

Limitations of Angiography in Evaluating the Left Main Coronary Artery Disease

Alexandra Lansky, MD
Yale University School of Medicine
University College London

YCRG

Yale Cardiovascular Research Group



Virtues of Angiography: Left Main CAD is Heterogenous Varying in Complexity and Burden of Disease



Isolated Ostial LM



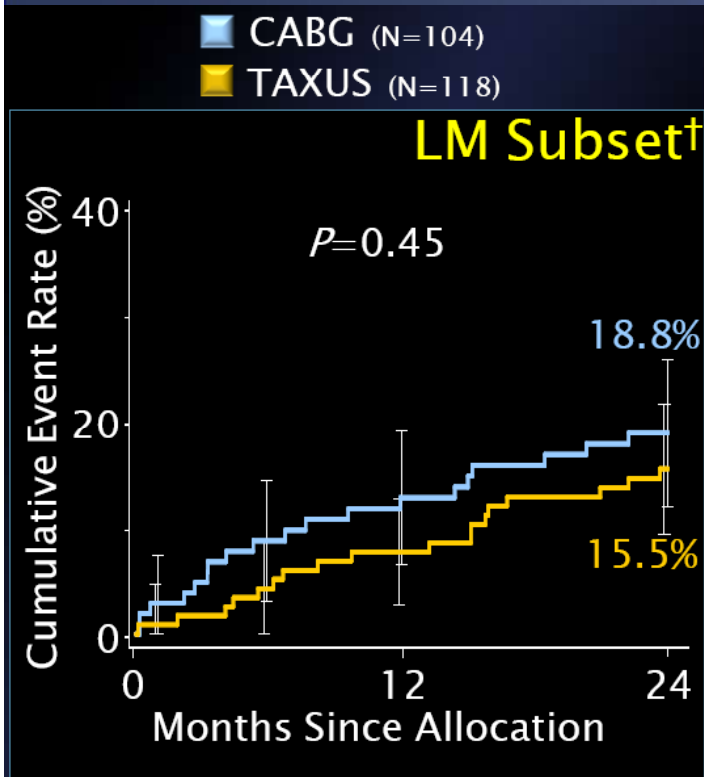
Distal Bifurcation +/- Calcified Diffuse 3 VD



