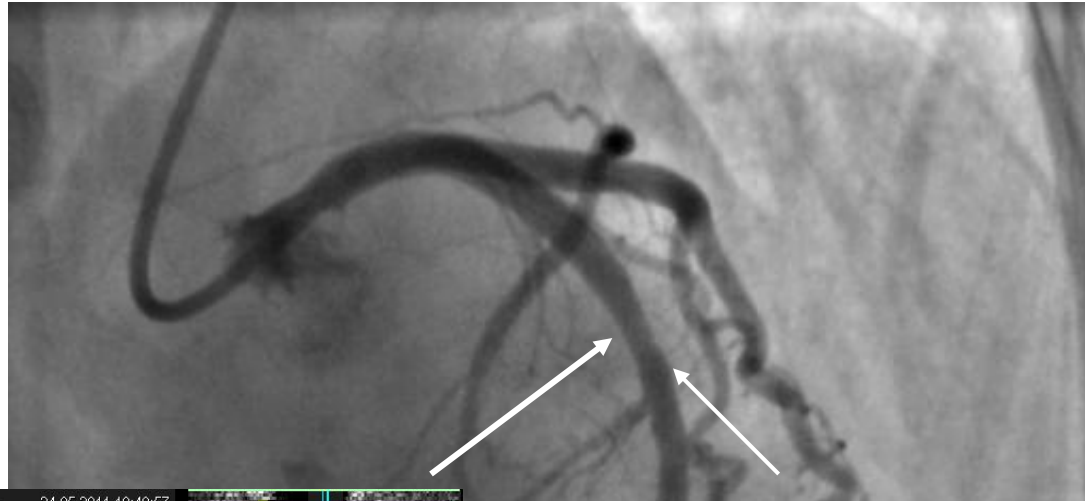
Giulio Guagliumi, MD,* Vasile Sirbu, MD,* Giuseppe Musumeci, MD,* Robert Gerber, MD,† Giuseppe Biondi-Zoccai, MD,* Hideyuki Ikejima, MD,* Elena Ladich, MD,‡ Nikolož Lortkipanidze, MD,* Aleksandre Matiashvili, MD,* Orazio Valsecchi, MD,* Renu Virmani, MD,‡ Gregg W. Stone, MD§

Bergamo, Italy; London, United Kingdom; Gaithersburg, Maryland; and New York, New York

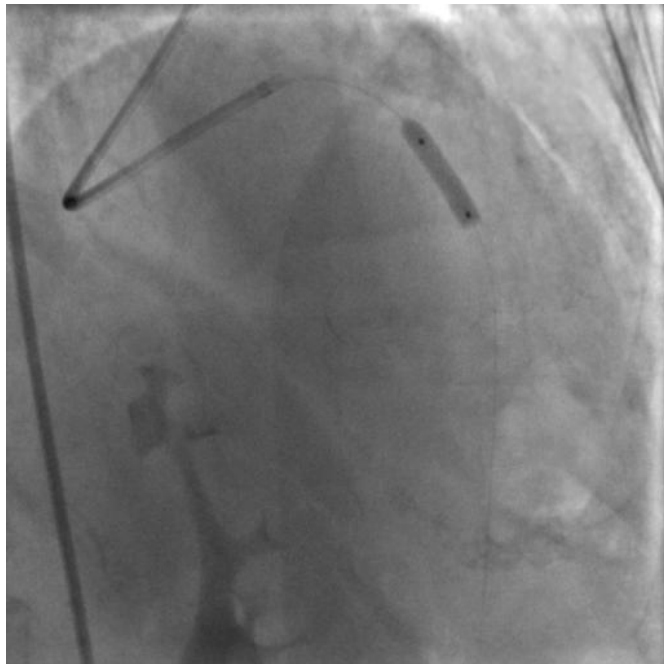
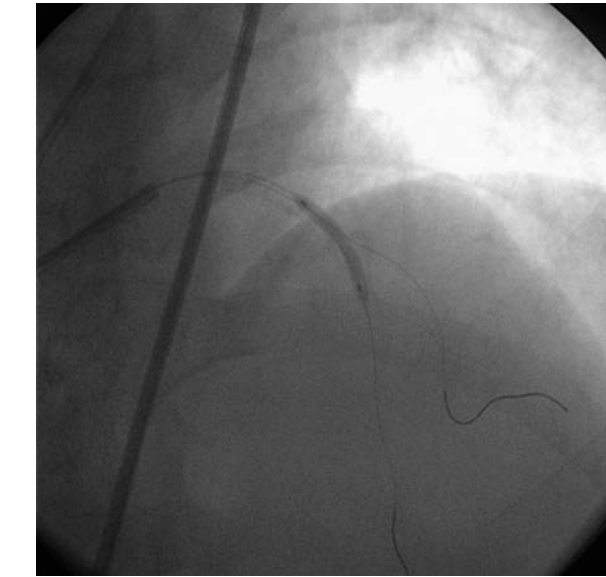
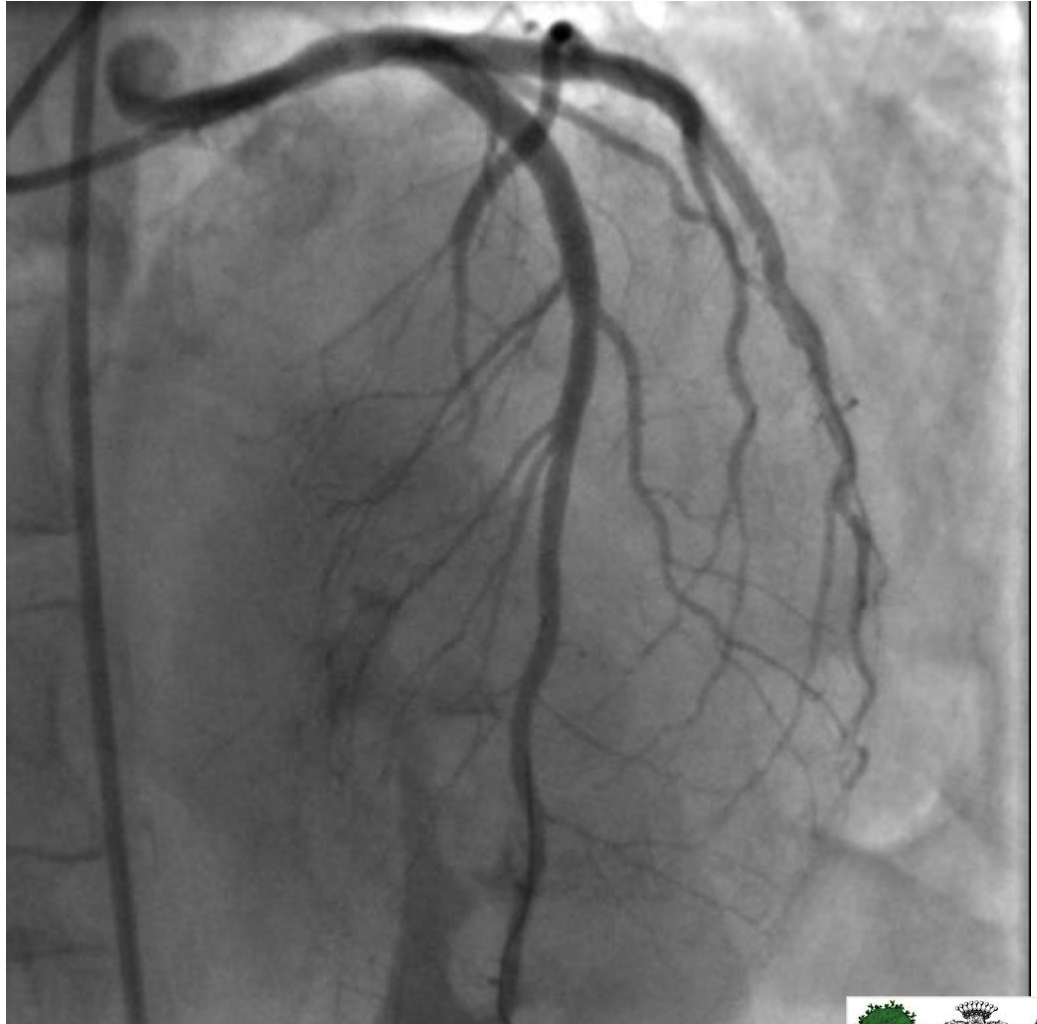


