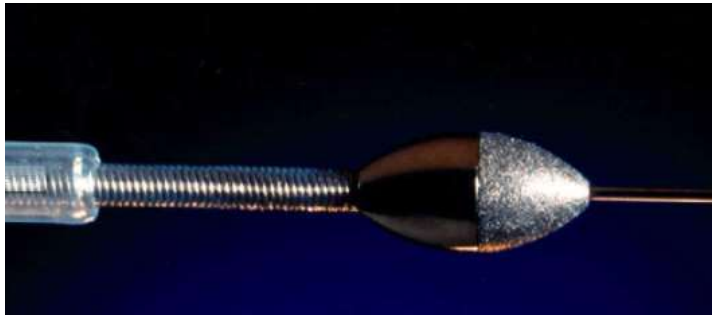
Pre-lesion Modification:
Why and How?



James D. Flaherty, MD
Associate Professor of Medicine
Medical Director, Coronary Care Unit
Bluhm Cardiovascular Institute
Feinberg School of Medicine, Northwestern University
November 25, 2021

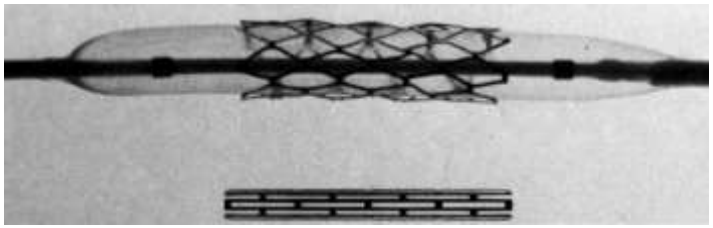
Disclosures

None

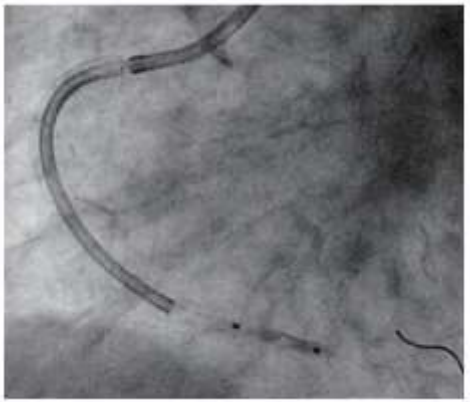
Pre-lesion Modification – Why?

1. Stent Delivery
2. Stent Expansion
3. Reduce Restenosis
4. Prevent Stent Thrombosis
5. Optimize PCI Efficacy

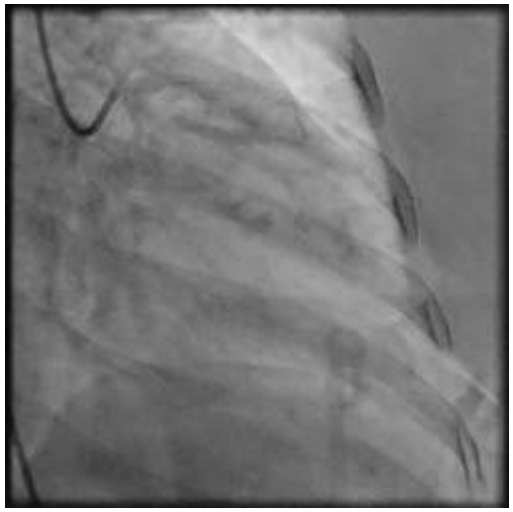

In the beginning...