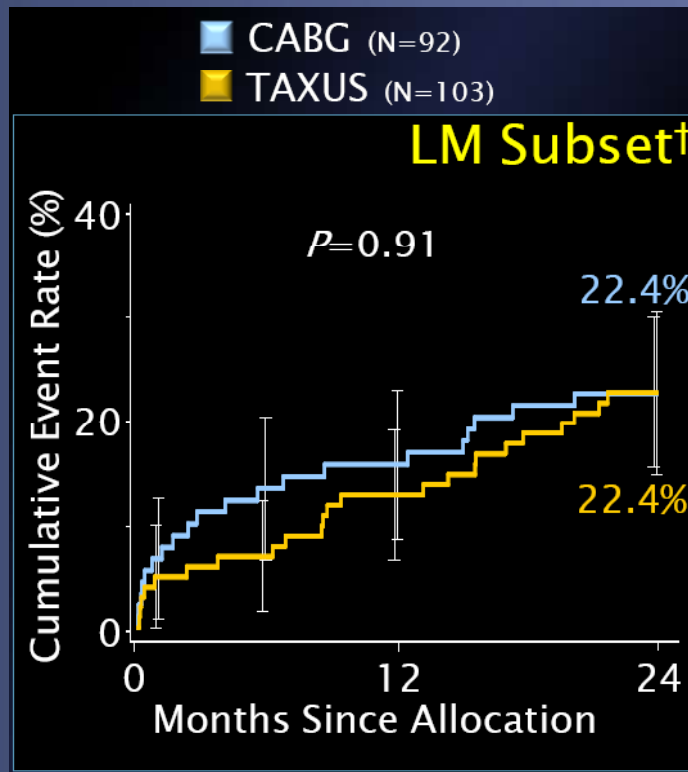
SYNTAX Left Main Subset

2 Year MACE

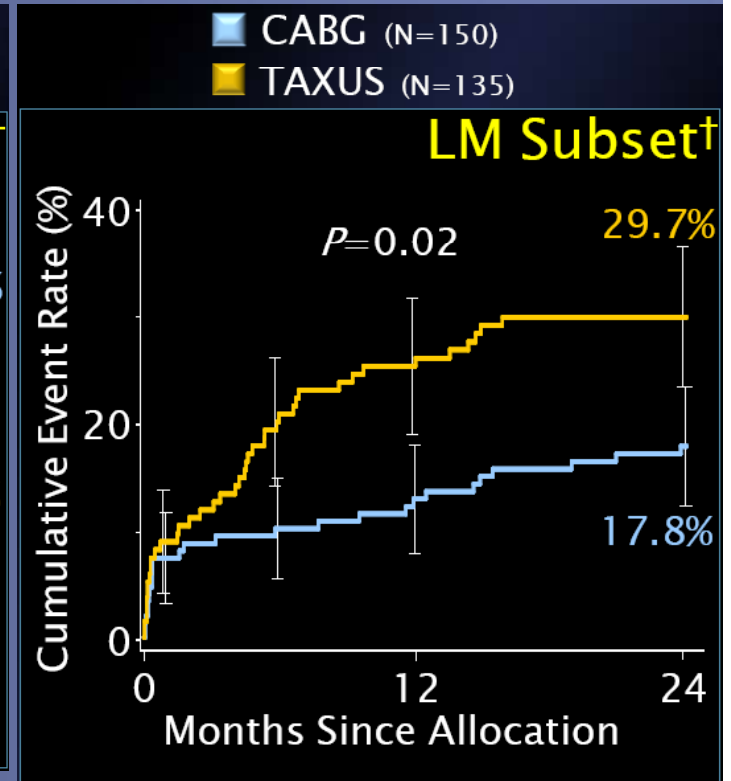
According to Syntax Score Tertile



0-22

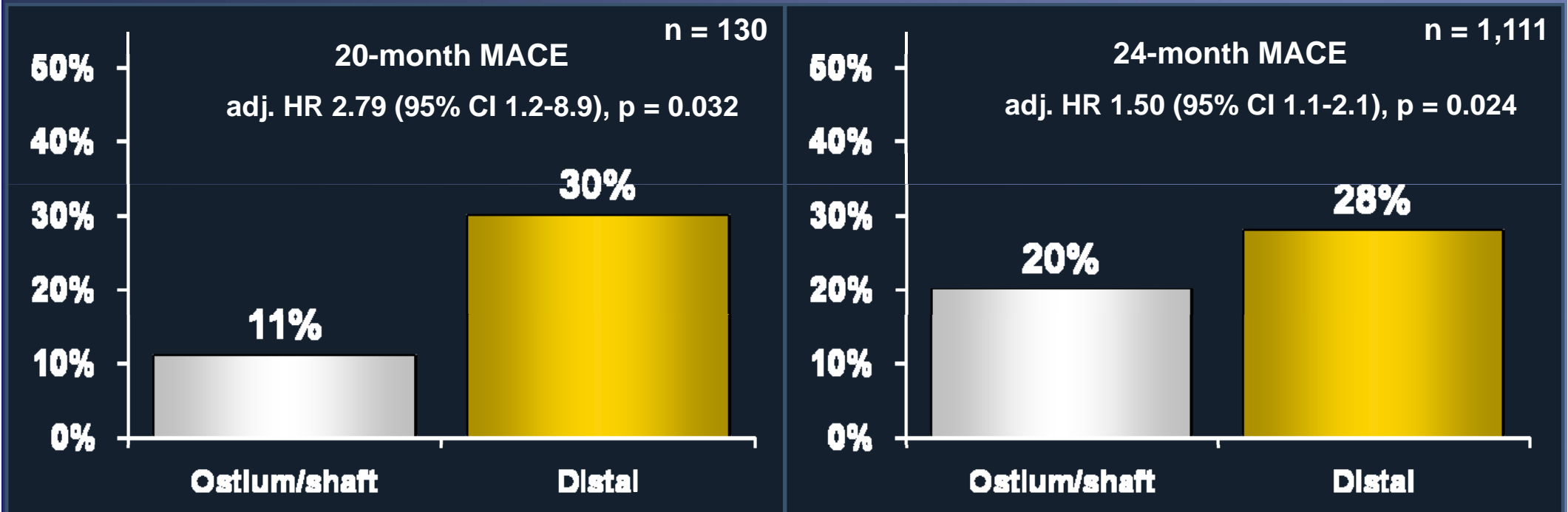


23-32



33+

Distal LM bifurcation PCI has higher MACE than PCI of ostial and midshaft lesions



T-SEARCH/RESEARCH
J Am Coll Cardiol 2006;47:1530-37

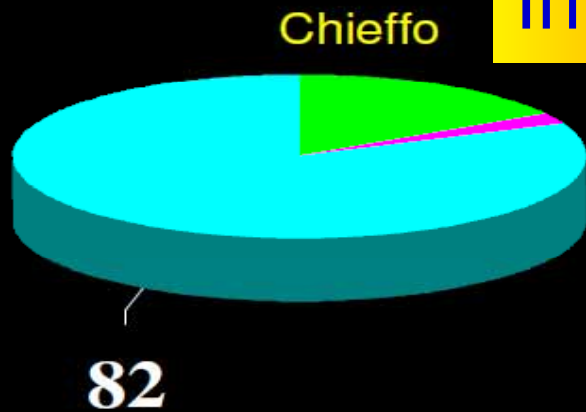
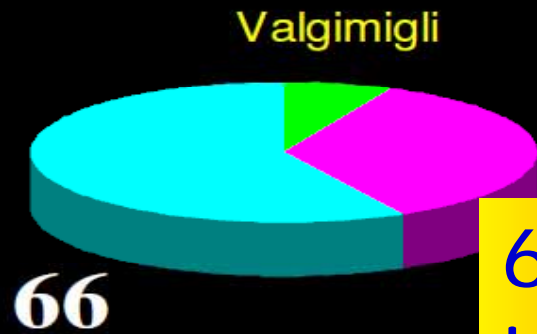
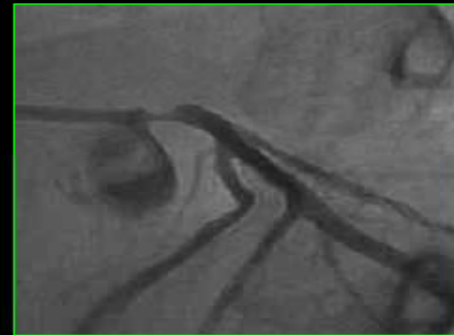
GISE/SICI
Eur Heart J 2010;30:2087-94

Distal Left Main Involvement

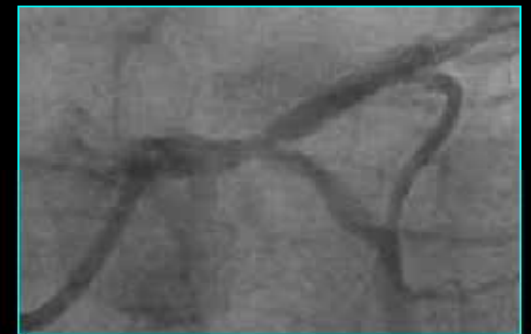
Park JACC 2005;45:351

Chieffo A, Circ 2005;111:791

Valgimigli M. Circ 2005;111:1383



66-82 % of interventions !



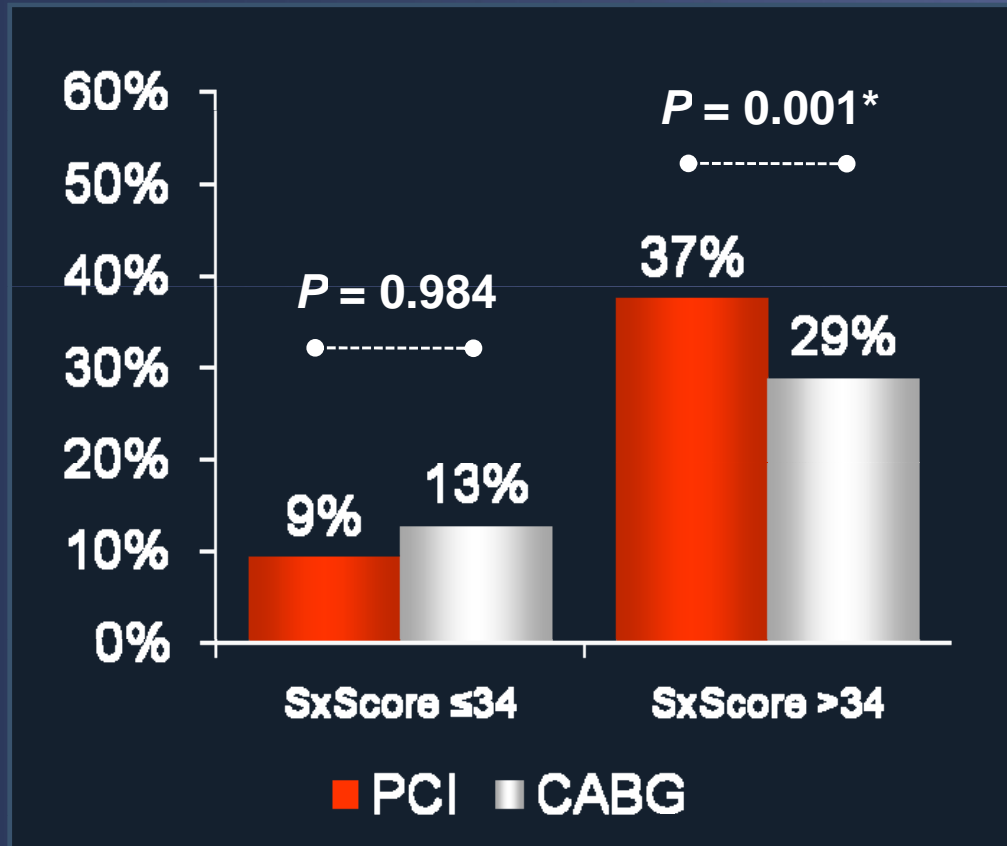
Distal left main disease is a marker of more extensive and multi-vessel CAD