May 2010

68y, female, Unstable angina

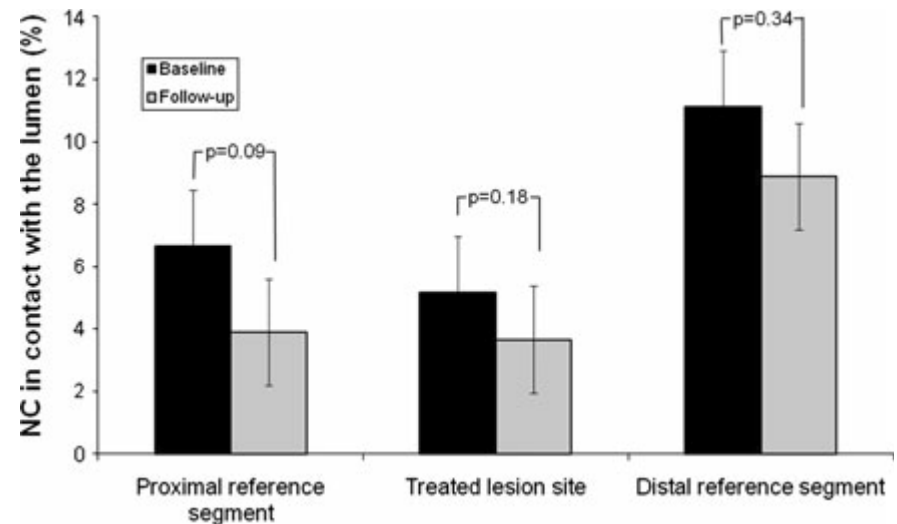
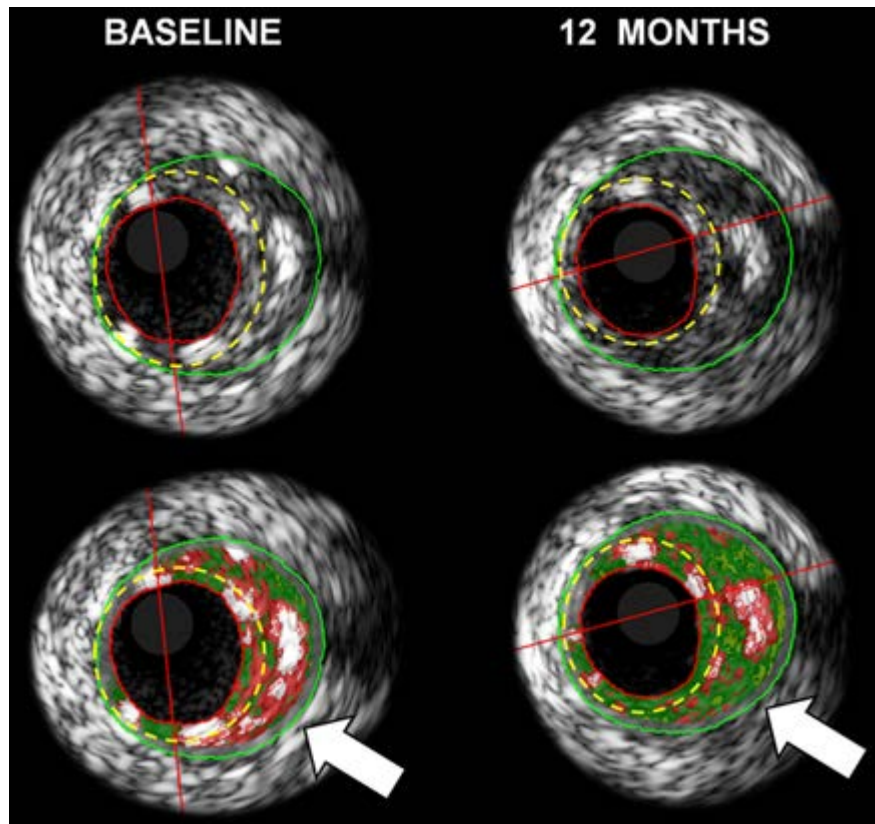


DES 4/16

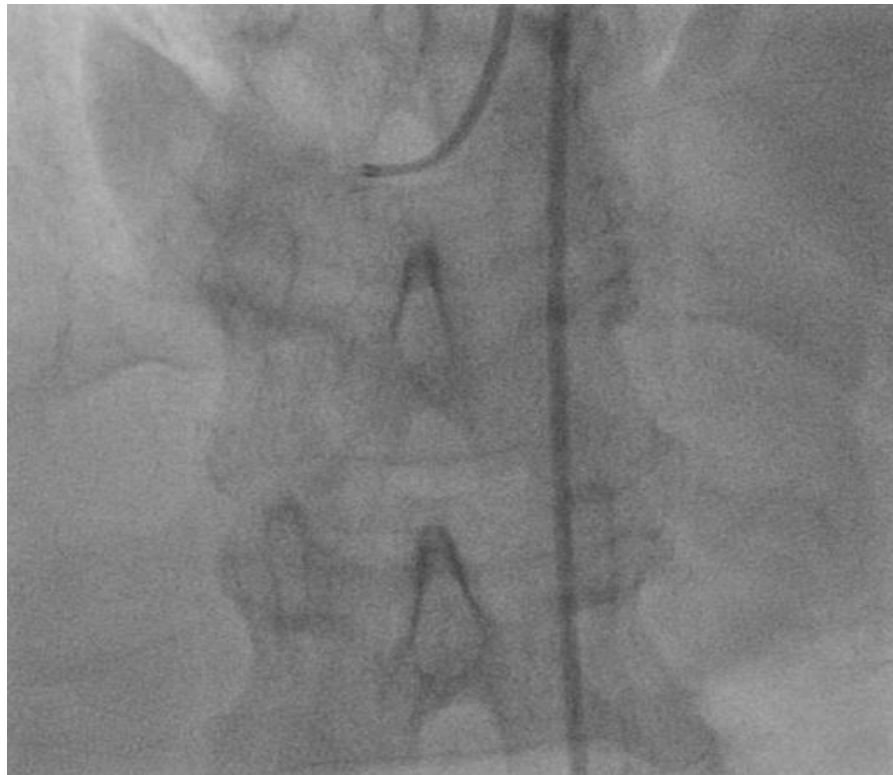
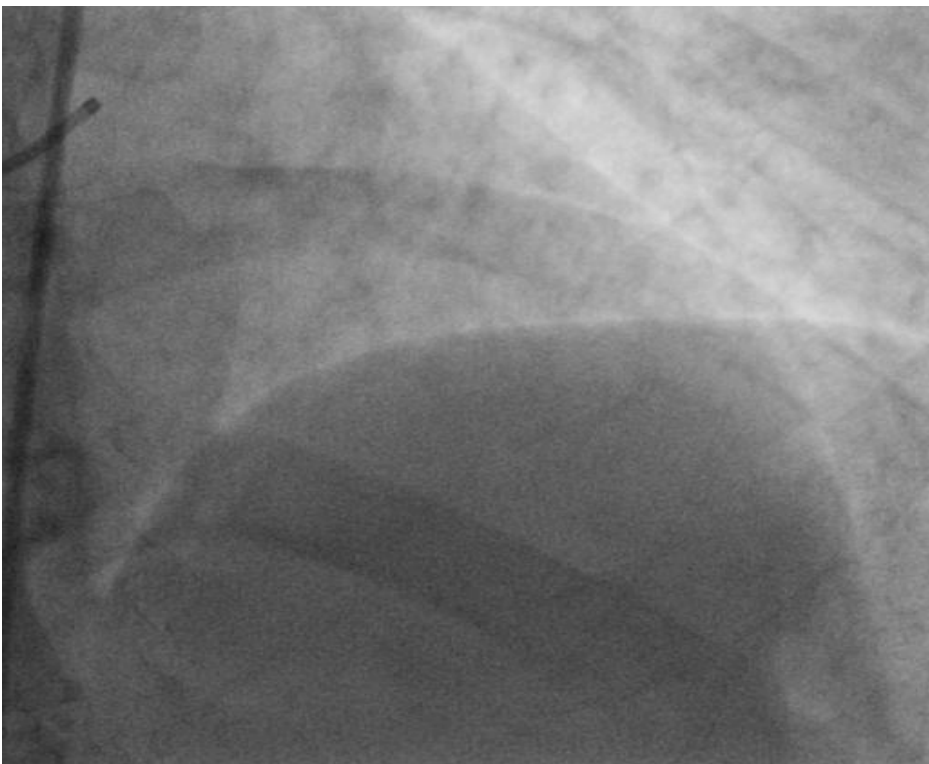