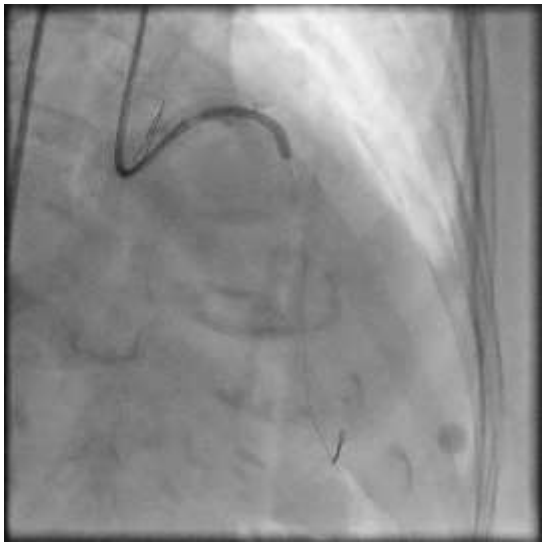


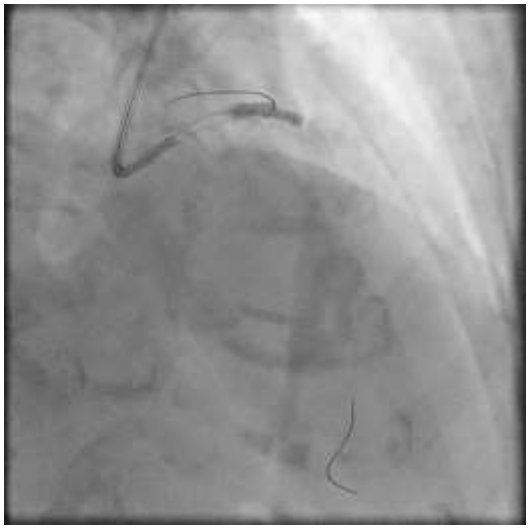

FAST FORWARD



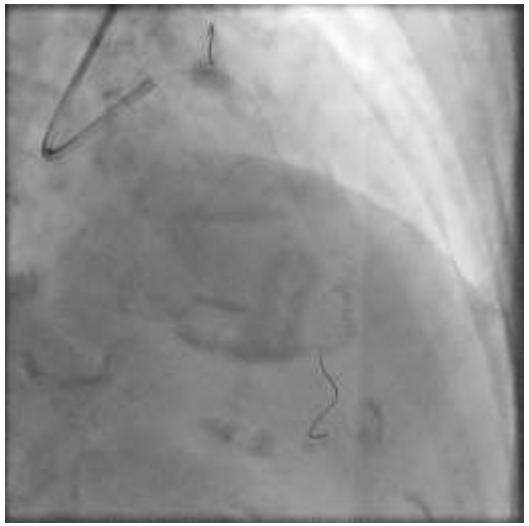
Case 1 87 y/o woman with unstable angina