Data from the SYNTAX LM PCI Cohort

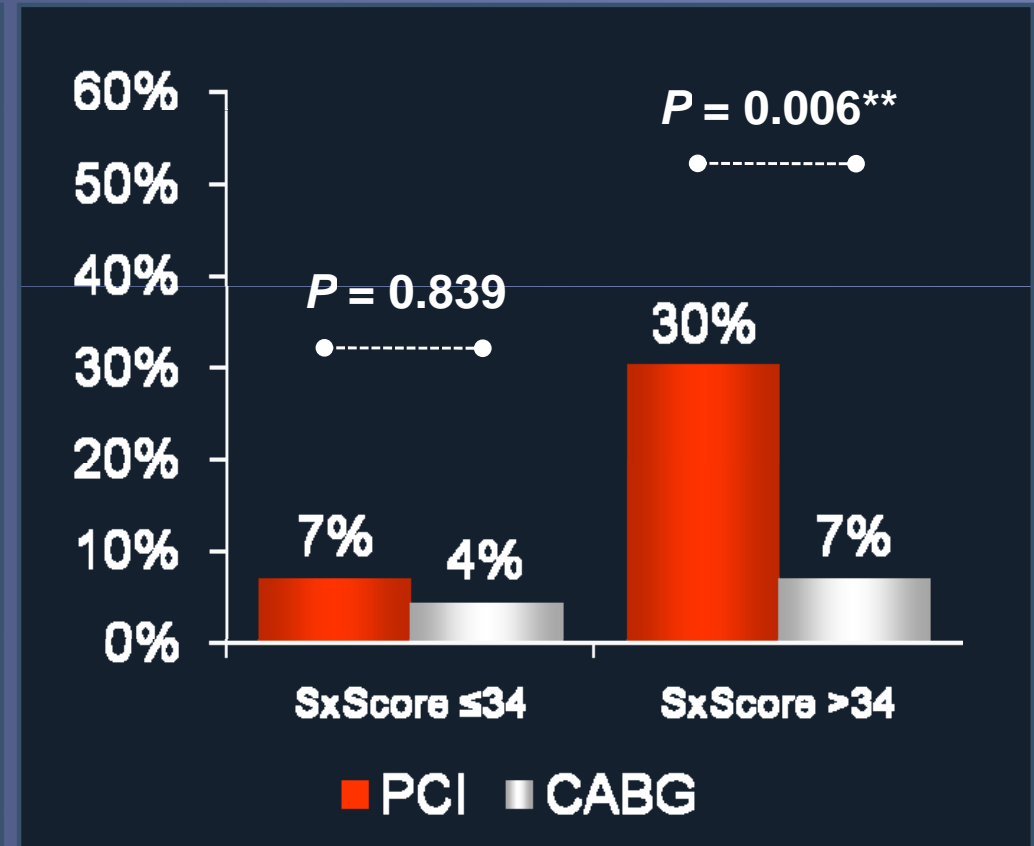
	Distal (n = 229)	Non-Distal (n = 128)	p value
Total SYNTAX score	31.4 ± 12.3	22.1 ± 10.1	< 0.001
LM only, %	7.4	19.5	< 0.001
LM + 1VD, %	13.5	28.1	< 0.001
LM + 2VD, %	36.2	22.7	0.008
LM + 3VD, %	42.8	29.7	0.01
Procedural success, %	82.5	92.7	0.008

Extent of CAD and Syntax Score predicts 2-year cardiac mortality regardless of lesion location

Ostium/shaft



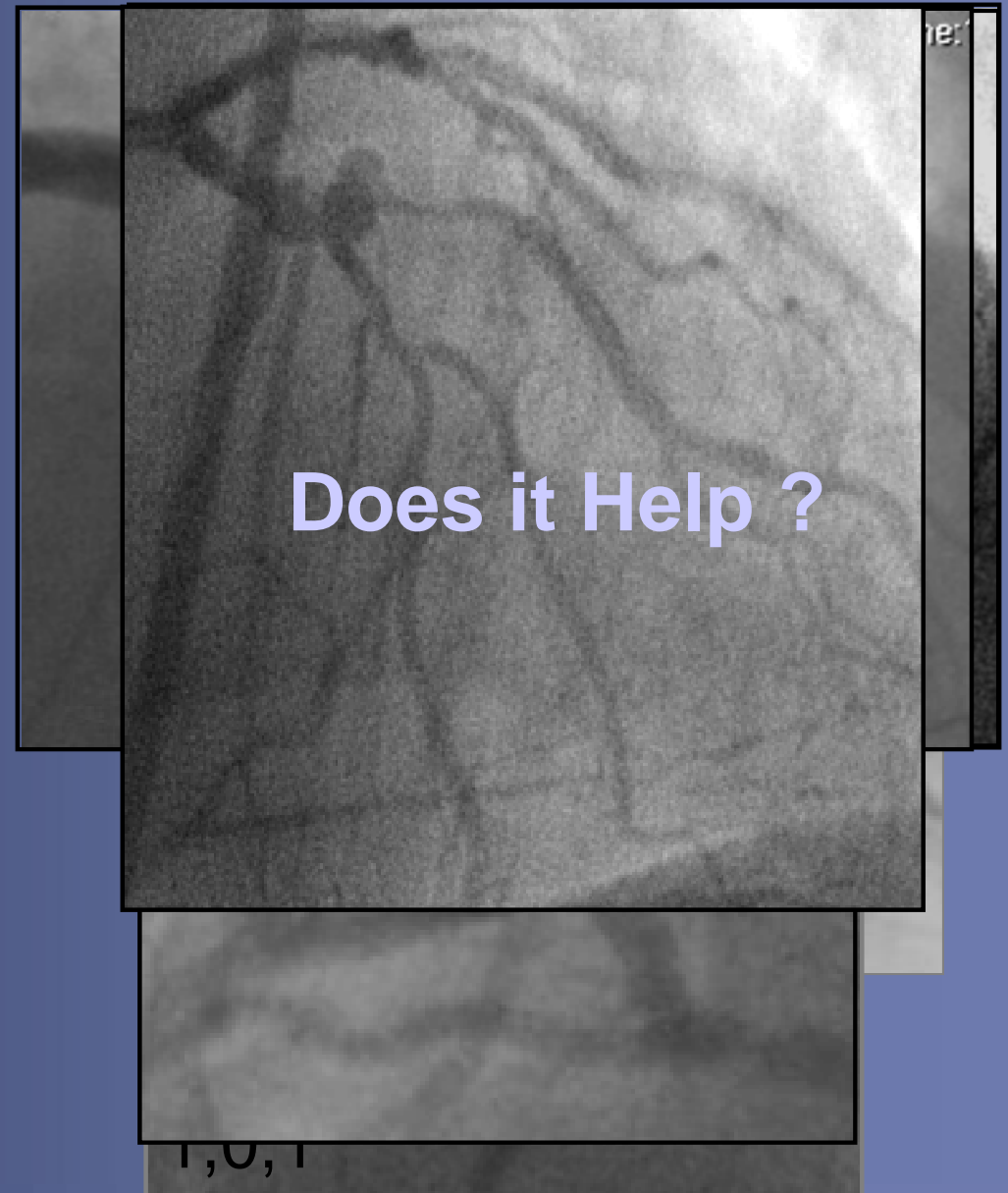
Bifurcation



* After adjusting for confounders: HR 2.89, 1.07-7.85, $p = 0.037$. ** After adjusting for confounders: HR 6.09, 1.00-36.9, $p = 0.049$. P for interaction between SYNTAX score, lesion location and treatment: 0.249

