21st CardioVascular Summit
TCTAP 2016
April 26-29, 2016
Coex, Seoul, Korea

Breakfast Symposium: Vulnerable Plaque

Focal Vulnerable Plaque Stabilization by Scaffold Treatment

Evelyn Regar
Thoraxcenter
Erasmus Medical Center
Rotterdam, The Netherlands

Disclosure

The institution Erasmus Medical Center receives research support from St. Jude Medical

What to Do with Vulnerable Plaque?

Current Paradigm (2016)

Functionally significant plaque

↓

PCI
CABG

Functionally insignificant plaque

↓

Medical therapy
“Prevention”

What to Do with Vulnerable Plaque?

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"Prevention"

What to Do with Vulnerable Plaque?
Medical Therapy
Side-effects

Nitrates
Headache
Hypotension
Syncope
Relfex tachycardia

B-blockers
Fatigue, depression
Bradycardia
Heart block
Bronchospasm
Peripheral vasoconstriction

Aspirin
GI pain, ulceration, bleeding
Rash
Renal damage

Statins
Muscle ache
Hepatotoxicity
Myopathy
Constipation

ACEi
Hypotension
Headache
Cough
Renal damage

CCBs (HR lowering)
Bradycardia
Heart conduction defect
Low ejection fraction
Constipation

CCBs (DHP)
Headache
Ankle swelling
Fatigue
Flushing
Reflex tachycardia

What to Do with Vulnerable Plaque?
Medical Therapy
Adherence

- Poor adherence
- Adherence is not greatly influenced by the class of drug prescribed

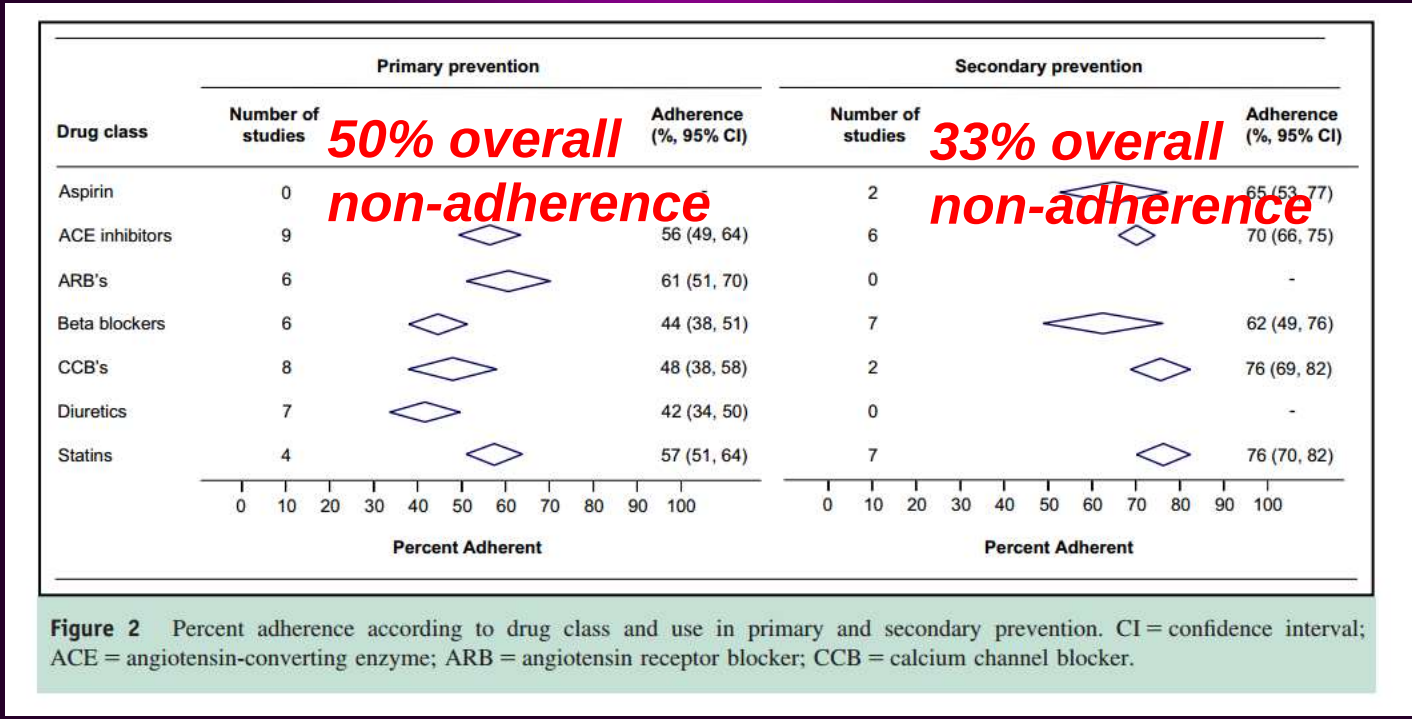

Figure 2 Percent adherence according to drug class and use in primary and secondary prevention. CI = confidence interval; ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; CCB = calcium channel blocker.

Naderi SH et al. Am J Med. 2012.

What to Do with Vulnerable Plaque?
Medical Therapy
How Many Pills?

- 40 year old man
- Life expectancy of 80 years:

  5 pills a day

  x 365 days a year

  x 40 years

  = 73,000 pills.

73,000 pills x 1 gram = 73 kg of pills

What to Do with Vulnerable Plaque?
Medical Therapy
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  5 pills a day

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  = 73,000 pills.

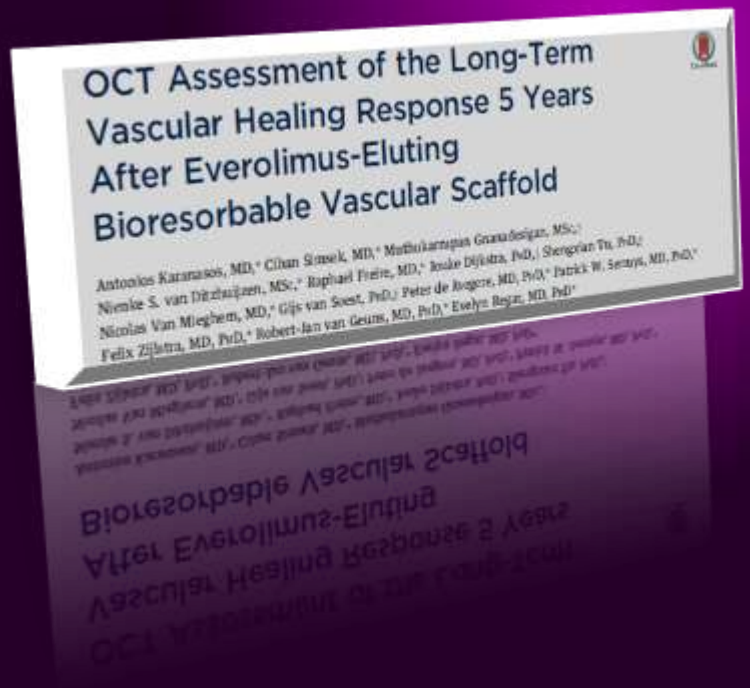
73,000 pills x 1 gram = 73 kg of pills

TO PREVENT THIS ???