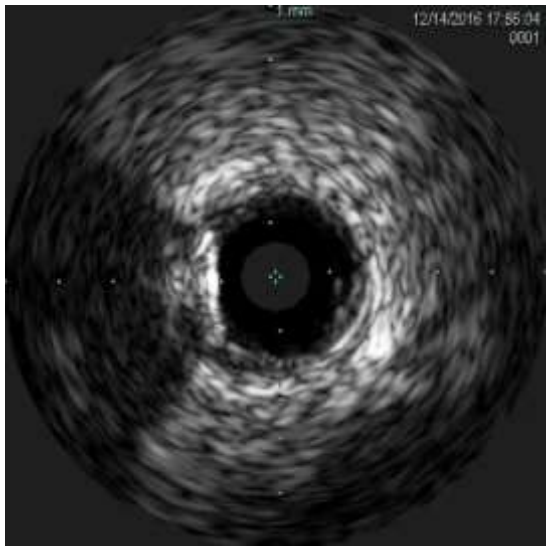


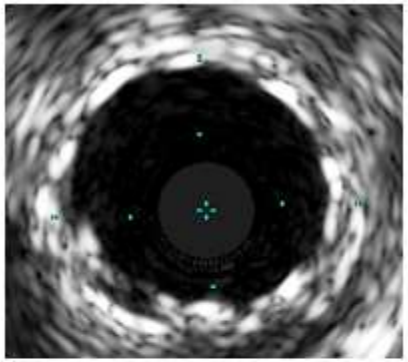


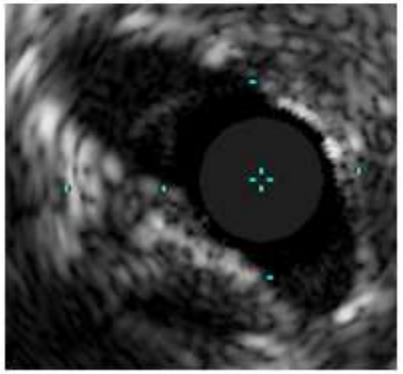


Case 1 87 y/o woman with unstable angina

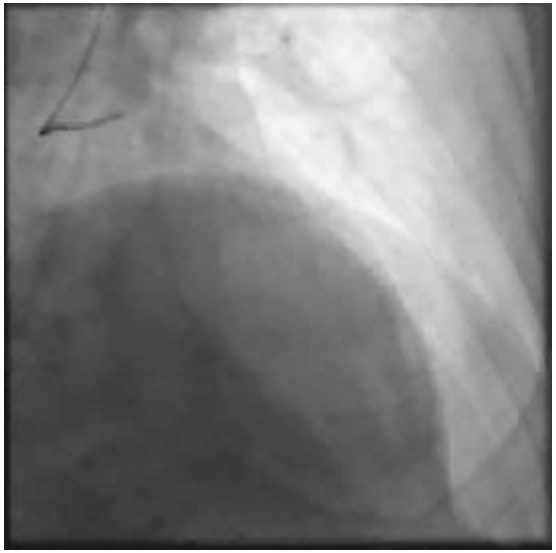








Case 2 68 y/o man with refractory angina

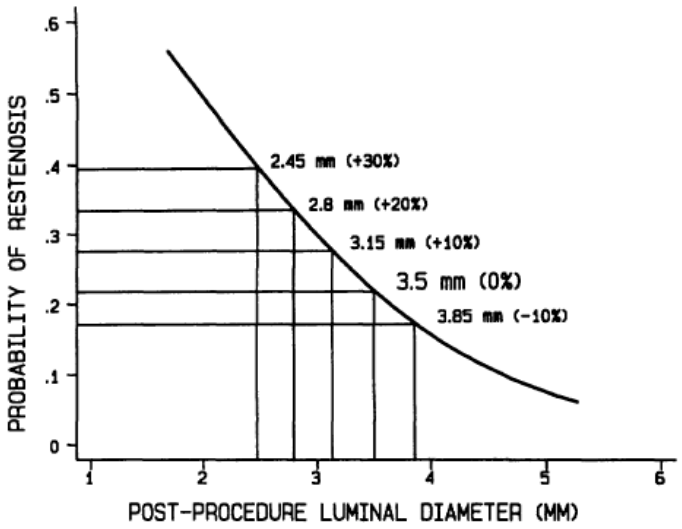


Pre-lesion Modification – Why?

The Importance of Acute Luminal Diameter in Determining Restenosis After Coronary Atherectomy or Stenting

Richard E. Kuntz, MD, MS; Robert D. Safian, MD; Joseph P. Carrozza, MD; Robert F. Fishman, MD; Michael Mansour, MD; and Donald S. Baim, MD

Angiography

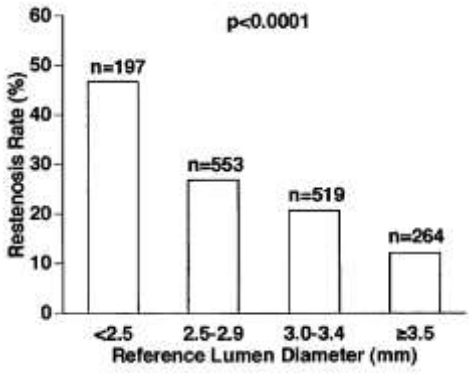


Circulation 1992;86:1827–1835

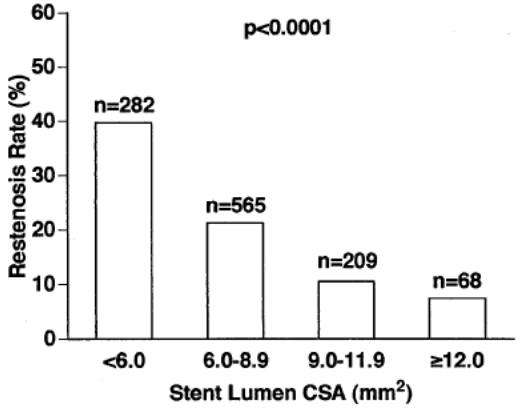
Angiographic and Intravascular Ultrasound Predictors of In-Stent Restenosis

SHUNJI KASAOKA, MD, JONATHAN M. TOBIS, MD, FACC, TATSURO AKIYAMA, MD, BERNHARD REIMERS, MD, CARLO DI MARIO, MD, FACC, NATHAN D. WONG, PhD, ANTONIO COLOMBO, MD, FACC