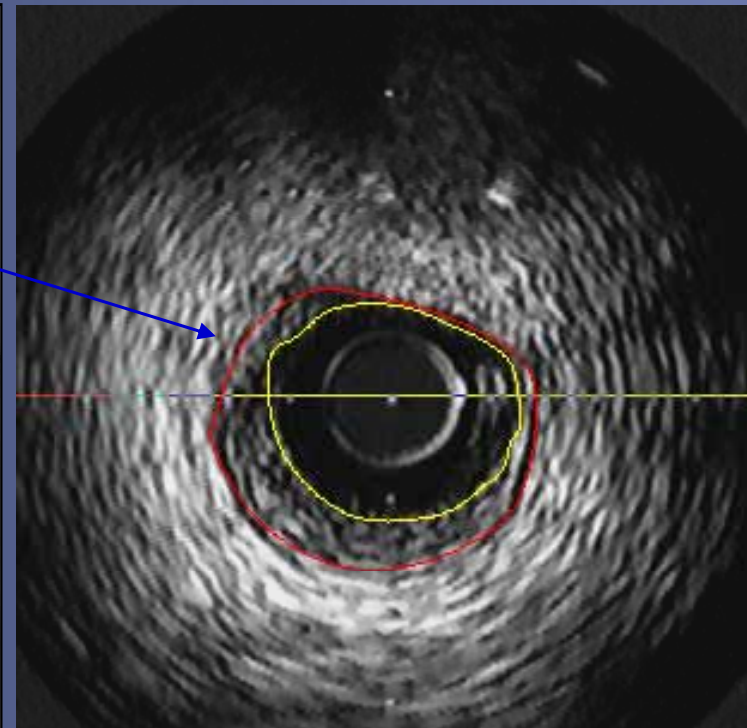
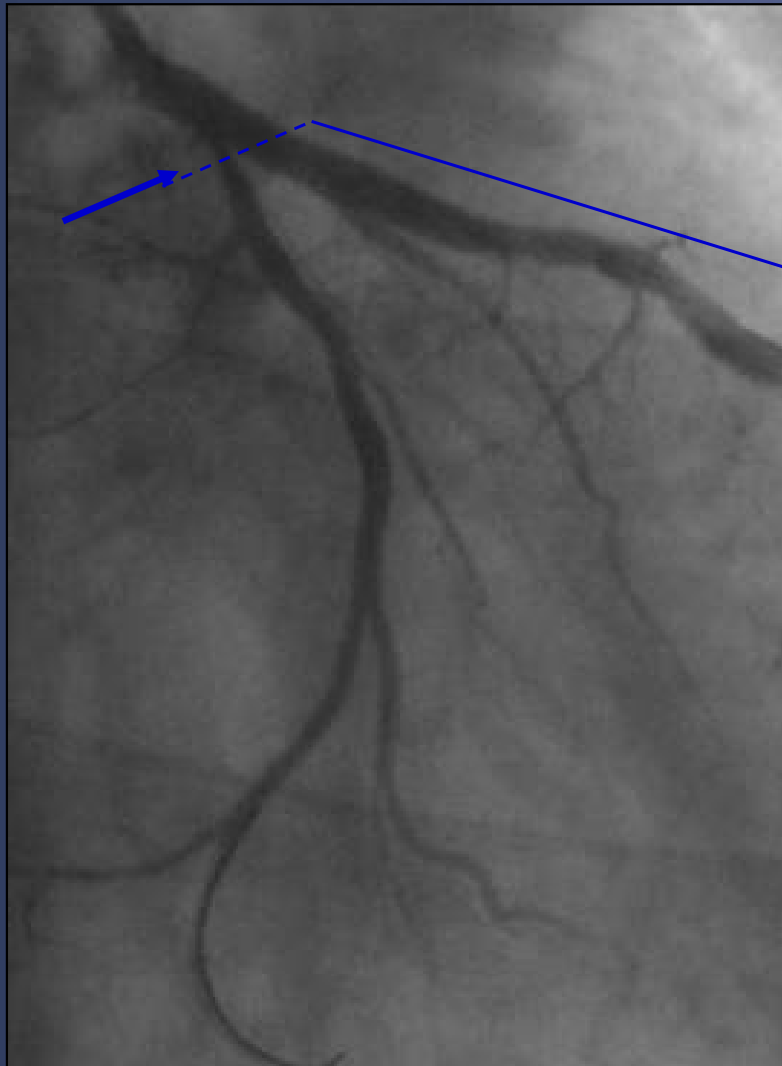
Medina Classification: Easy to use but...

- Ignores the size of the side branch
- Ignores the severity and length of the side branch lesion
- Ignores the angle of the side branch
 - Does not help with treatment selection
 - Does not predict prognosis