Courtesy ms. ASA Autar, Dr. HMM van Beusekom

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)
Long-term outcome (>5y) is favourable



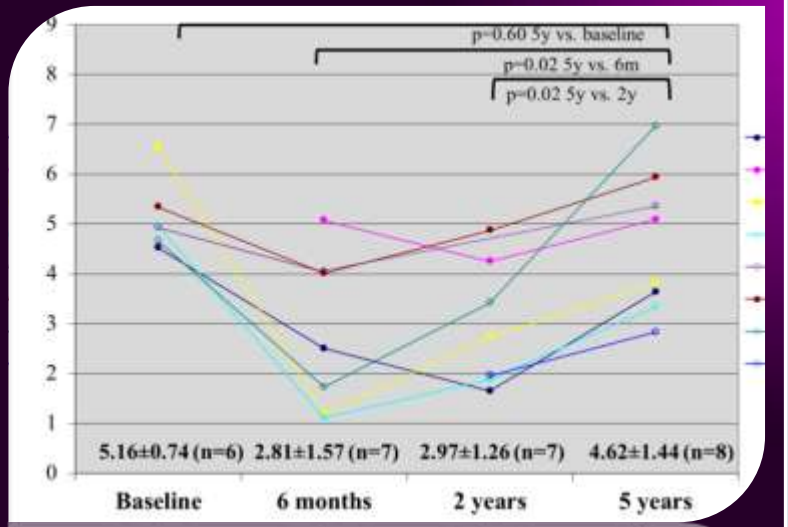
Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)

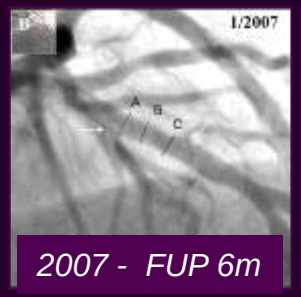
Long-term outcome (>5y) is favourable

Consistent increase in lumen area



2006 - Pre

2006 - Final



2007 - FUP 6m

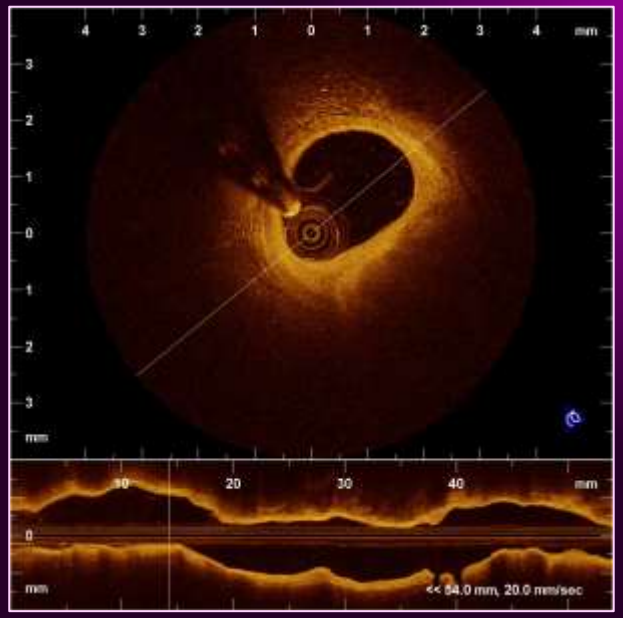
2012 – FUP 5y

Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)

Long-term outcome (>5y) is favourable
Complete strut resorption &
Formation of a signal-rich layer



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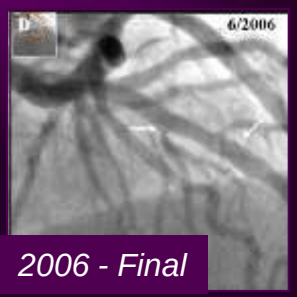

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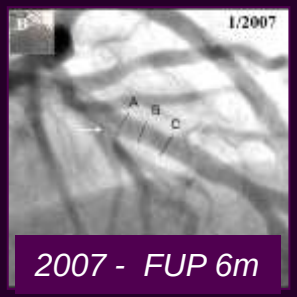

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Karanasos A et al. JACC 2014

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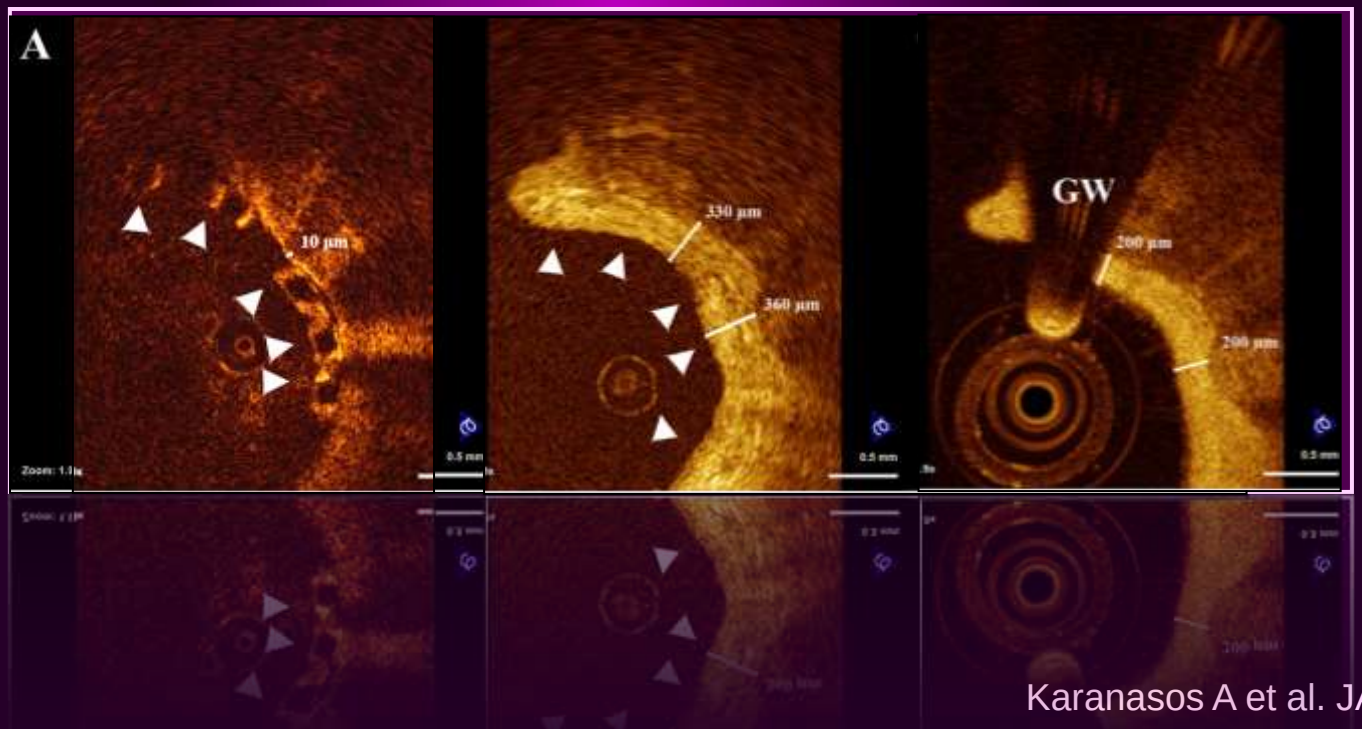

Karanasos A et al. JACC 2014

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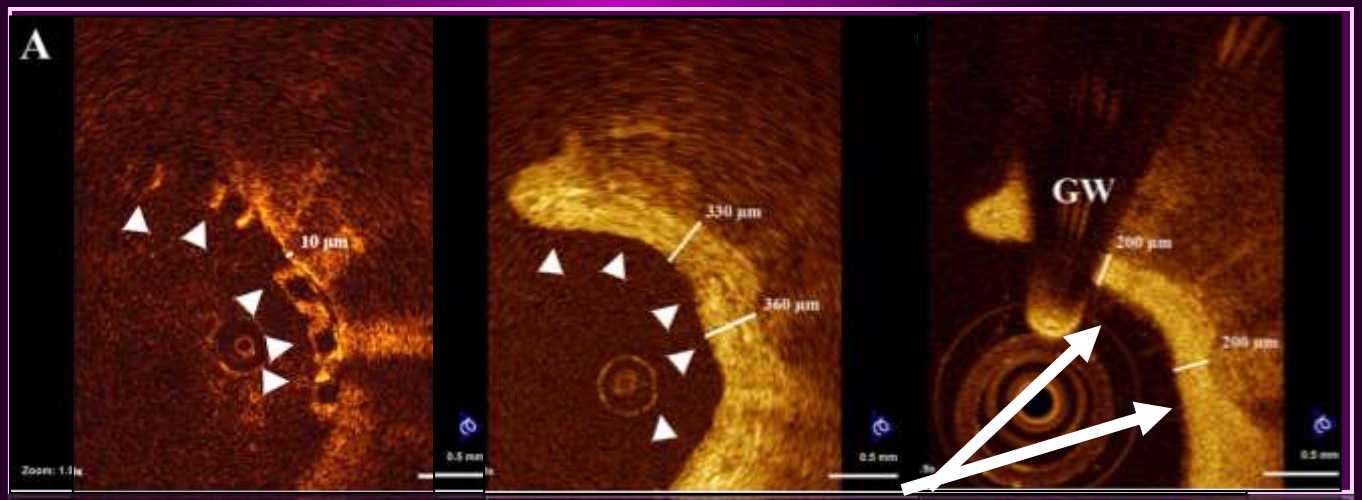


" Sealing or Re-capping "

- Development of signal-rich layer
- Separation of thrombogenic plaque from the lumen

Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)

Long-term outcome (>5y) is favourable

Complete strut resorption &

Formation of a signal-rich layer

How can we characterize this signal-intense layer and the underlying plaque?

Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)
OCT Attenuation Imaging

Fibrous	low
Calcium	low
Necrotic core	HIGH
Macrophages	very HIGH

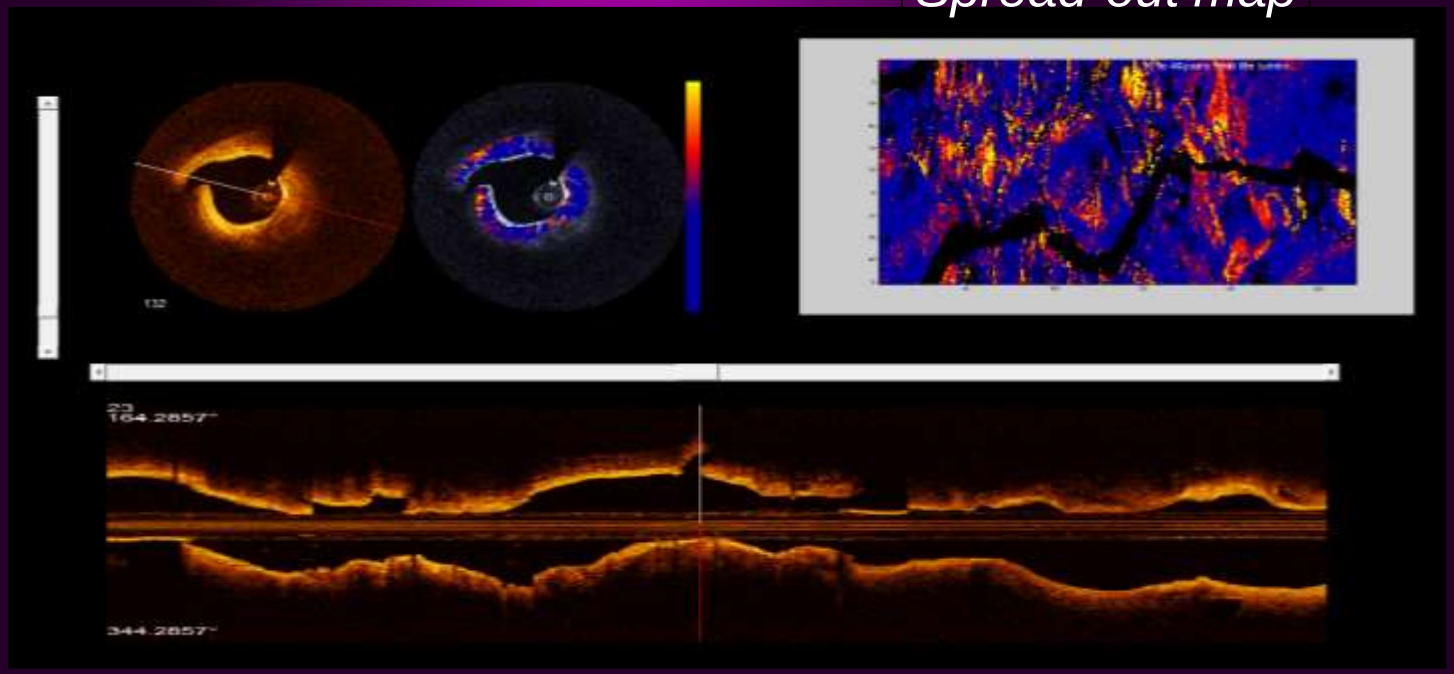
Relation between tissue type & attenuation coefficient