Angiography



IVUS

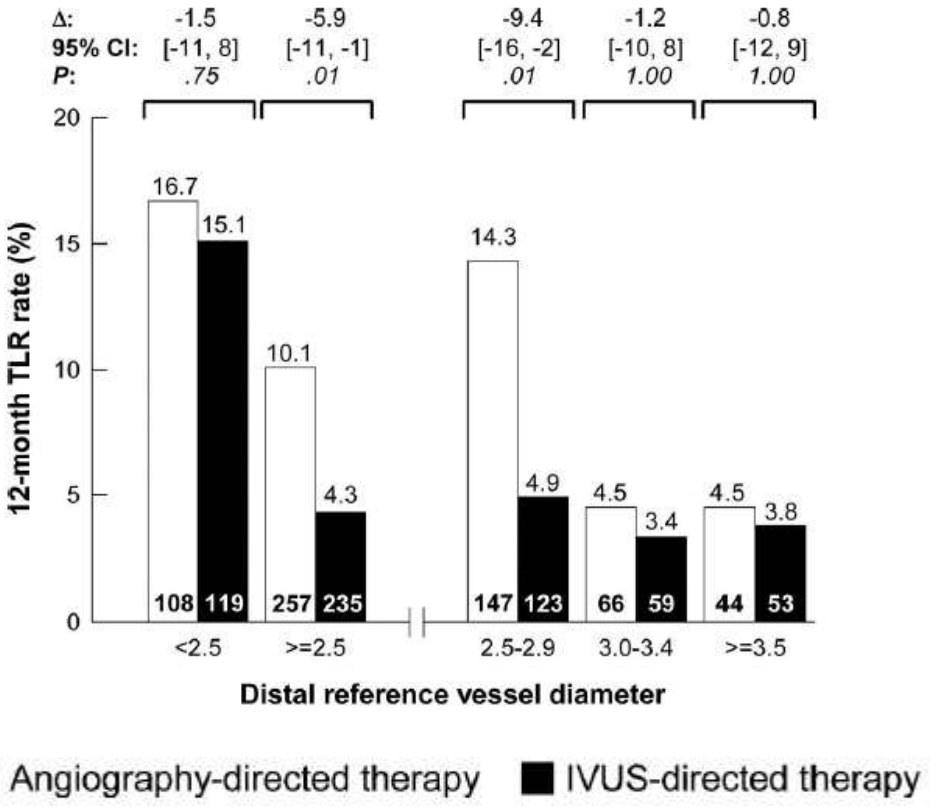


In lesions where IVUS guidance was used, the restenosis rate was 24% as compared with 29% if IVUS was not used ($p < 0.05$).

JACC 1998;32:1630–5

A Randomized Controlled Trial of Angiography Versus Intravascular Ultrasound-Directed Bare-Metal Coronary Stent Placement (The AVID Trial)

IVUS use *after* optimal angiographic result (<10% stenosis).



Russo RJ et al *Circ Cardiovasc Intervent* 2009;2:113-23.

And Then Came Drug-Eluting Stents

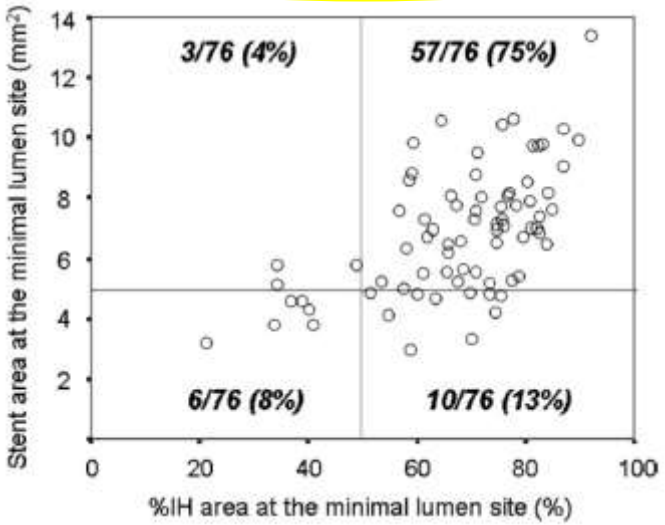
Mechanisms of In-Stent Restenosis After Drug-Eluting Stent Implantation
Intravascular Ultrasound Analysis