Diagnostic Conundrums in LM Disease

Ostial SB Lesion Severity at Baseline

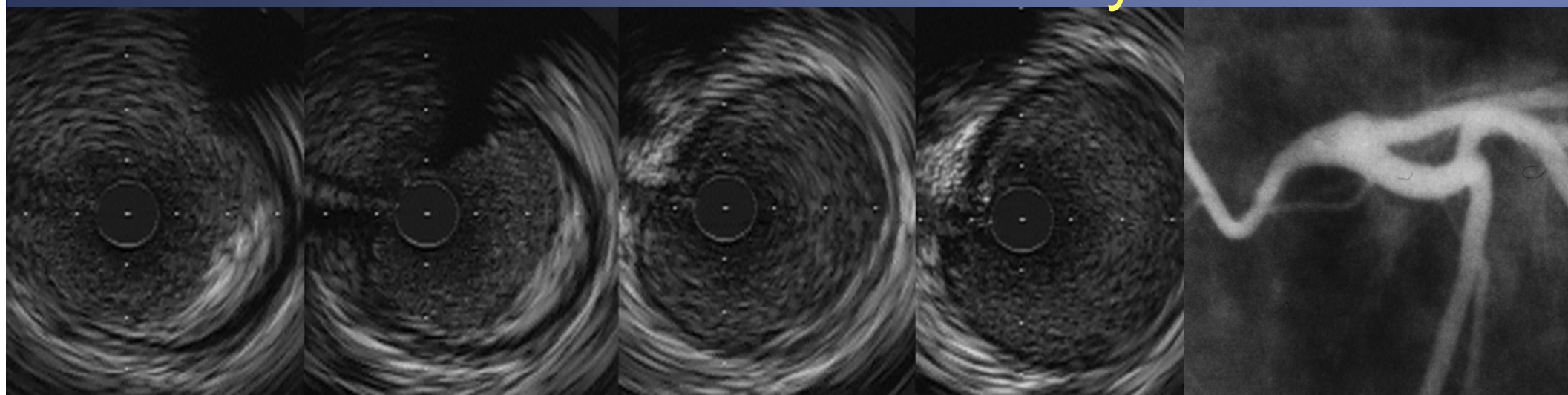


Measurements On Current Frame

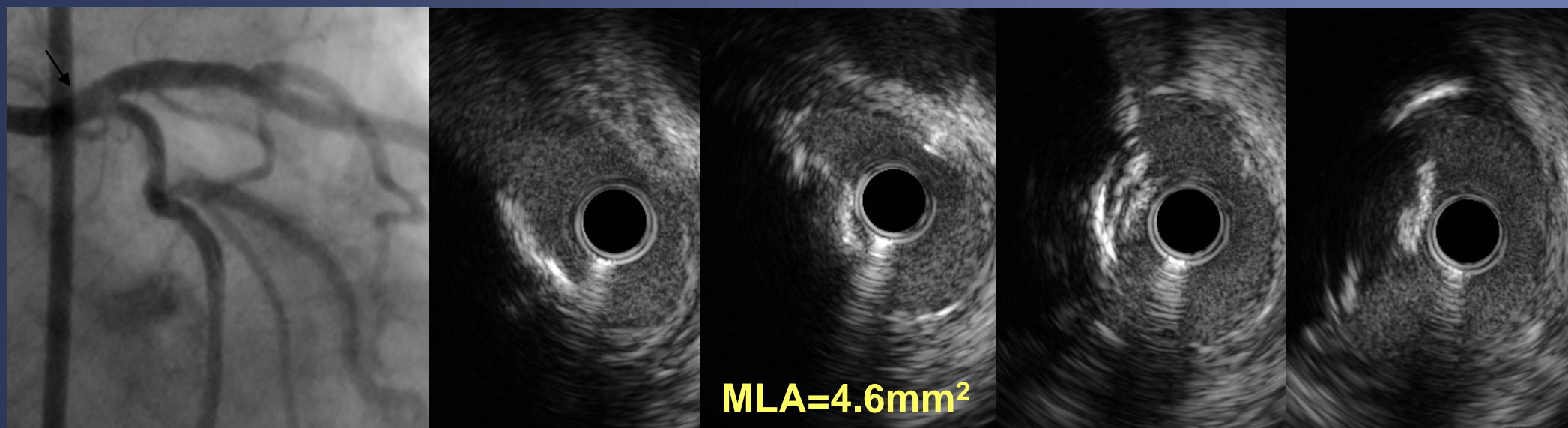
	Area (mm ²)	Diameter (mm)			
		Mean	Min	Max	Min/Max
Lumen	3.83	2.23	2.03	2.46	0.82
Vessel	6.31	2.85	2.57	3.10	0.83
Stent					
Plaque	2.48 (39.2% of Vessel)				Comparative Lumen Area
NIH					

Diagnostic Conundrums in LM Disease

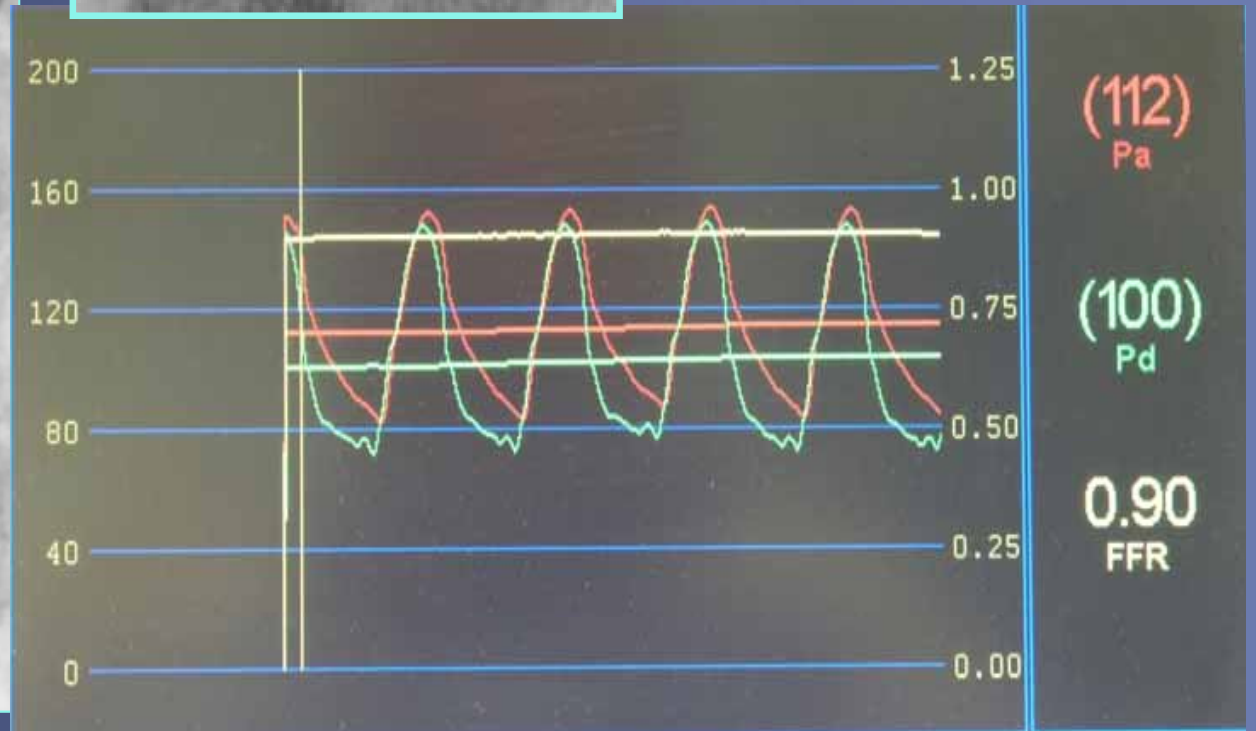
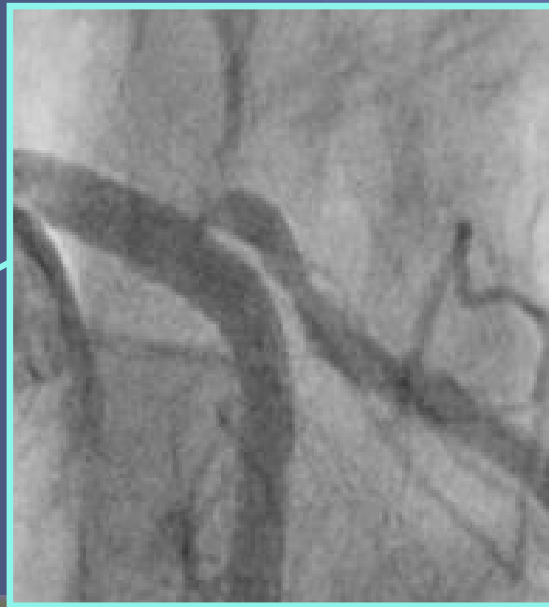
Ostium and Shaft Lesion Severity at Baseline