van Soest G et al, J. Biomed. Opt. 2010

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)
OCT Attenuation Imaging

Spread-out map

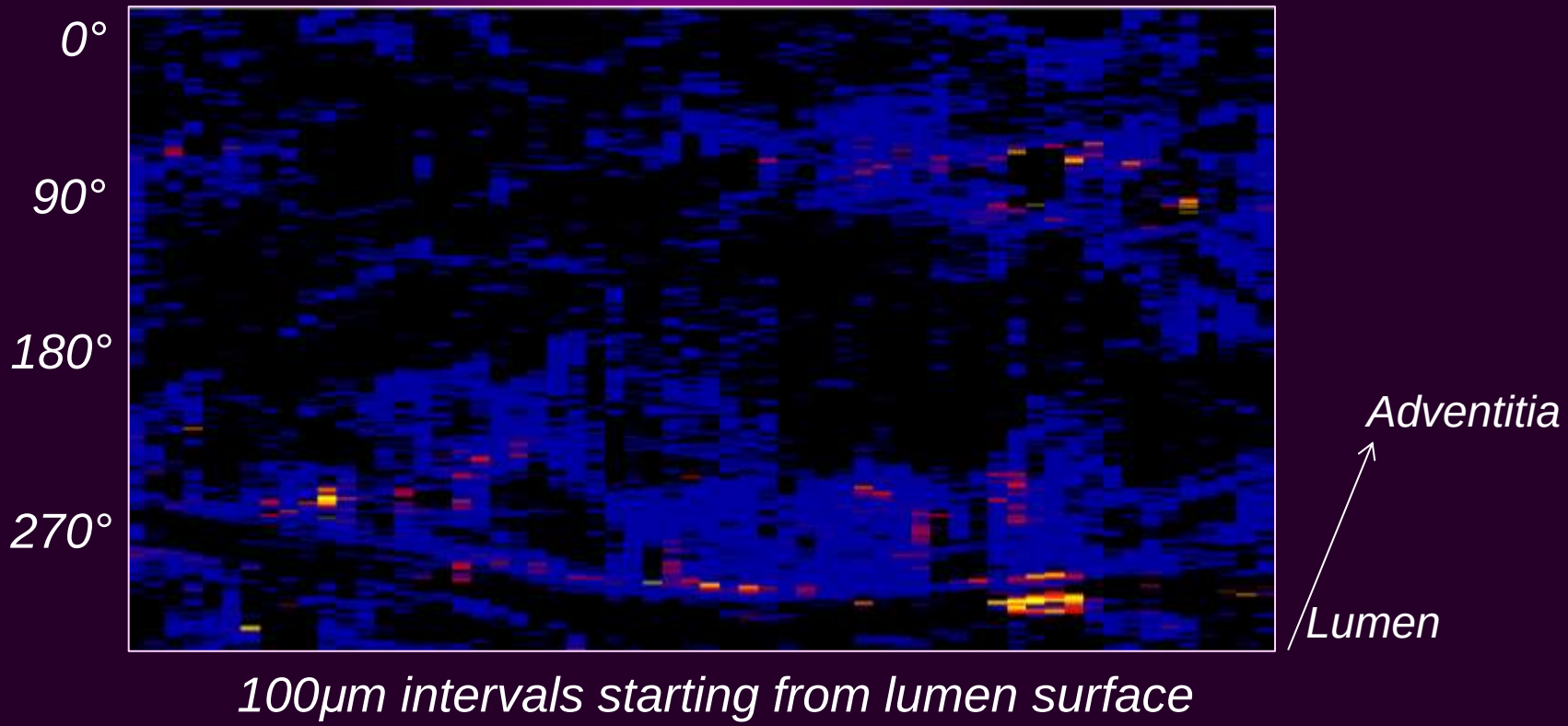


Courtesy
M. Gnanadesigan
T. Kameyama

van Soest G et al, J. Biomed. Opt. 2010

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

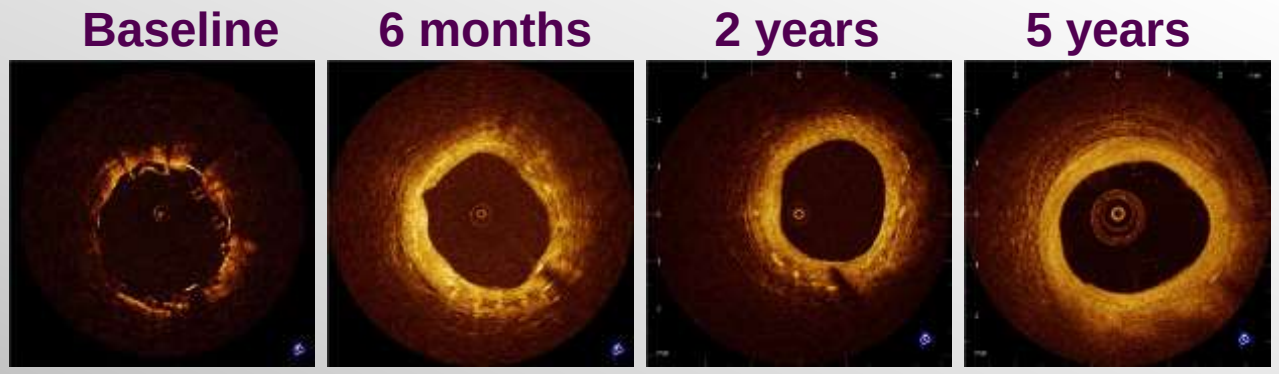
BVS (ABSORB A)
OCT Attenuation Imaging

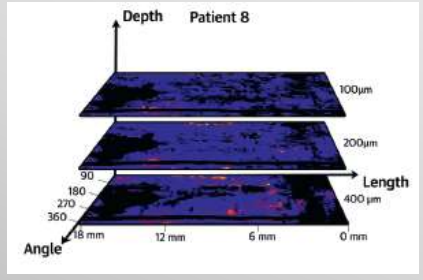


Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)
OCT Attenuation Imaging