Soo-Jin Kang, MD; Gary S. Mintz, MD; Duk-Woo Park, MD; Seung-Whan Lee, MD; Young-Hak Kim, MD; Cheol Whan Lee, MD; Ki-Hoon Han, MD; Jae-Joong Kim, MD; Seong-Wook Park, MD; Seung-Jung Park, MD

76 lesion with IVUS-defined ISR:

93% intimal hyperplasia

42% stent underexpansion



Circulation
Cardiovascular Interventions
2011;4:9-14

Stent Underexpansion and Residual Reference Segment Stenosis Are Related to Stent Thrombosis After Sirolimus-Eluting Stent Implantation
An Intravascular Ultrasound Study

Kenichi Fujii, MD, Stéphane G. Carlier, MD, PhD, Gary S. Mintz, MD, Yi-ming Yang, MD, Issam Moussa, MD, Giora Weisz, MD, George Dangas, MD, PhD, Roxana Mehran, MD, Alexandra J. Lansky, MD, Edward M. Kreps, MD, Michael Collins, MD, Gregg W. Stone, MD, Jeffrey W. Moses, MD, Martin B. Leon, MD

15 patients with ST after SES implantation

	Stent Thrombosis (n = 15)	Matched Control Group (n = 45)	p Value
Stent segment			
Minimum stent CSA (mm²)	4.3 ± 1.6	6.2 ± 1.9	<0.001
Stent expansion	0.65 ± 0.18	0.85 ± 0.14	<0.001
Plaque burden (%)	62 ± 13	46 ± 9	<0.001
Significant residual stenosis	10 (67%)	4 (9%)	<0.001

JACC
2005;45:995–8

Other Important Developments in Lesion Prep

Blinded Physiological Assessment of Residual Ischemia After Successful Angiographic Percutaneous Coronary Intervention The DEFINE PCI Study

In this study, 24% of subjects had abnormal iFR post-PCI, the vast majority (81.6%) were due to angiographically inapparant focal stenoses.

JACC cardiovascular Interventions Jeremias et al 2019;12:1991-2001.

In-stent restenosis characteristics and repeat stenting underexpansion: insights from optical coherence tomography

OCT is an effective tool to define the mechanism of stent failure. Restenting that results in underexpansion was associated with higher MI and TVR rates at 2 years.

EuroIntervention Yin D et al 2020;16:e335-43.

Bioresorbable Coronary Scaffold Thrombosis

Multicenter Comprehensive Analysis of Clinical Presentation, Mechanisms, and Predictors

Low post-procedure luminal diameter is a major risk factor for BVS scaffold thrombosis and dedicated lesion prep reduces this risk.

JACC Puricel S et al 2016;67:921-31.

Impact of lesion preparation strategies on outcomes of left main PCI: The EXCEL trial

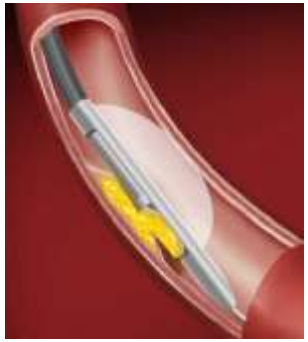
In complex left main lesions treated by more lesion prep (atherectomy, cutting/scoring balloons), clinical outcomes at 3 years were comparable to simple lesions.

CATHETERIZATION & CARDIOVASCULAR INTERVENTIONS Beohar N et al 2021;98:24-32.

Pre-lesion Modification – How?