Analysis of 1 year virtual histology changes in coronary plaque located behind the struts of the everolimus eluting bioresorbable vascular scaffold

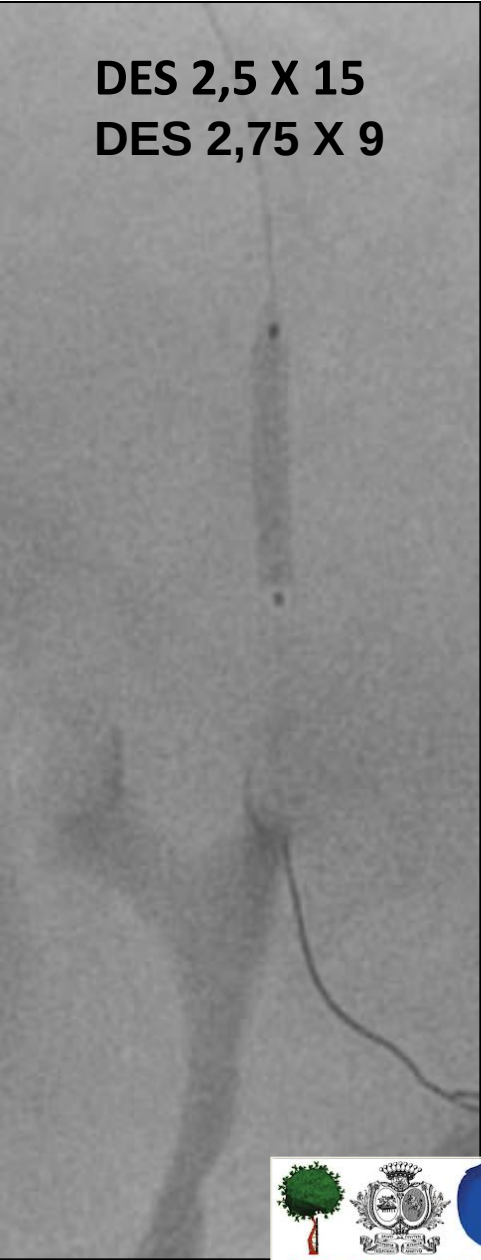
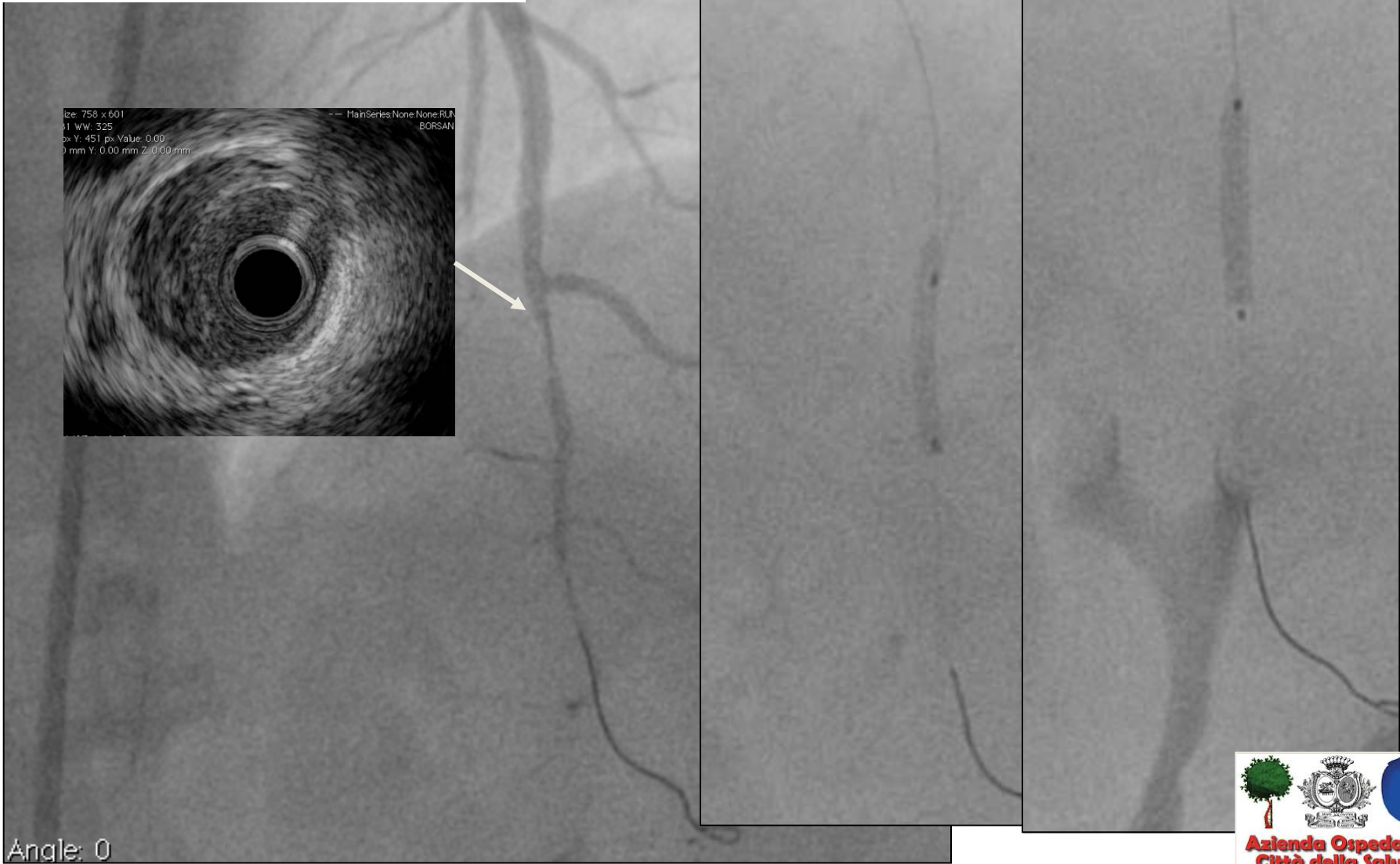
Salvatore Brugaletta · Josep Gomez-Lara · Hector M. Garcia-Garcia ·
Jung Ho Heo · Vasim Farooq · Robert J. van Geuns · Bernard Chevalier ·
Stephan Windecker · Dougal McClean · Leif Thuesen · Robert Whitbourn ·
Ian Meredith · Cecile Dorange · Susan Veldhof · Richard Rapoza ·
John A. Ormiston · Patrick W. Serruys