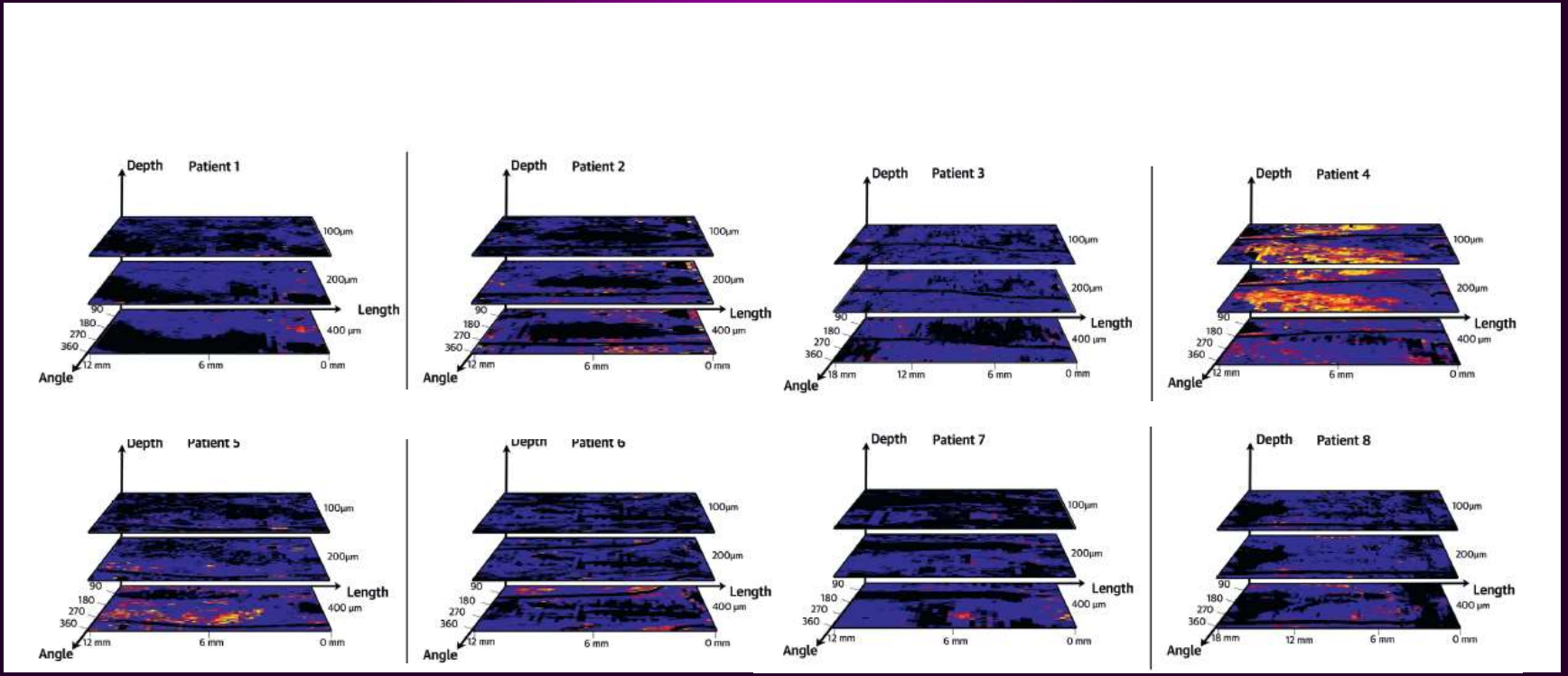




Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

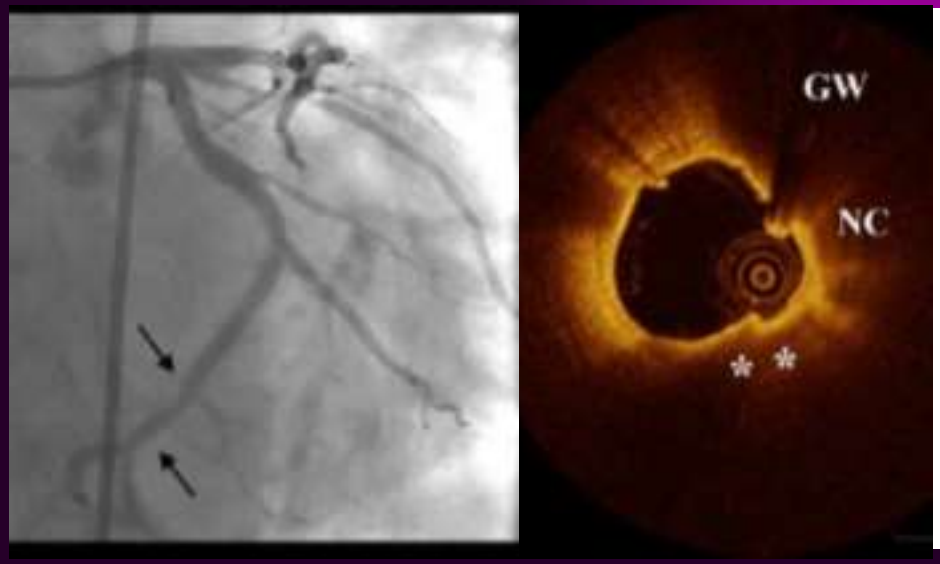
BVS (ABSORB A)
OCT Attenuation Imaging

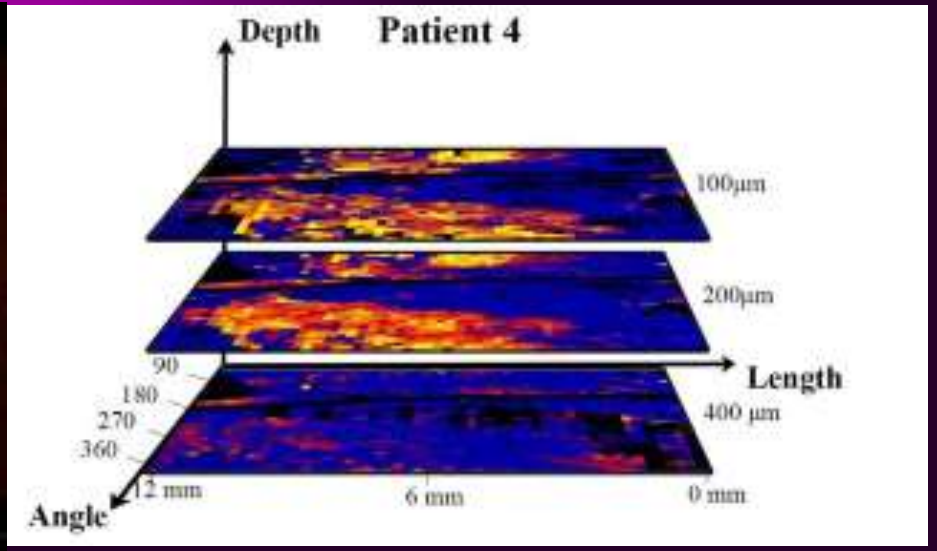


Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)
OCT Attenuation Imaging





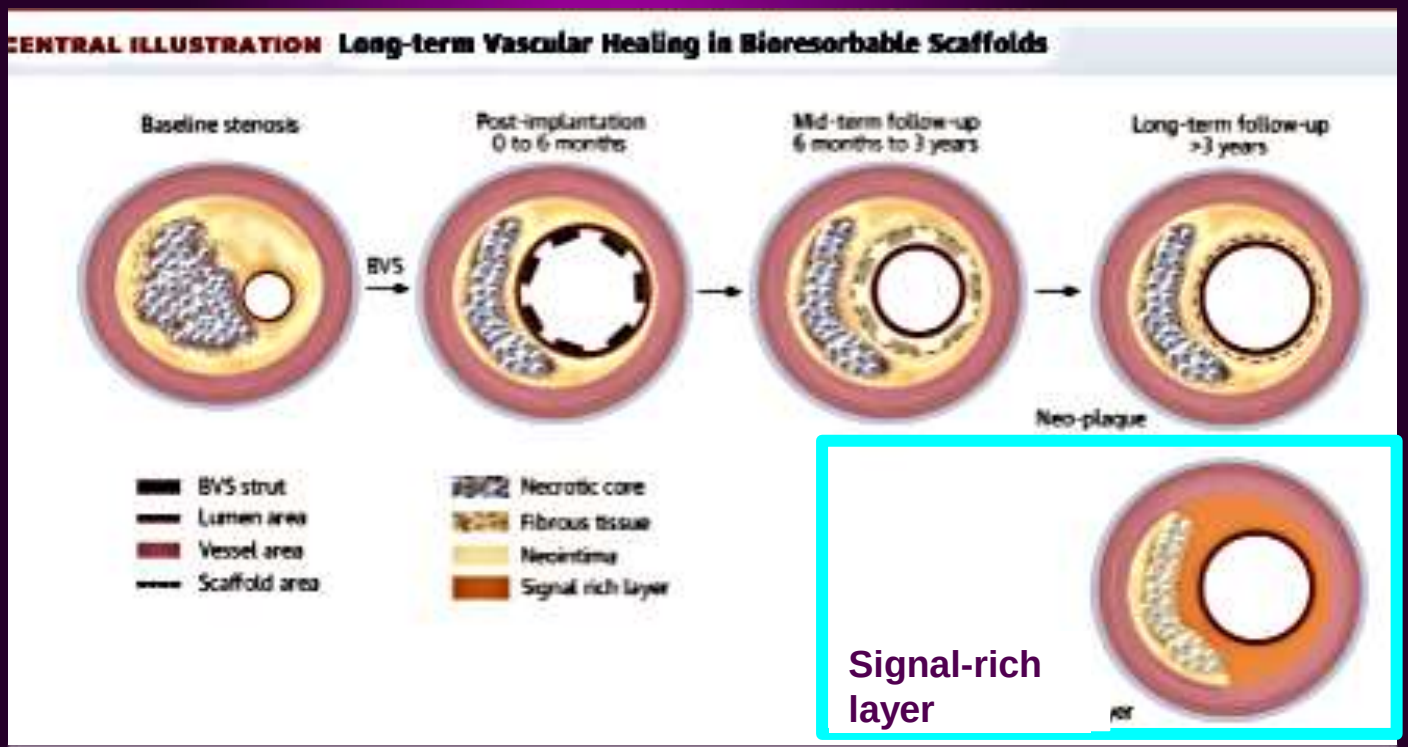
Asymptomatic, non-flow limiting rupture in 1/8 pts

Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS (ABSORB A)

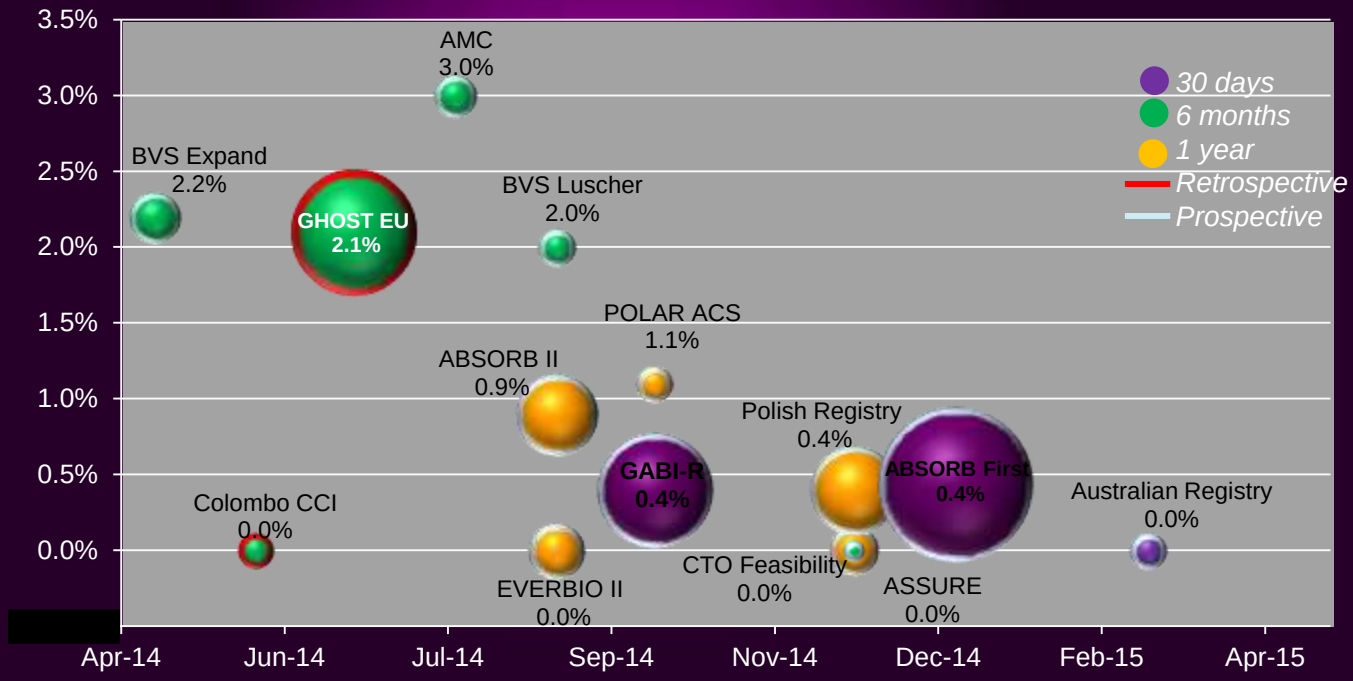
Plaque composition & architecture can be modified.