The Old Toolbox

Non-compliant balloons

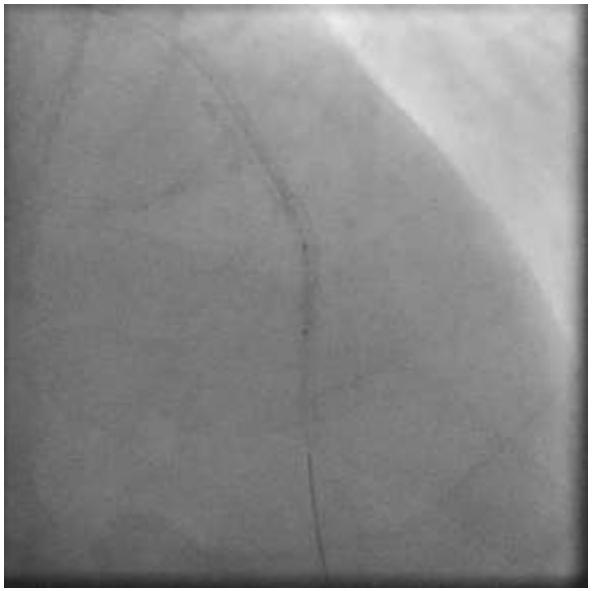


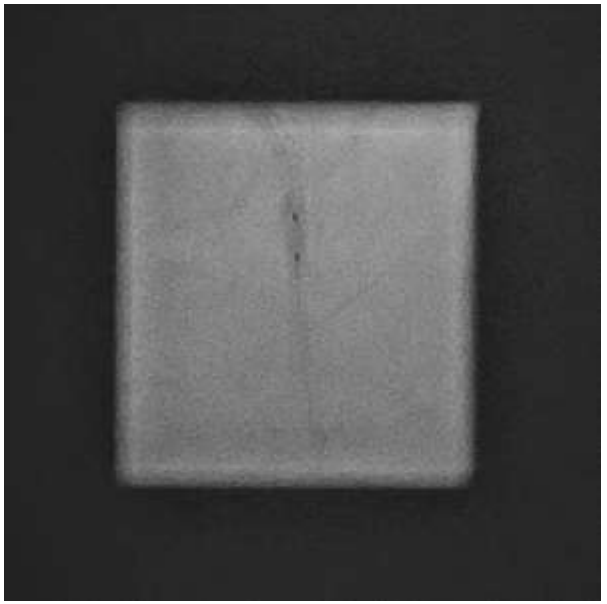
Directional Atherectomy

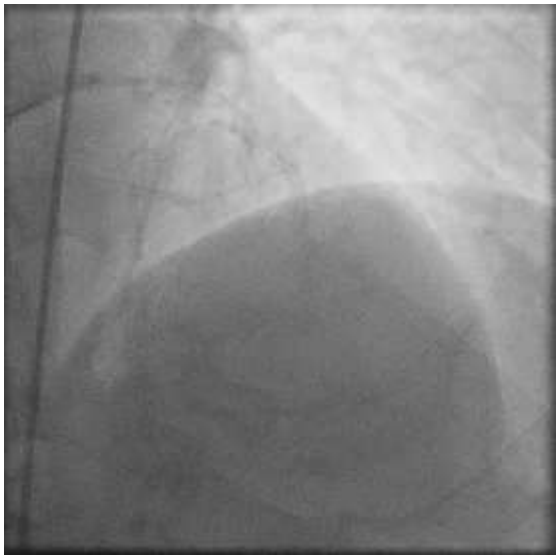
Rotational Atherectomy

1st gen Cutting Balloons

Back to Case 2







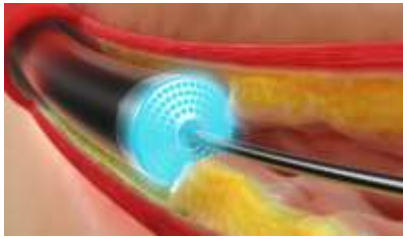
Pre-lesion Modification – How?