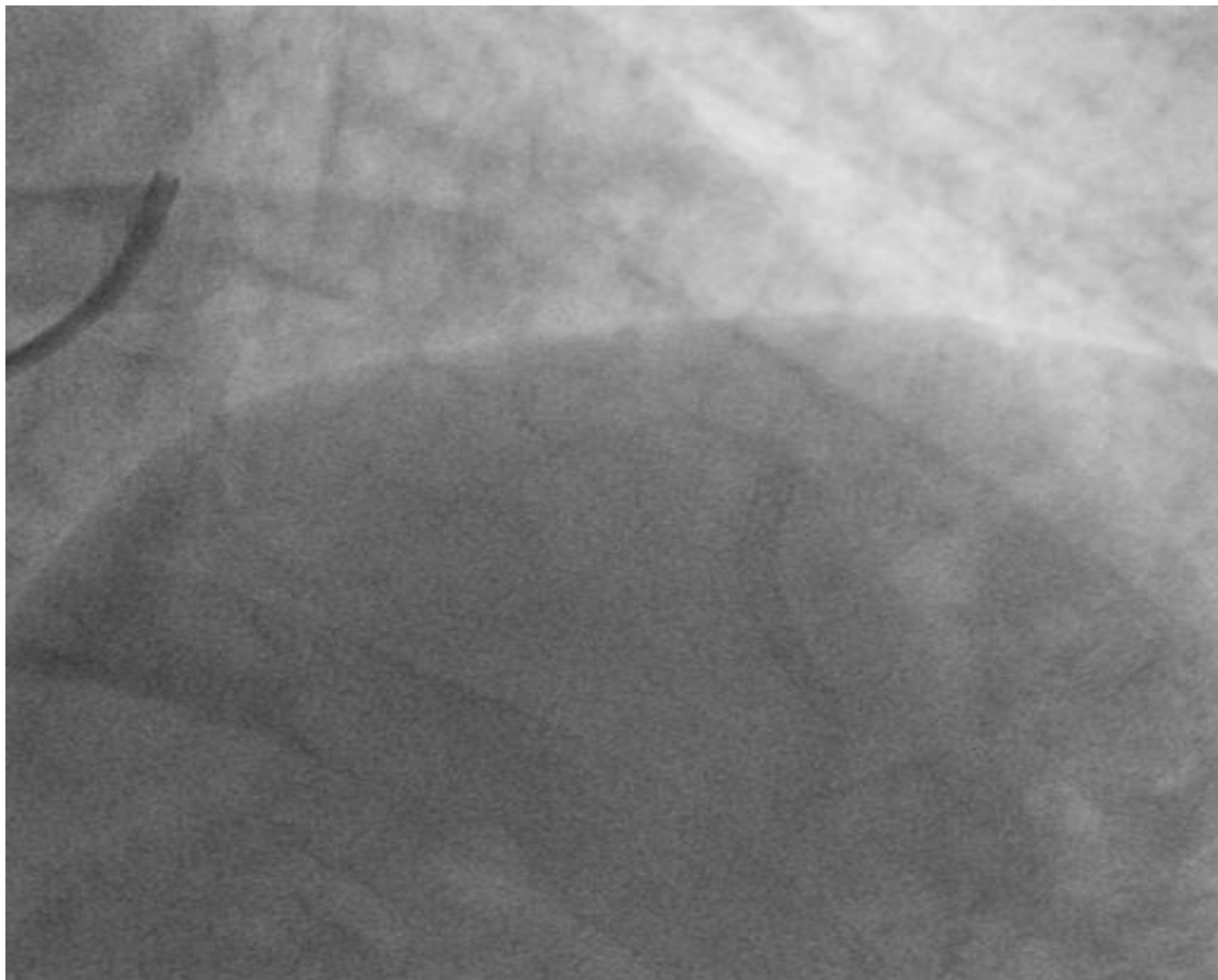


November 2011
48y, hypertension
Anterolateral STEMI



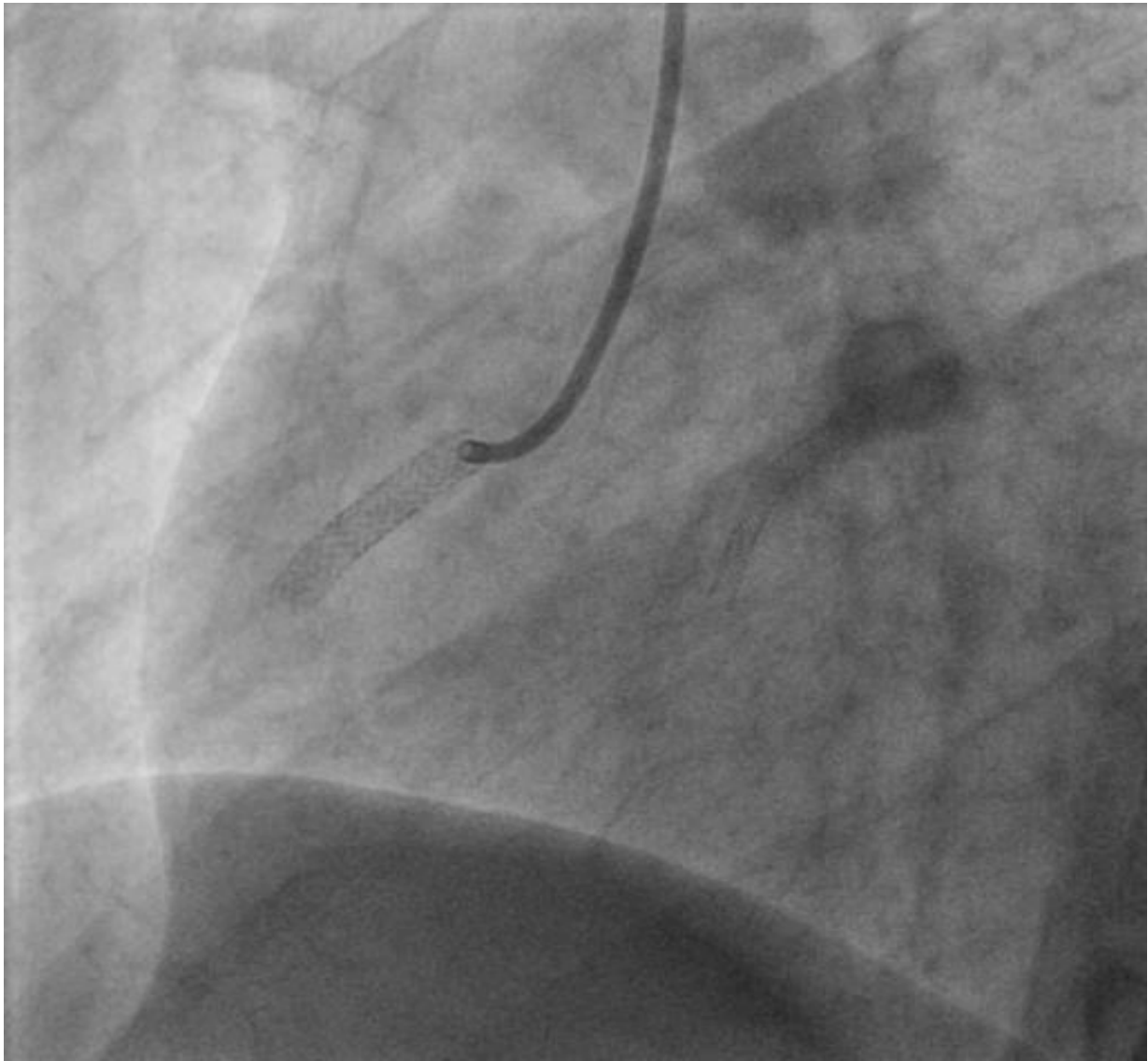
November 2011
48y, hypertension
Anterolateral STEMI