Karanasos A et al. JACC 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

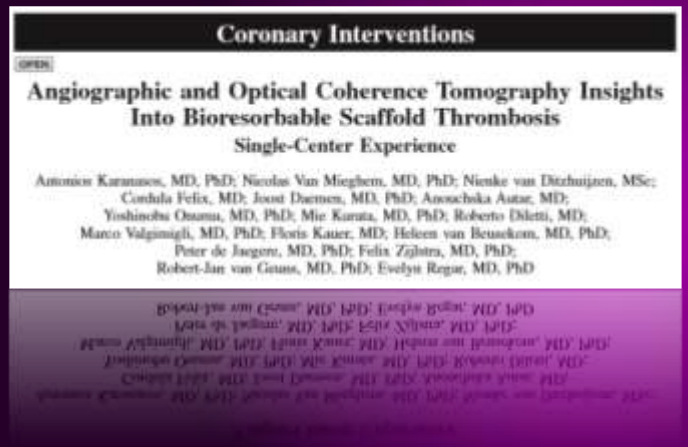
BVS: Performance in Complex Lesions
Scaffold Thrombosis



R. Van Guens: BVS Expand Presentation, PCR 2014; D. Capodanno: PCI with BVS in routine clinical practice: GHOST-EU Registry, EuroIntervention 2014; doi: 10.4244/EIJY14M07_11; Kraak: Initial experience and clinical evaluation of the Absorb BVS in real world practice: AMC Single Center PCI Registry, EuroIntervention 2014; doi: 10.4244/EIJY14M08_08; Cook: EVERBIO II presentation, TCT2014; Serruys: ABSORB II, Lancet Sept 2014; T. Luscher: Feasibility of second generation BVS implantation in complex anatomical and clinical scenarios; Clinical Research Cardology 2014; Doi 10.1007/s00392-014-0757-4; Prof Christian Hamm, Prof Holger Nef, Prof Stephan Achenback, Dr. Christoph Naber. Press conference DGK Herbsttagung Oct 10, 2014, Dusseldorf; D. Dudek: Polar ACS Study, Polish Archives of Internal Medicine Oct 2014; AOP_14_076; J. Worhrle: Beyond the early stages: insights from the ASSURE registry on BVS. EuroIntervention 2014; doi: 10.4244/EIJY14M12_10; B. Vaquerizo: BVS for the treatment of CTOs: CTO-ABSORB Pilot study; Eurointervention 2014; doi: 10.4244/EIJY14M12_07 ; D. Dudek: Polish Absorb Experience BVS Registry Update, NFIC Conference December 2014; A. Colombo: Comparison of early clinical outcomes between Absorb BVS and EES In a Real World Population, CCI June 2014. doi: 10.1002/ccd.25569; E. Eeckhout: Absorb First Interim Report on 1800 pt 30 days, AsiaPCR 2015; N. Jepsen: Everolimous-eluting bioresorbable vascular scaffold implantation in real world, Heart, Lung, and Circulation (2015).02.011.

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS Thrombosis



Coronary Interventions

OPEN

Angiographic and Optical Coherence Tomography Insights Into Bioresorbable Scaffold Thrombosis

Single-Center Experience

Antonios Karanasos, MD, PhD; Nicolas Van Mieghem, MD, PhD; Nienke van Ditzhuijzen, MSc; Cordula Felix, MD; Joost Daemen, MD, PhD; Anoschka Autar, MD; Yoshinobu Onuma, MD, PhD; Mie Kuruta, MD, PhD; Roberto Diletti, MD; Marco Valgimigli, MD, PhD; Floris Kauer, MD; Heleen van Beusekom, MD, PhD; Peter de Jaegere, MD, PhD; Felix Zijlstra, MD, PhD; Robert-Jan van Geuns, MD, PhD; Evelyn Regar, MD, PhD

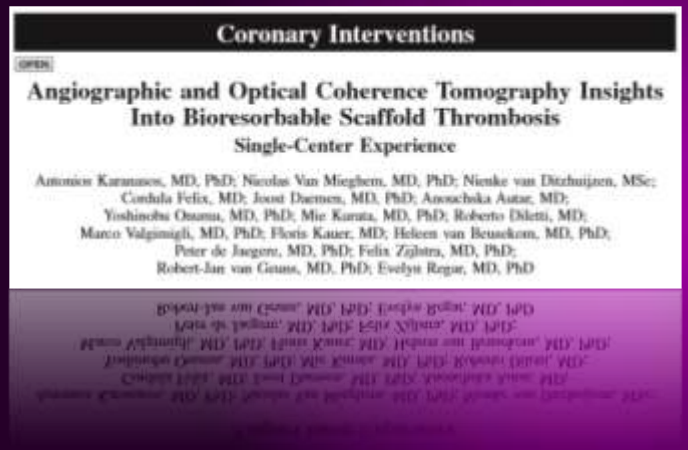
Main Pathomechanisms

- **Incomplete lesion coverage**
- **Underexpansion &**
- **Malapposition**

Karanasos A et al. Circ Cardiovasc Intervent 2015

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS Thrombosis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- **Incomplete lesion coverage**
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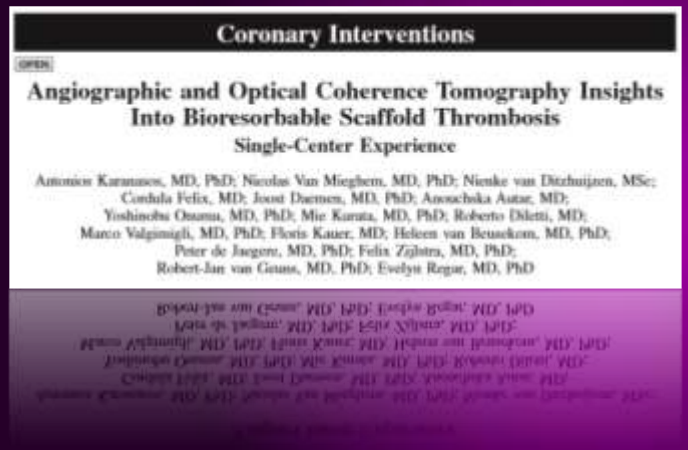
Seems to be triggered by implantation technique and thus, potentially avoidable

Karanasos A et al. Circ Cardiovasc Intervent 2015

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS Thrombosis



Coronary Interventions

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FUP after thrombosis

3/14 pts suffered a recurrent event!