And Now …

Orbital Atherectomy

Intravascular Lithotripsy

Latest Gen Scoring/Cutting Balloons



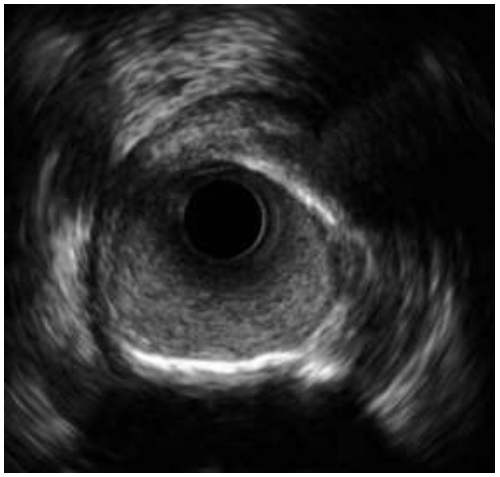
Excimer Laser

Ultrahigh-pressure NC balloons

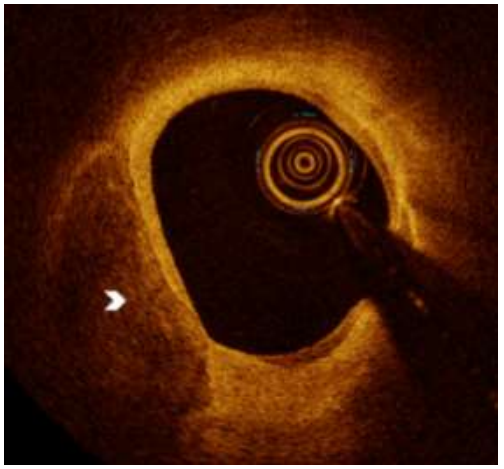
Bioadaptive DES

Pre-lesion Modification – Axillary Tools

Imaging

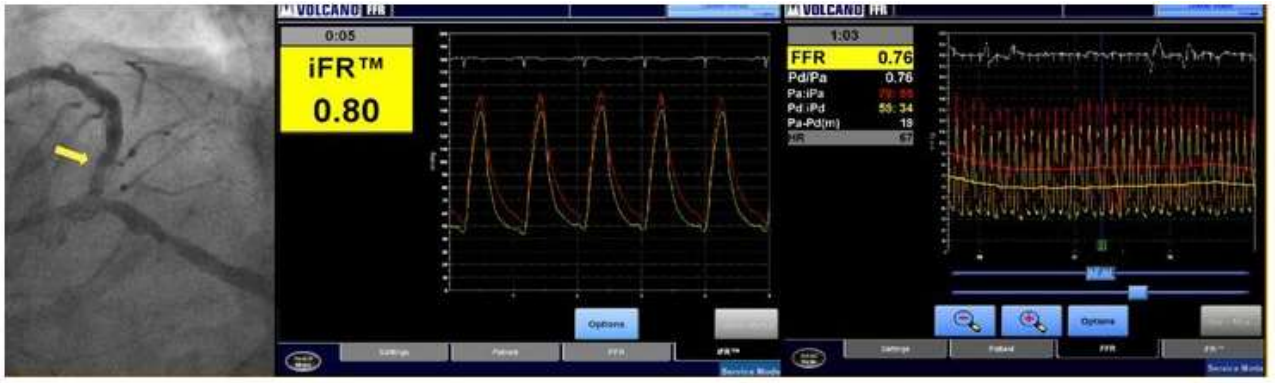


IVUS



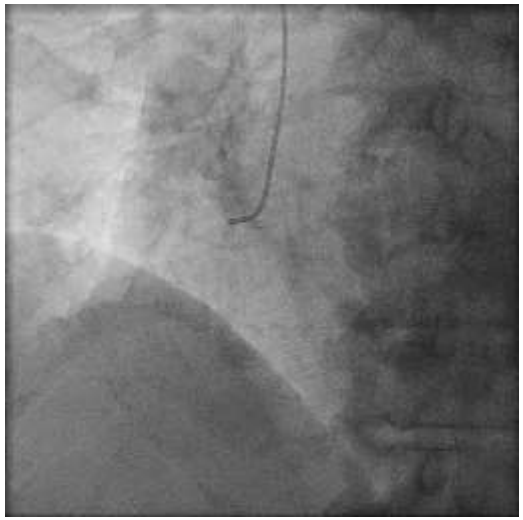
OCT

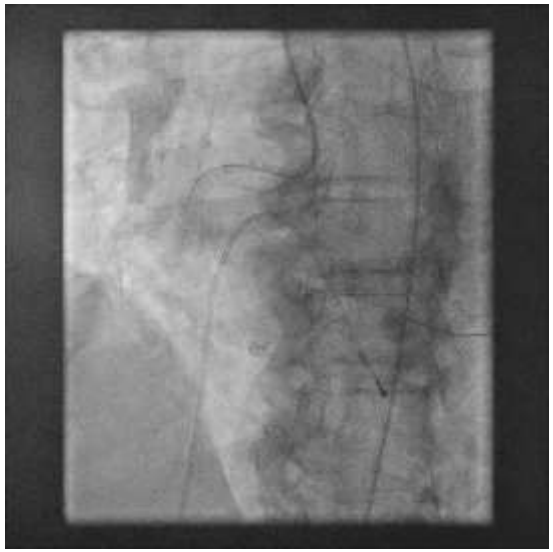
Physiologic

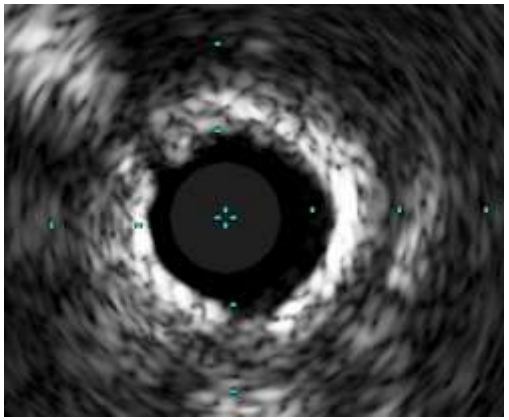


iFR/FFR

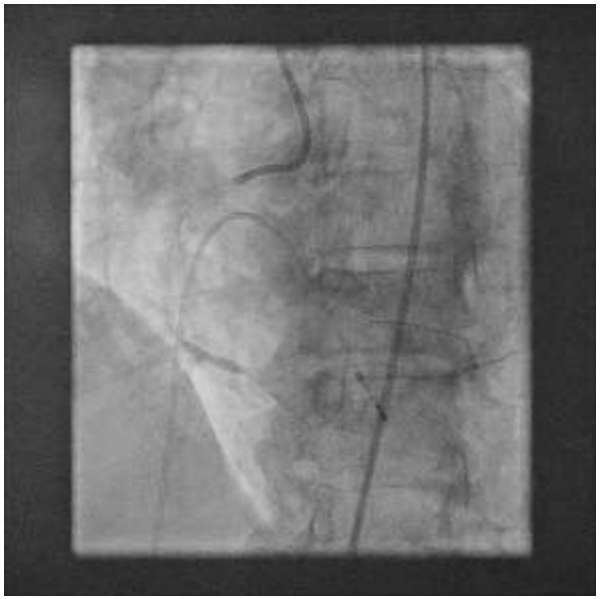
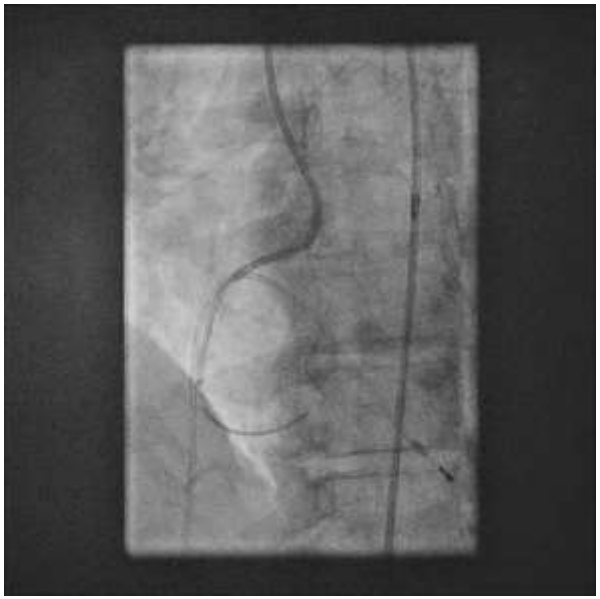
Case 3 74 y/o woman with unstable angina







Case 3


Pre-lesion Modification – How?

1. Pre-dilation is the default strategy
2. Low threshold for intravascular imaging
3. Plaque modification with appropriate devices
4. Low threshold for post-stent intravascular imaging
5. High pressure post-dilation when needed
6. Proper final assessment

Conclusions

- Pre-dilation remains critically important, especially in the era of thin strut easily deliverable DES.
- Full stent expansion has been correlated with reduced risk of restenosis and stent thrombosis.
- There is now a variety of tools to address calcified and resistant lesions.
- Intravascular imaging with IVUS or OCT is often necessary to optimize pre-dilation and stent expansion.