BMS/DES

4/30, 4/30, 4/18,
3/22, 2,5/22,
2,5/18

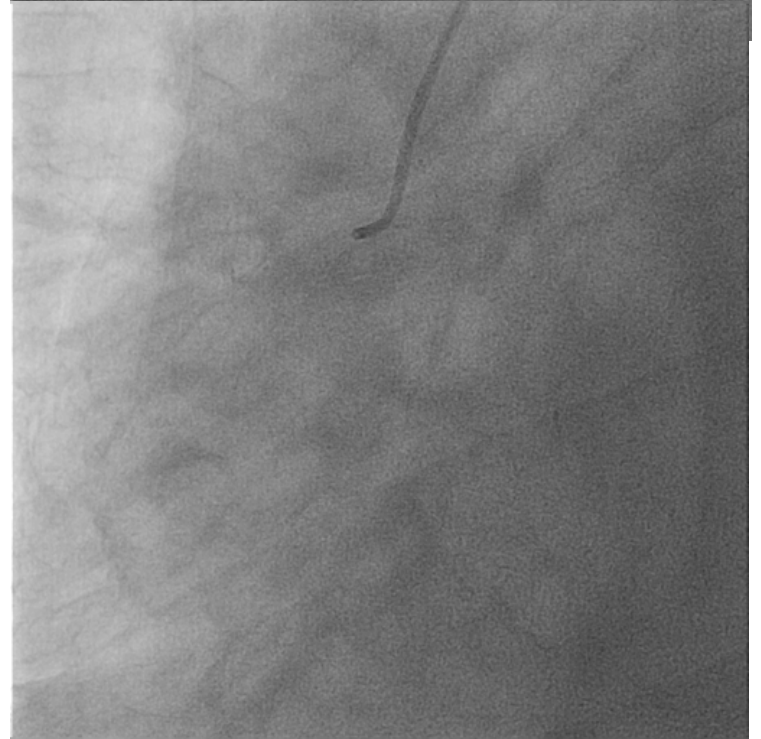
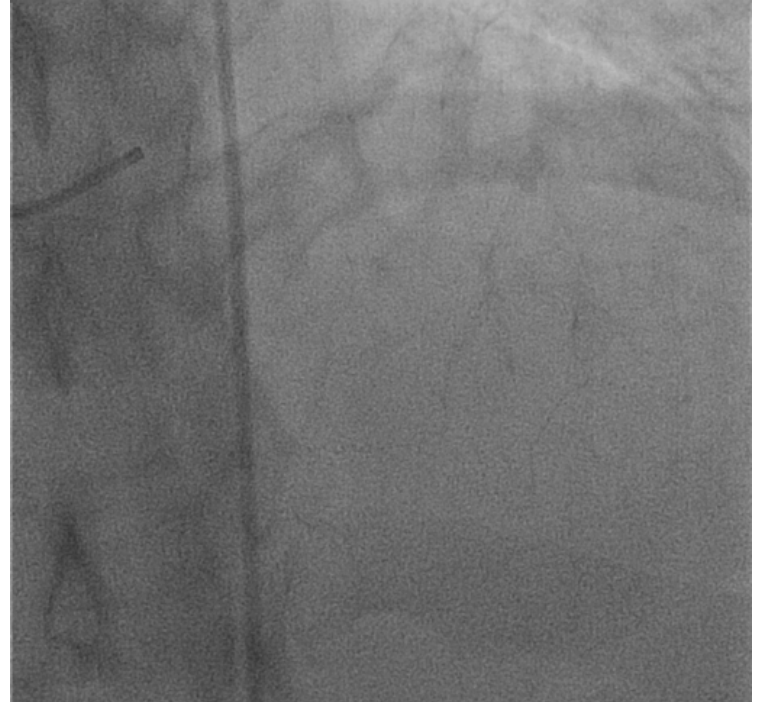
117% Angle: 0