0 → 1.5 → 6.0mm



YCRG 0 → 2.0 → 5.0mm

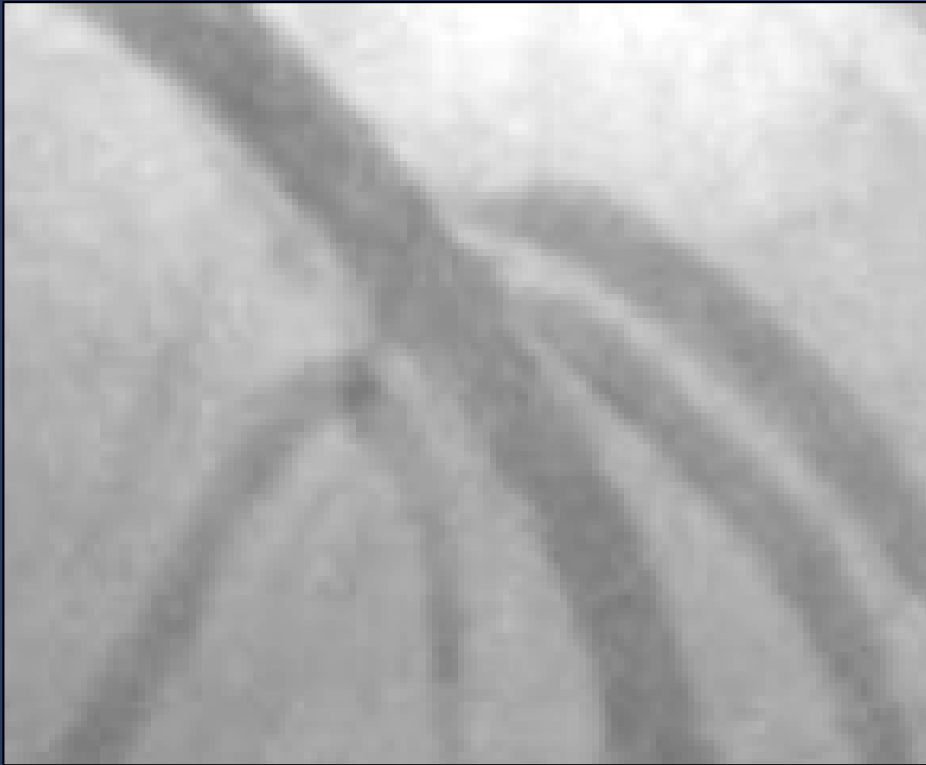


YCRG

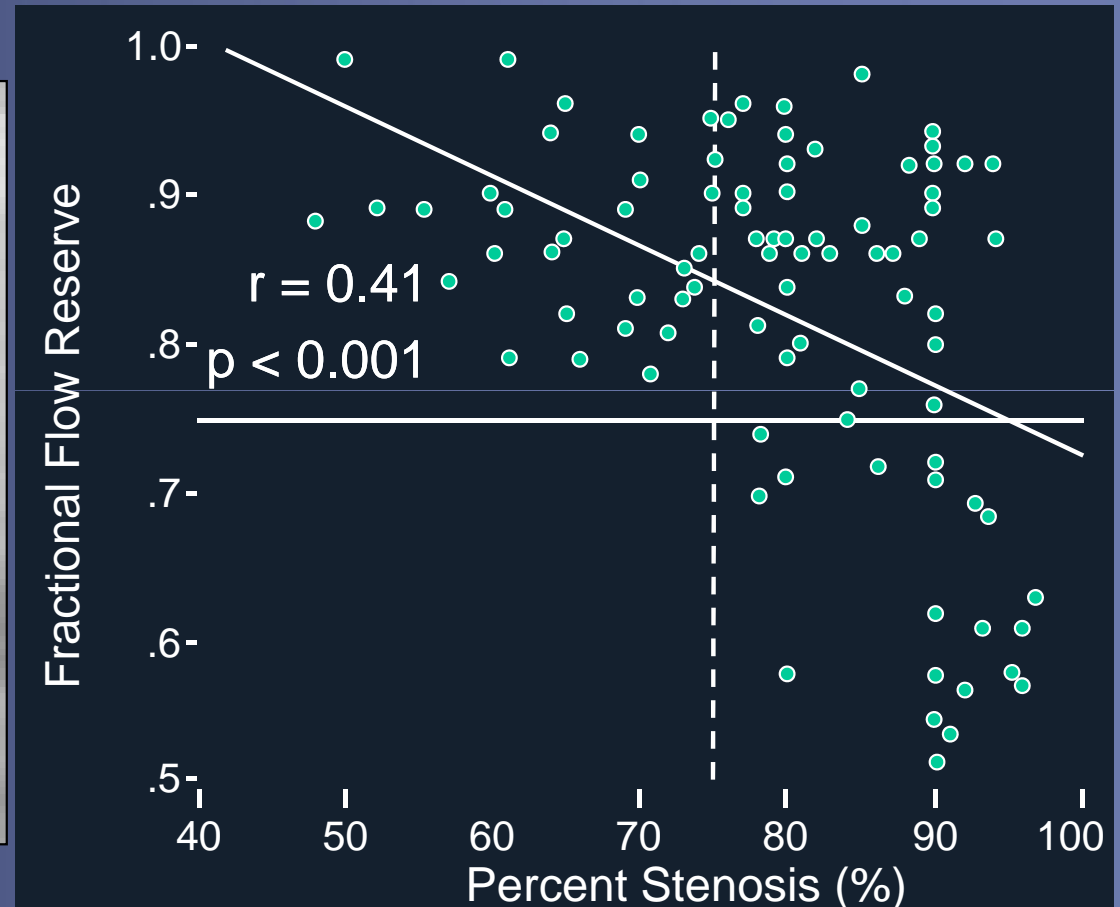
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Ostial SB Lesion Severity after SB Jailing



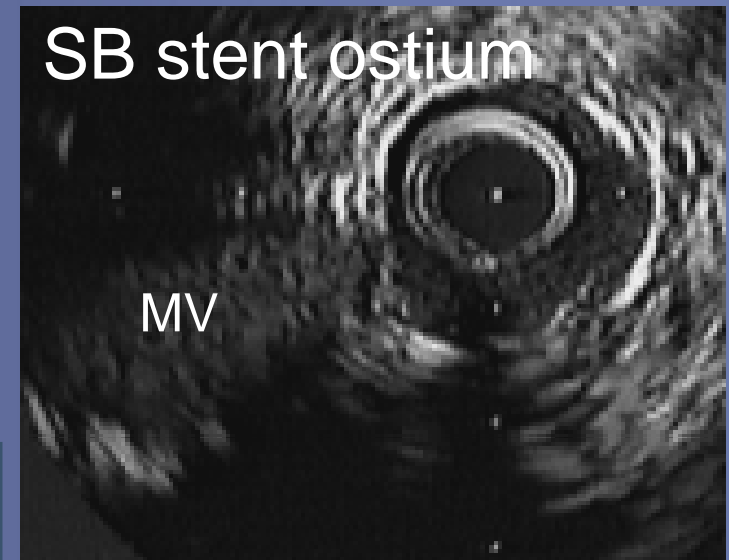
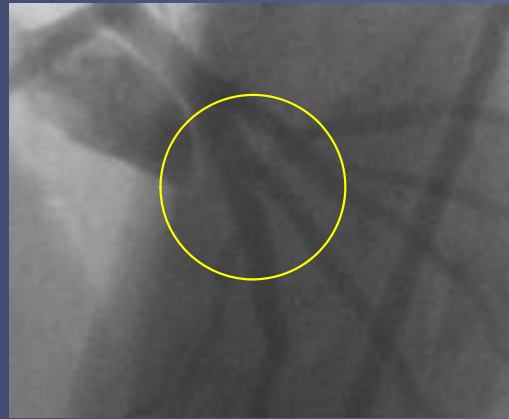
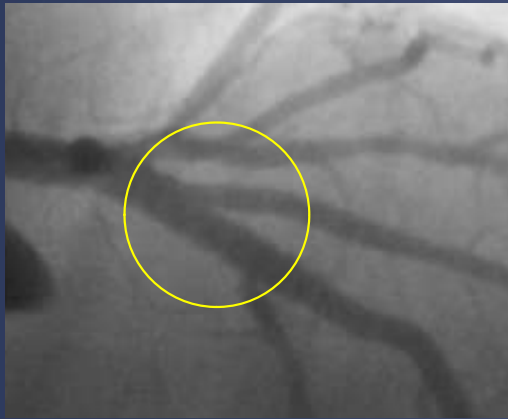
Correlation between FFR and % Stenosis