Seems to be triggered by implantation technique and thus, potentially avoidable

Karanasos A et al. Circ Cardiovasc Intervent 2015

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS Performance in STEMI

BVS STEMI-First Registry

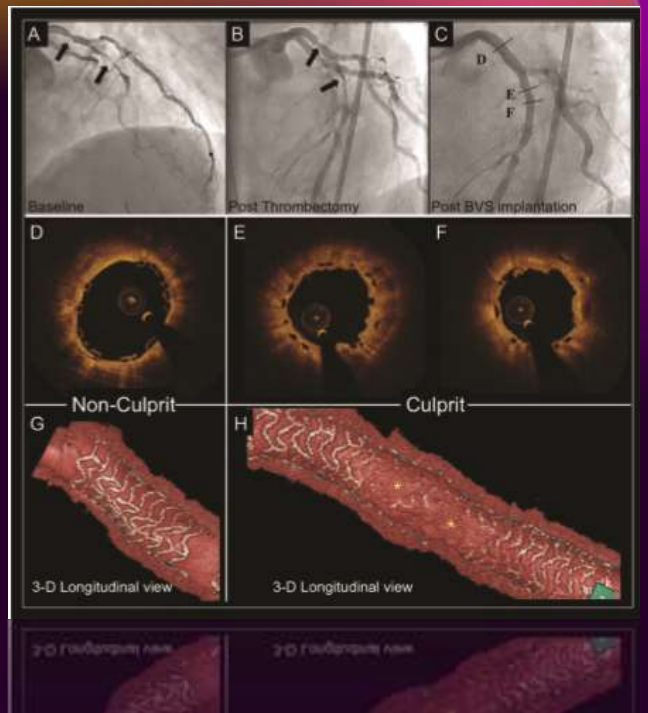

Table 6 Clinical outcomes at the 30-day follow-up intent-to-treat population

Clinical events	N = 49	95% CI
Target-lesion failure	(0/49) 0%	(0–7.41)
TVF	(0/49) 0%	(0–7.41)
Cardiac death	(0/49) 0%	(0–7.41)
Target-vessel MI	(0/49) 0%	(0–7.41)
Q-wave MI	(0/49) 0%	(0–7.41)
Non Q-wave MI	(0/49) 0%	(0–7.41)
Clinically driven target-vessel revascularization	(0/49) 0%	(0–7.41)
Any MI	(1/49) 2.6%	(0–10.69)
Q-wave MI	(0/49) 0%	(0–7.41)
Non Q-wave MI	(1/49) 2.6%	(0–10.69)
Major adverse cardiac events	(1/49) 2.6%	(0–10.69)
Non-target-vessel revascularization	(1/49) 2.6%	(0–10.69)
Definite or probable scaffold thrombosis	(0/49) 0%	(0–7.41)

Data are expressed number and proportion, *n* (%). 95% CI, 95% confidence interval.

Diletti R et al. Eur Heart J. 2014

What to Do with Vulnerable Plaque?
BVS Implantation
Current Knowledge

BVS Performance in STEMI

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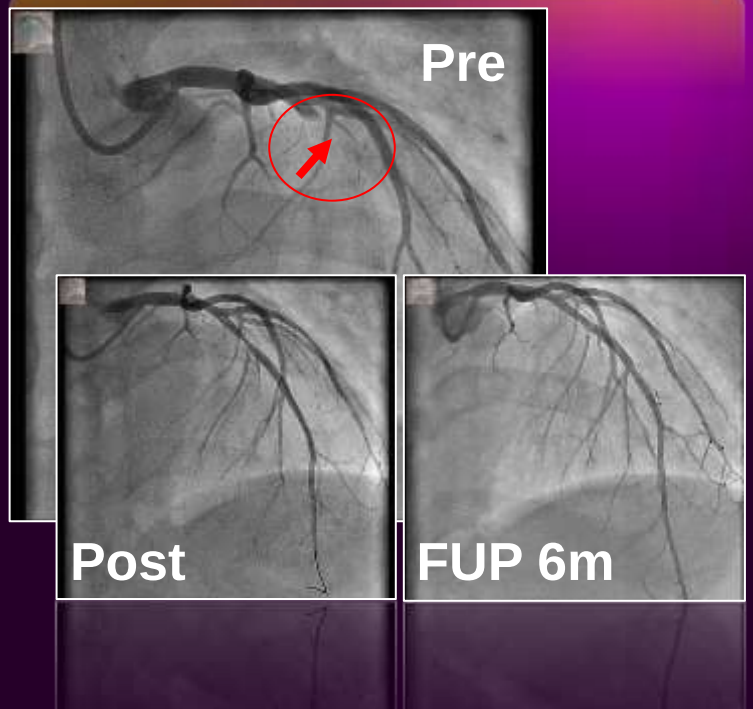
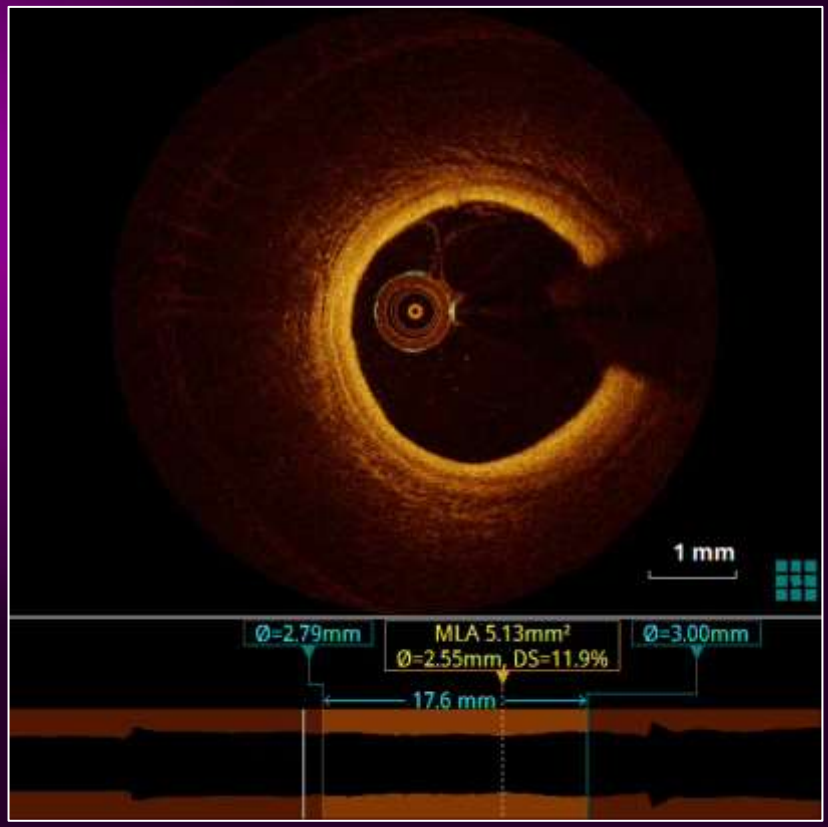




Karanasos A et al. Hellenic Cardiol J 2015

What to Do with Vulnerable Plaque?
BVS Implantation
Summary & Conclusion

BVS emerge as a potential mechanical solution for the treatment of vulnerable plaque.

Observations in small patient cohorts suggest favourable effects of BVS in obstructive lesions.

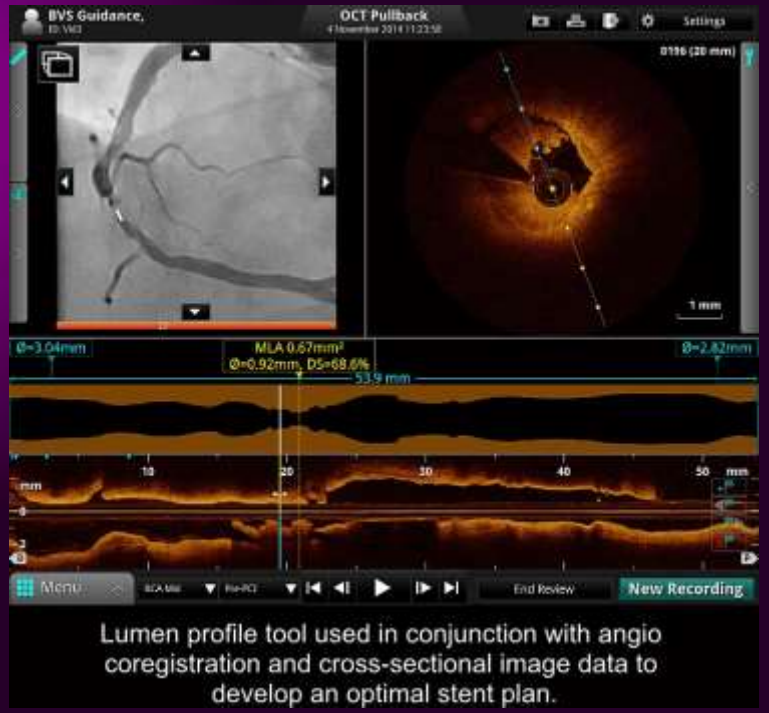
- **Late lumen enlargement**
- **Formation of a signal-rich layer**

These are hypothesized to be protective against plaque rupture & thrombosis.