117% Angle: 0

n: 117% Angle: 0

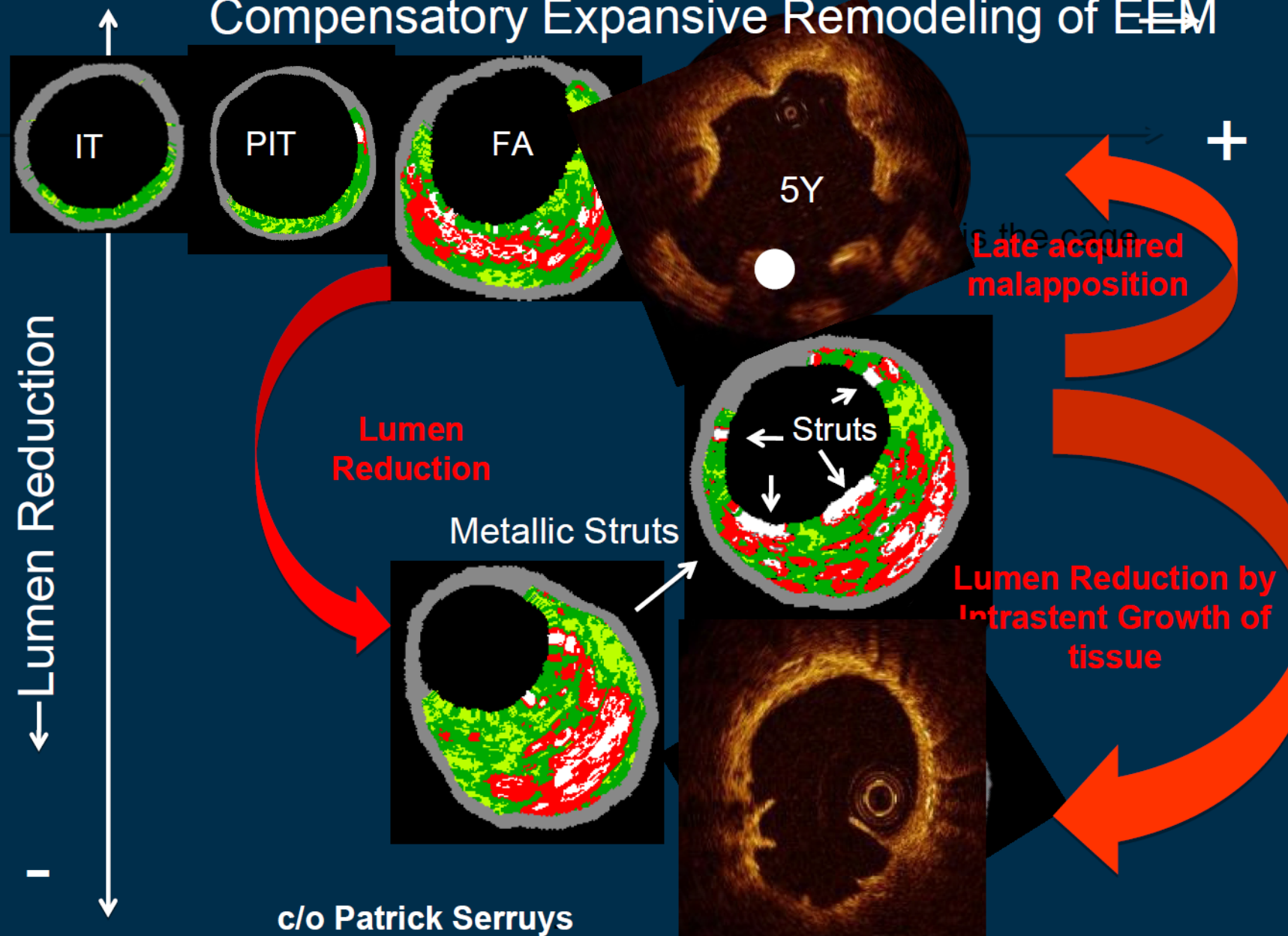


December 2012, 48y,
Acute Heart Failure
Type 1 diabetes EF 38%
Moderate mitral regurgitation



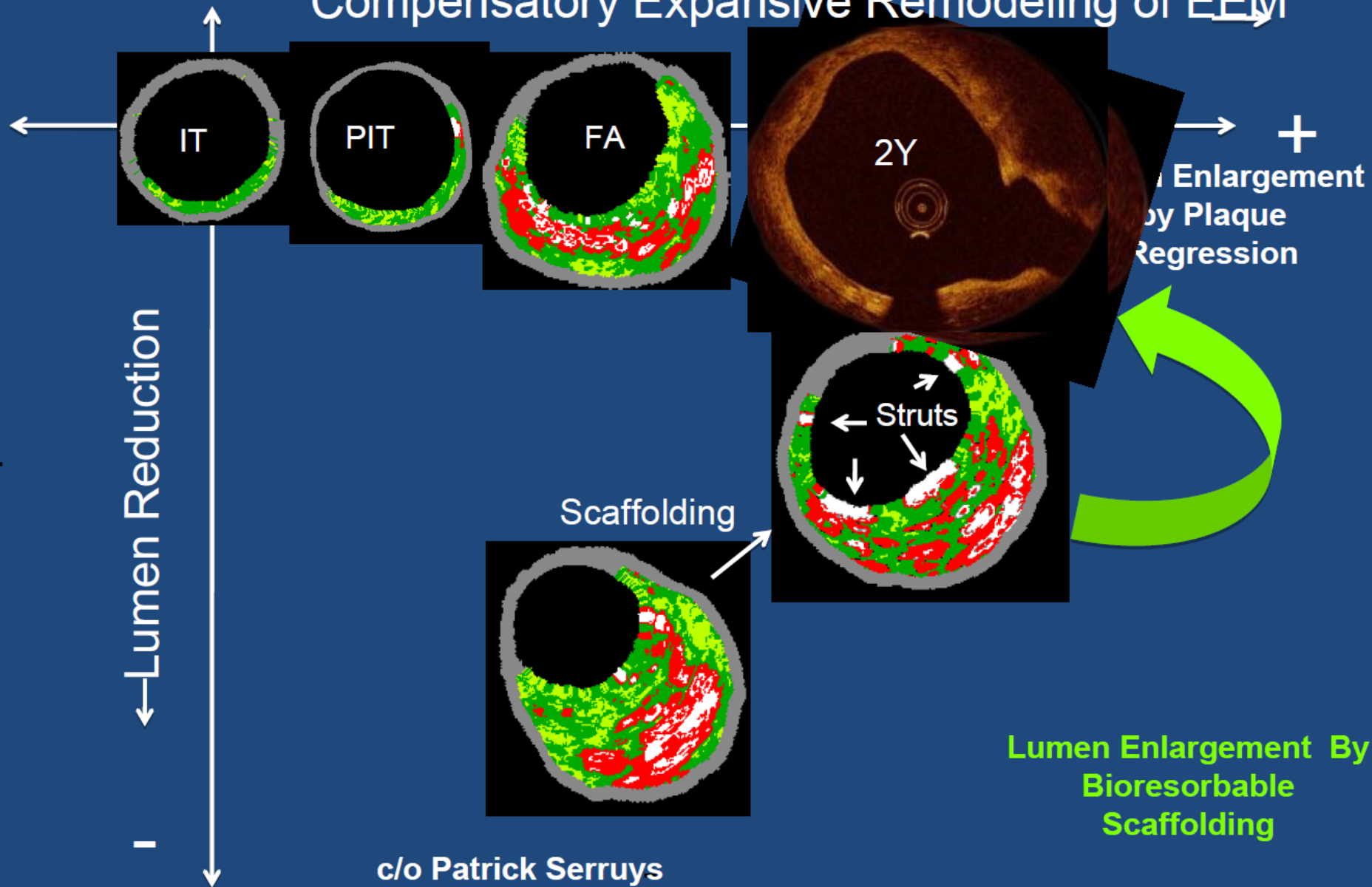
Metallic Stent – A caged lumen doomed to get reduced, or a cage doomed to get malapposed

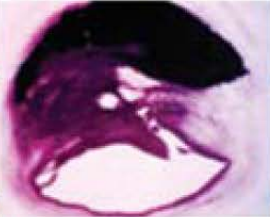
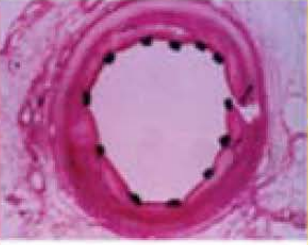
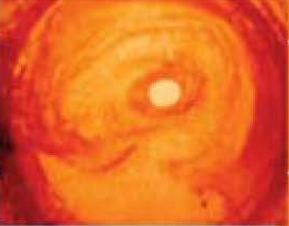
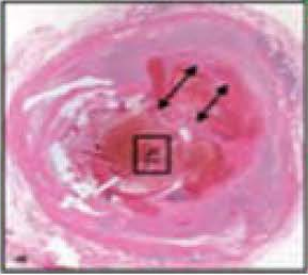
Compensatory Expansive Remodeling of EEM



Bioresorbable Scaffold – A new treatment Paradigm for Atherosclerotic Plaque

Compensatory Expansive Remodeling of EEM



	BA		BMS	Sealing of dissection with BMS	DES		VRT
Acute Occlusion	—	Dissection and intraparietal haemorrhage 	+		+		+
Acute ST	NA		—/+		+		+
Subacute ST			+		+		+
		Dissection Post-angioplasty					
Acute recoil	—		+		+		+
Constrictive remodelling	—		+	Neointimal hyperplasia making obstruction in the metallic stent	+		+
Neointimal hyperplasia	—	4 months later restenosis due to constrictive remodelling and neointimal hyperplasia	--		+		+
Expansive remodelling	+		—		—	Late/very late stent thrombosis	+
Late Luminal Enlargement	+		—		—		+
Late and Very late ST	NA		—		—		+/?

Incremental benefit of BRS over Xience

	One year	Five year
Mortality	-	?
MI	-	?
TLR	-	?