The optimal cutoff value for percent stenosis to predict functionally significant stenosis was 85% (Sensitivity: 0.80, Specificity: 0.76)

SB Stent Underexpansion After Crush

Final optimal angiographic result

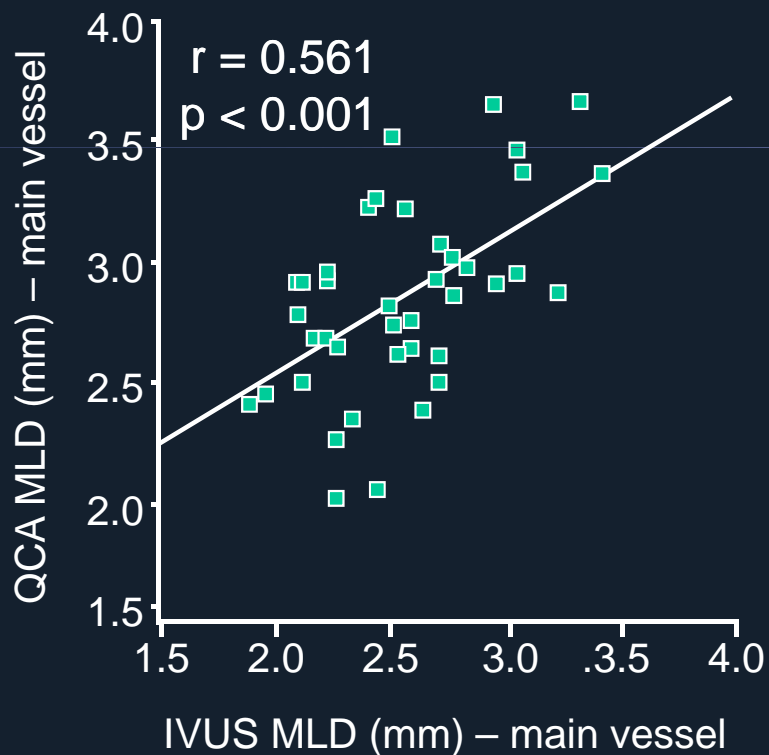


Variable	PV	SB	P
Stent minimum CSA, mm ²	6.5 ± 1.7	3.9 ± 1.0	<0.0001
Stent expansion, %	92.1 ± 1.6	79.9 ± 12.3	0.02
Stent CSA < 4 mm ²	10% (2/20)	55% (11/20)	0.007
Stent CSA < 5 mm ²	20% (4/20)	90% (18/20)	<0.0001