What to Do with Vulnerable Plaque?
BVS
The Interesting Questions …

Benefit of scaffold

Challenge of VP localization



Lumen profile tool used in conjunction with angio coregistration and cross-sectional image data to develop an optimal stent plan.

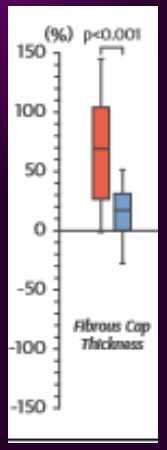
Co-Registration

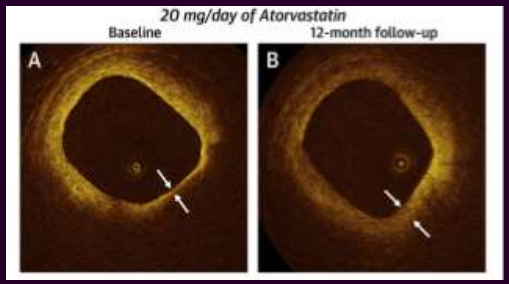
What to Do with Vulnerable Plaque?
BVS
The Interesting Questions …

Benefit of scaffold

Intensified Statin Therapy

EASY-FIT Trial:
50% Increase in TCFA cap thickness over 24m





Atorvastatin 20mg

Atorvastatin 5mg

Komukai et al. JACC 2014

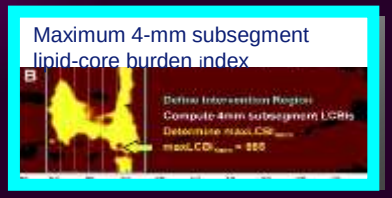
What to Do with Vulnerable Plaque?
BVS
The Interesting Questions …

Benefit of scaffold

Risk of TCFA treatment

Culprit TFCA have a higher risk for periprocedural MI & worse outcome

RR ~ 10



Goldstein J at el. Circ Cardiovasc Interv 2011

Lee et al. Circ Cardiovasc Interv 2011

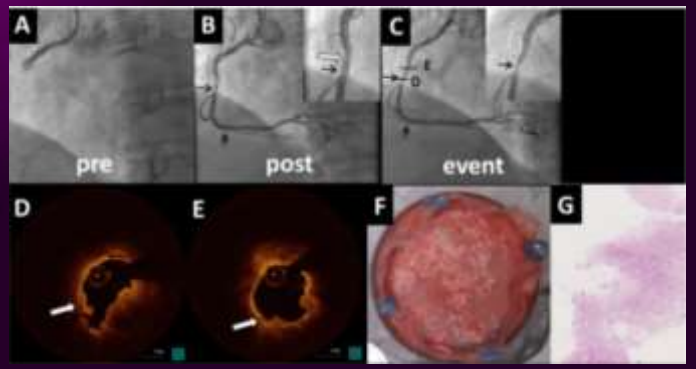
What to Do with Vulnerable Plaque?
BVS
The Interesting Questions ...

Benefit of scaffold

Risk of BVS Thrombosis

Seems avoidable!

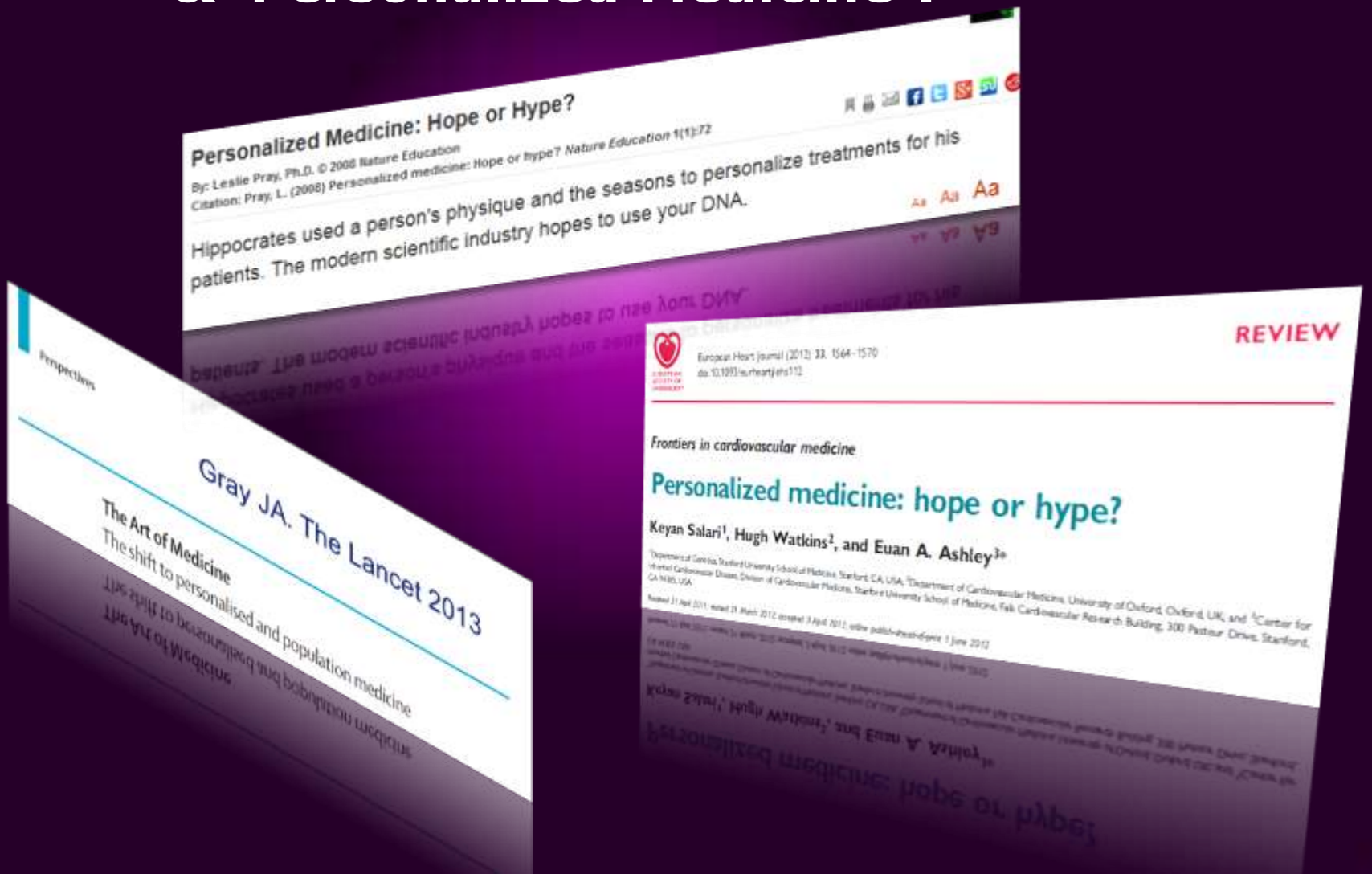
in the majority of cases



Karanasos A et al. in press.

What to Do with Vulnerable Plaque? BVS

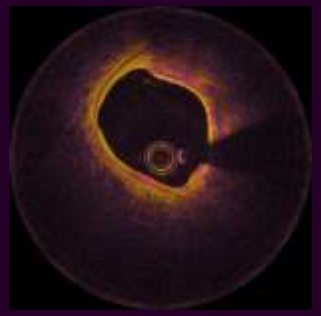
… Avenue Towards Improved Prognosis & Personalized Medicine ?



Thank You For Your Attention!

PhD Students & Guest Researchers

A. Karanasos
J. van der Sijde
J.M. Fam
B. Zhang
N. van Ditzhuijsen



Interventional Cardiology

J. Ligthart
K. Witberg
R.J. van Geuns (BVS)
P. de Jaegere
N. van Mieghem
R. Diletti
F. Zijlstra

Experimental Cardiology

H. van Beusekom

Hemodynamics Laboratory

J. Wentzel
F. Gijsen

Bioengineering

G. van Soest
A.F.W. van der Steen

Imaging Group

N. Bruining
K. Sihan