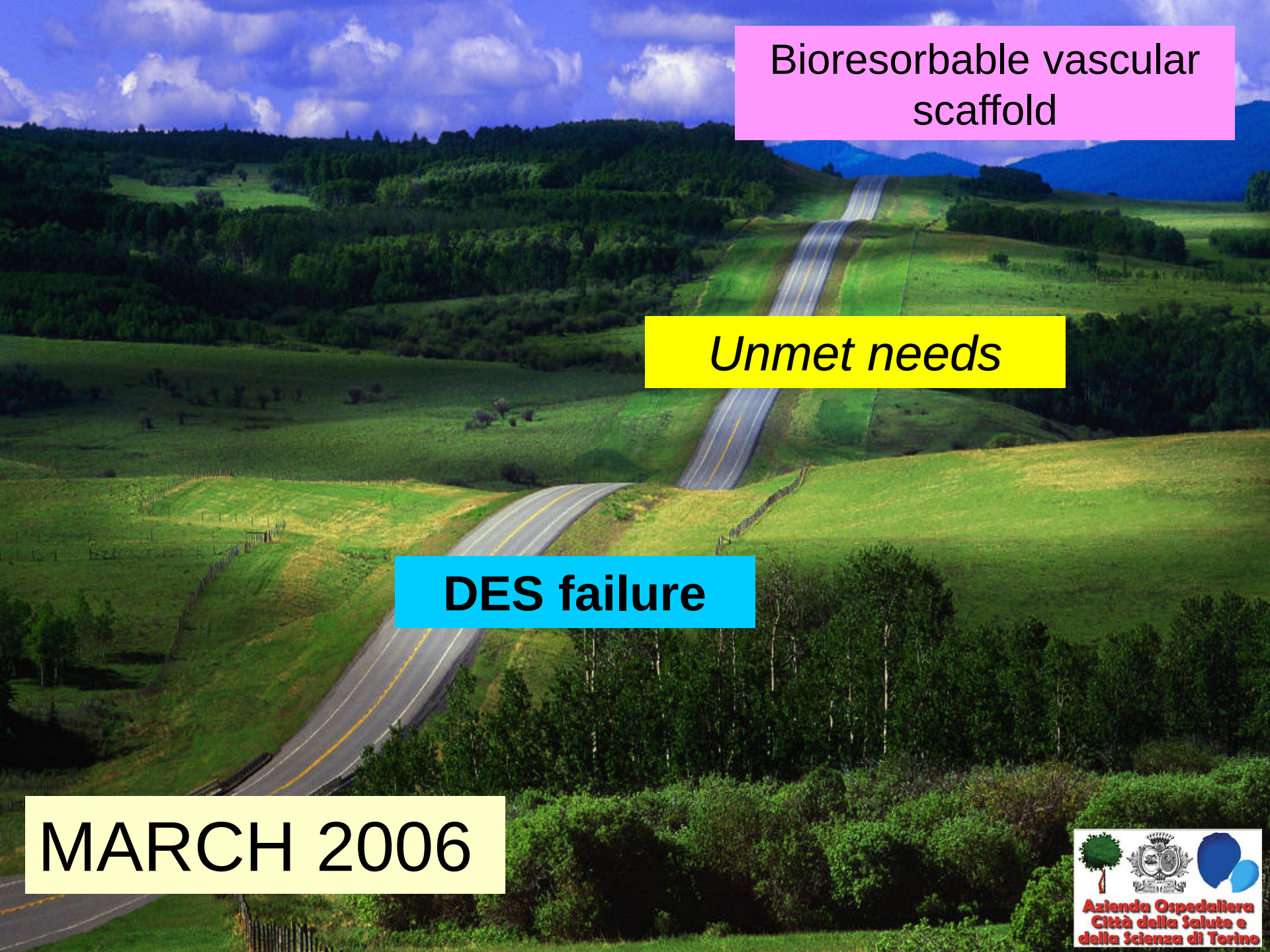
Conclusion: No benefit at one year

	One year	Five year
Scaffold thrombosis	-	+?
Vasomotion/ Pulsatility	+	+
Pharmaco-access	+	+

Acetylcholine positive have better outcomes

	One year	Five year
Late lumen enlargement	-	+
Wall thinning	-	+
Adaptive remodelling	-	+

Late benefit of VRT

A scenic landscape photograph showing a two-lane asphalt road that winds through a lush green valley. The road curves from the bottom left towards the upper right, disappearing into the distance. The surrounding hills are covered in dense green vegetation and forests. The sky is blue with scattered white clouds. Several text boxes are overlaid on the image.

Bioresorbable vascular
scaffold

Unmet needs

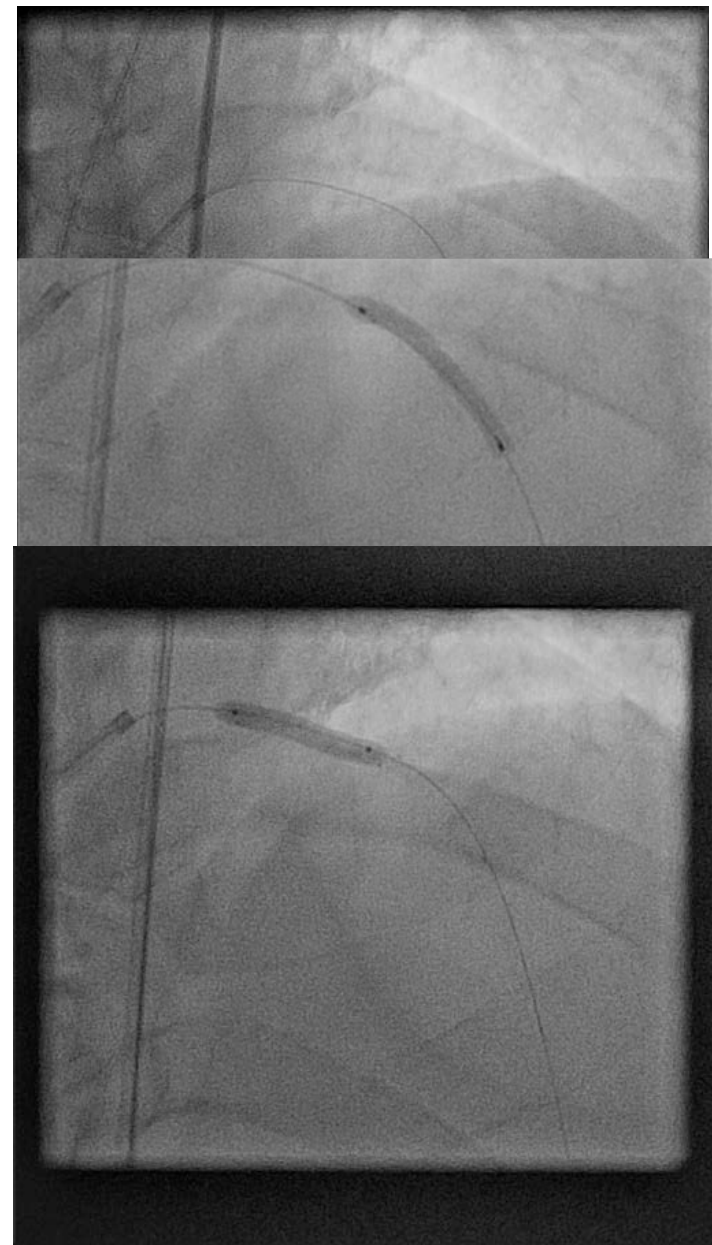
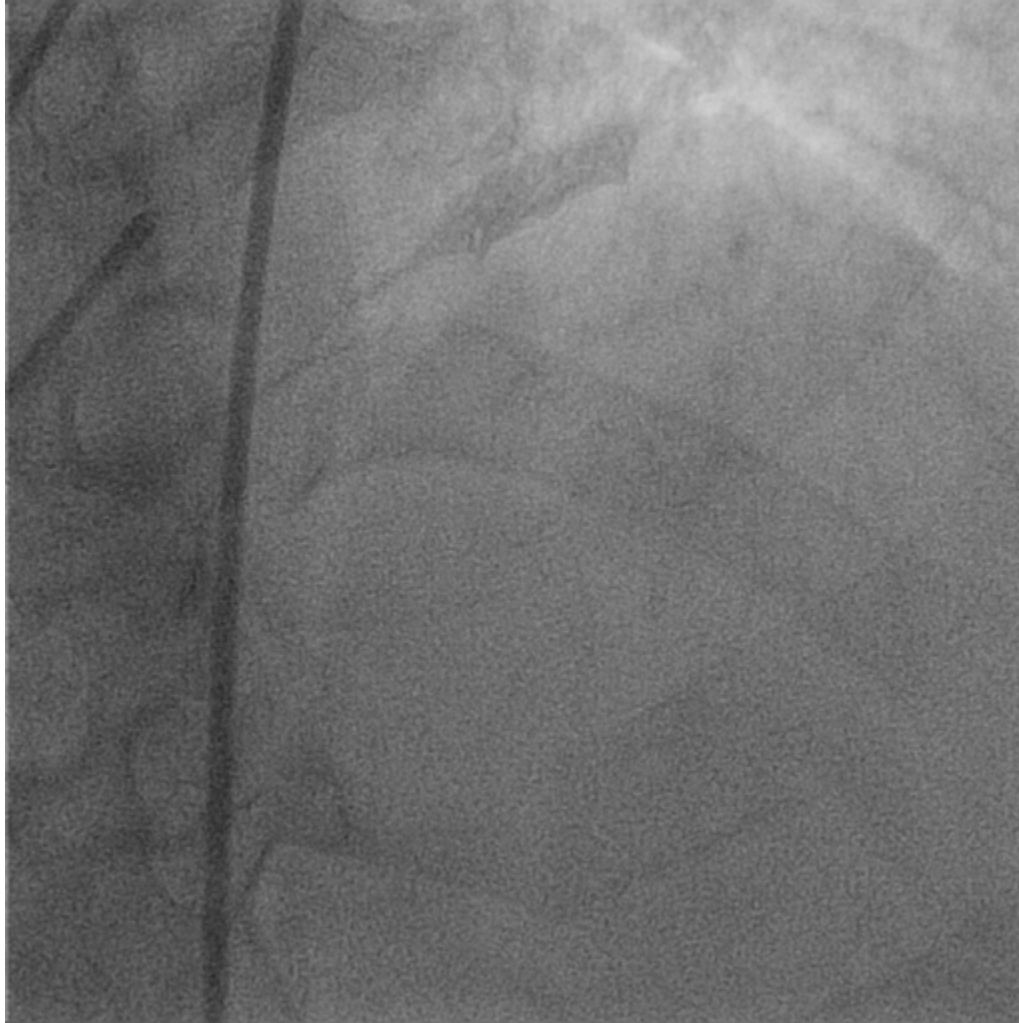
DES failure