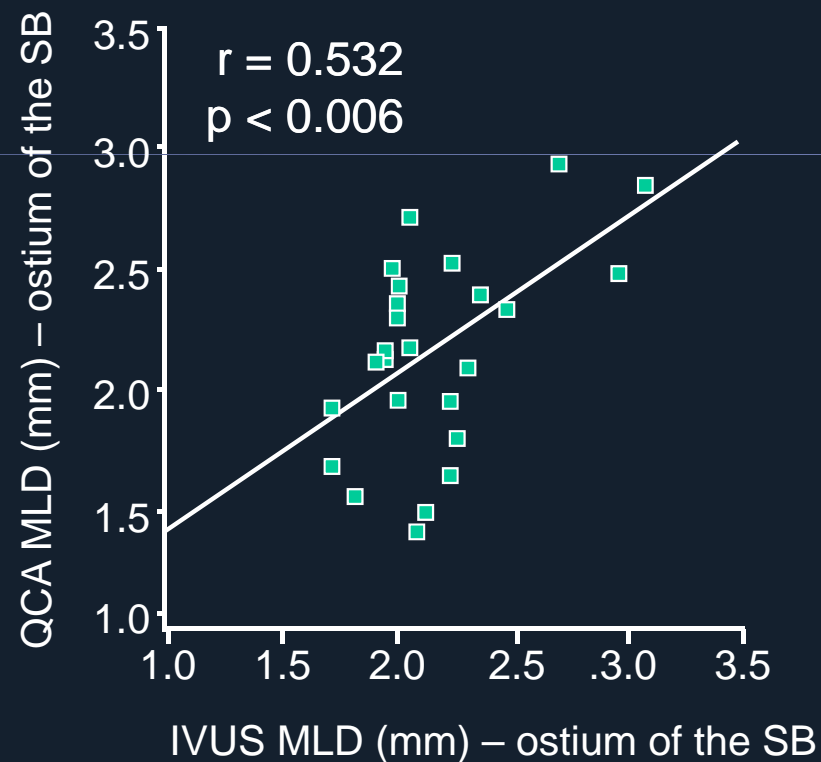
Correlation Between IVUS and QCA

Final MLD in Parent Vessel and Side Branch Following “Crush” Stenting

Main vessel



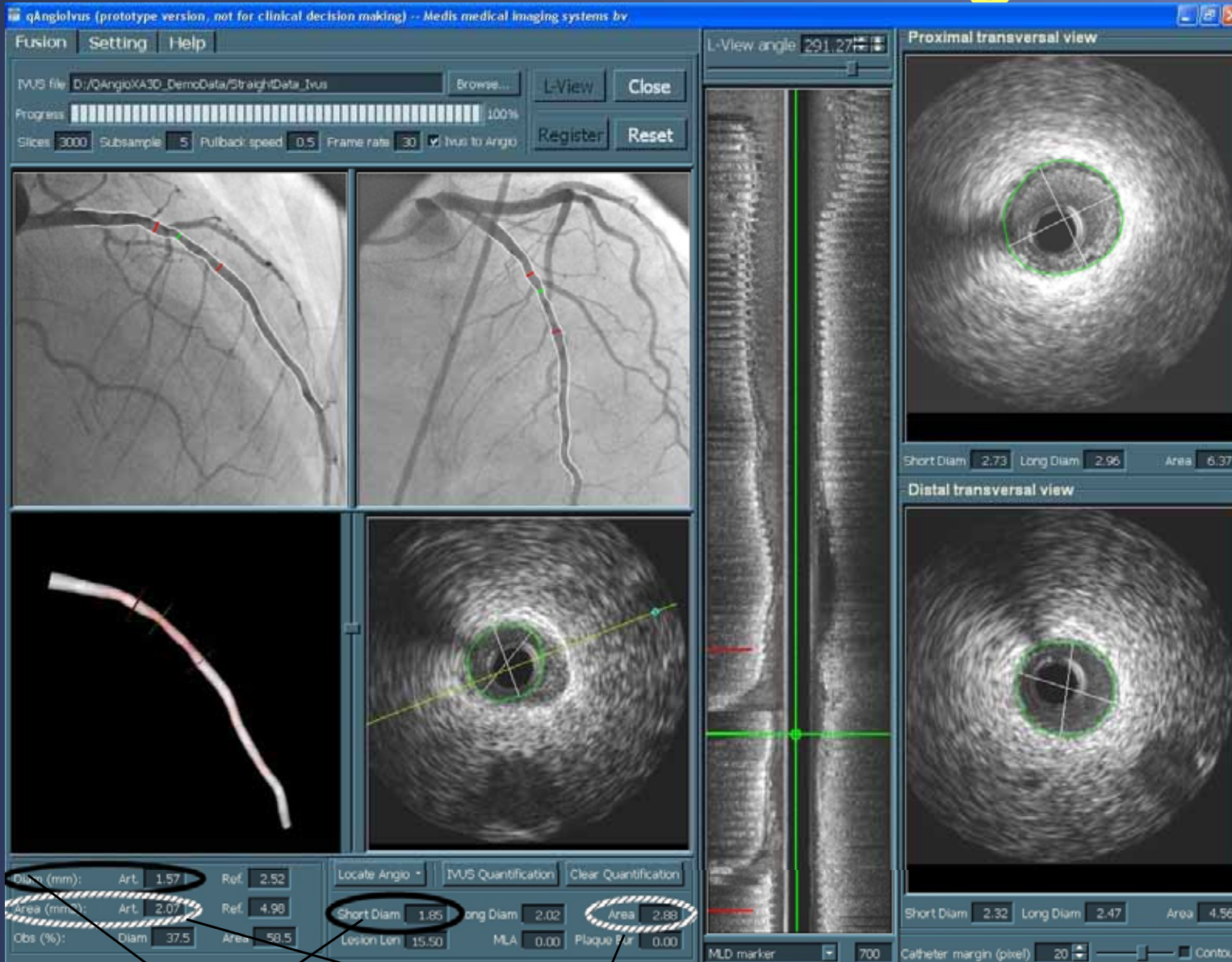
Side branch



Advantages of 3D QCA vs 2D QCA

- Elimination of out-of-plane magnification and foreshortening
- More accurate lesion length and severity assessment
- Assessment 3D bifurcation angles and optimal viewing angle
- Assessment vessel cross-sectional area and volume
- Assessment vessel tortuosity

XA-IVUS Co-Registration



Register by identifying the same marker (sidebranch, stent border, etc) as baseline positions in both image modalities;

After that, markers in different views are synchronized;

Stent-positions can be mapped from IVUS/OCT to XA fluoroscopy to plan stent deployment;

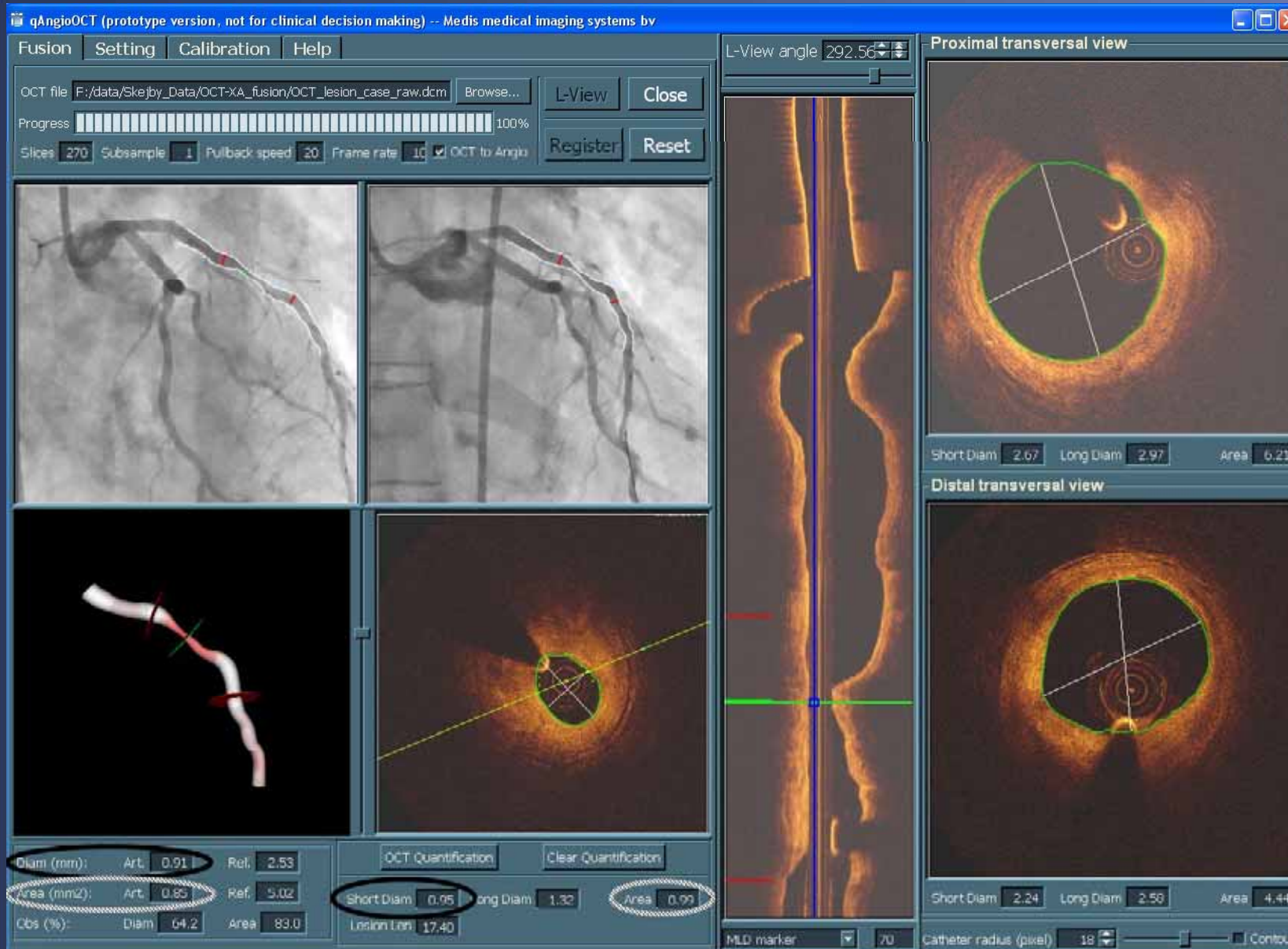
Vessel dimensions and plaque information can be assessed at every corresponding position.

	QCA	IVUS
MLD	1.57	1.85
Area	2.07	2.88

Min lumen diameter

Lumen area

XA-OCT co-registration



	QCA	OCT
MLD	0.91	0.95
Area	0.85	0.99

Conclusions

- Angiography remains the gold standard in risk stratifying patients with Left Main Disease
- IVUS Guidance is important for assessing ambiguous lesions and procedure optimization
- 3D angiographic reconstruction allows more accurate angle measures and lesion length
- 2D and 3D co-registration with other imaging modalities (IVUS, VH and OCT) will provide greater procedural insights to optimize results