MARCH 2006

July 2013, 54y

Familiar history of CAD, active smoker

Effort angina



ABSORB stent 2.5/28, 3/28, 3.5/28



Stent implantation: technical aspects

- Assessment vessel caliber with IVUS
- Lesion predilation
- Precise stent overlapping
- Accurate planning of multiple stent overlap (no more than 0.5mm)
- Bifurcation issue (off label): not aggressive: small caliber KB; low pressure KB (8 atm)
- Avoid excessive postdilation (no more than 0.5 mm)
- IVUS/OCT control

Scaffold diameter (mm)

2,5

3

3,5

***Scaffold
length (mm)***

12

-

-

+

18

+

+

+

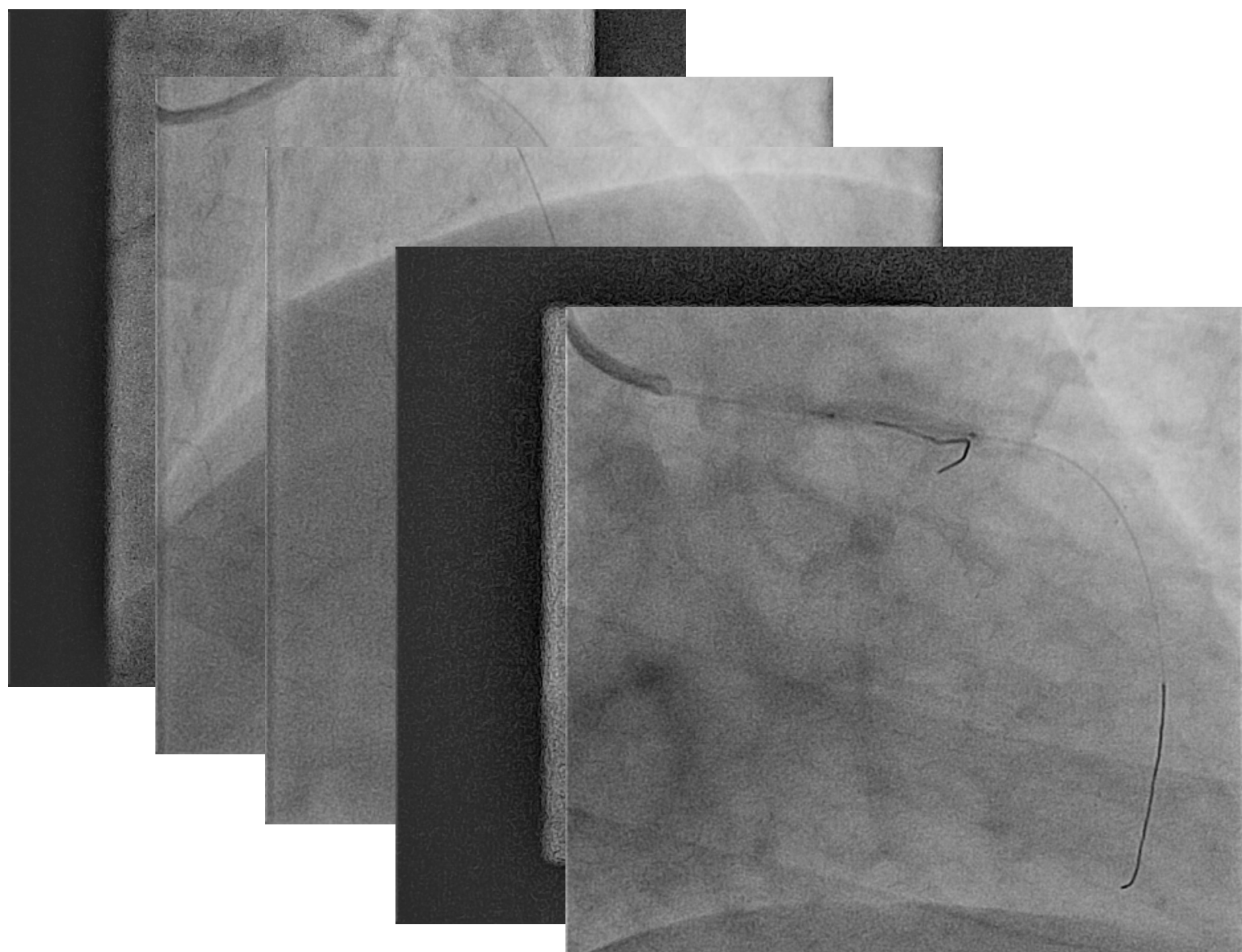
28

+

+

+







My next patients (?)

- Young patient
- Long lesions
- 3V disease
- Ostial lesions (?)
- Vulnerable plaque
- STEMI
- Non atherosclerotic lesion
- Diabetic patients

XXV GIORNATE CARDIOLOGICHE TORINESI

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