Quantitative Angiographic Measurement of Bifurcation Coronary Lesions

Left Main vs. Non-Left Main

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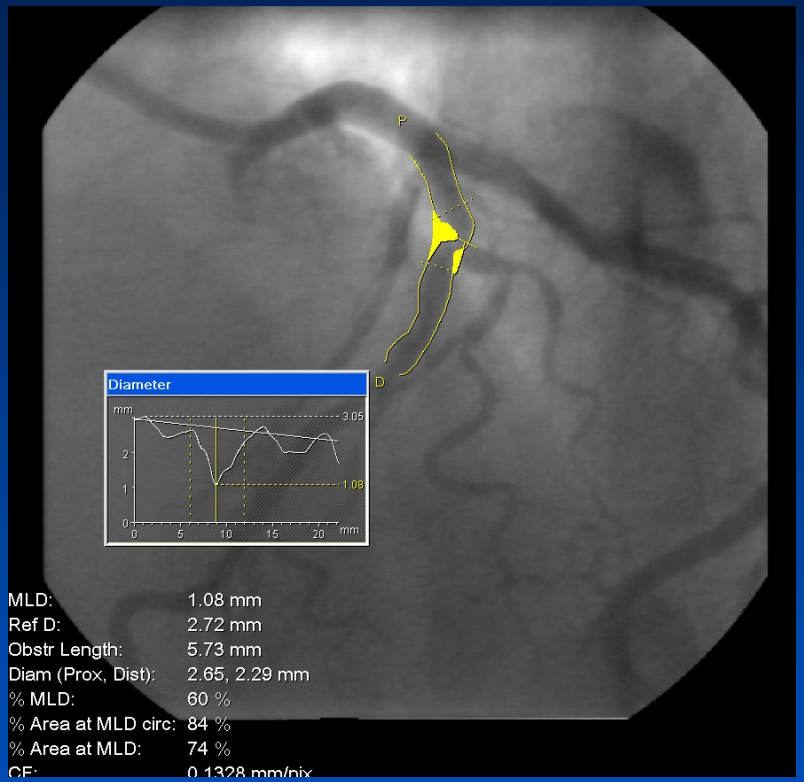
Quantitative Coronary Angiography

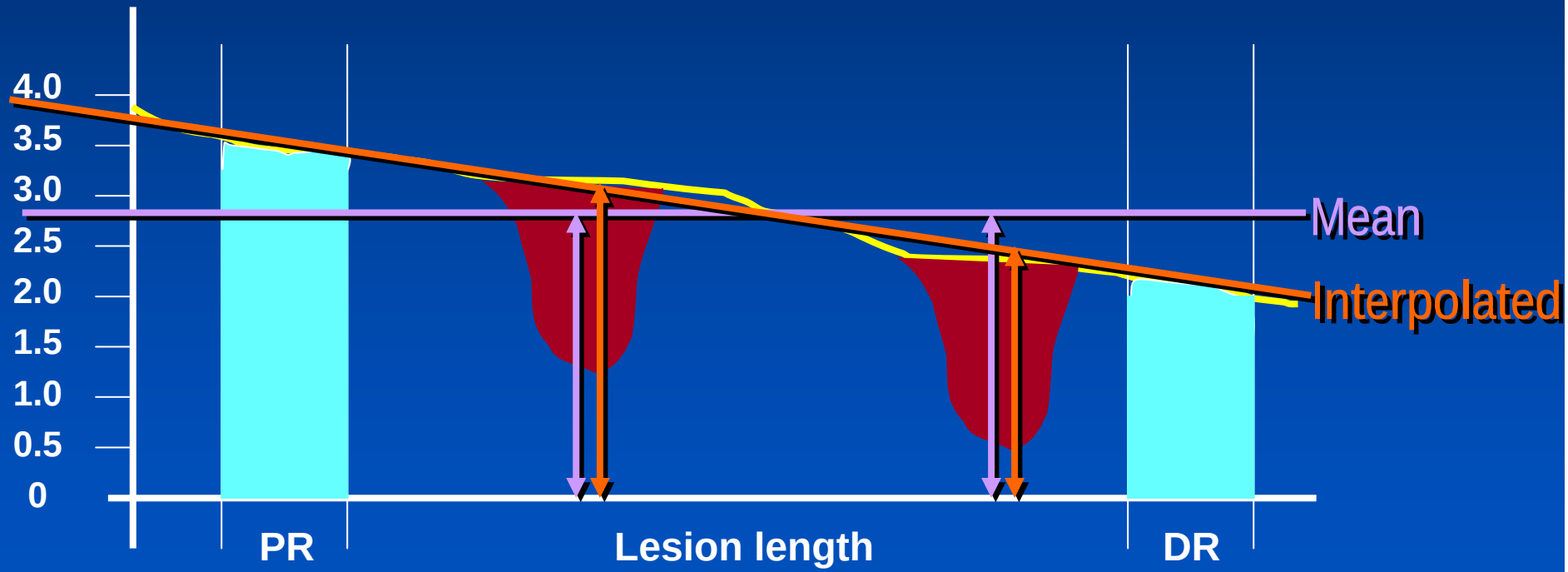


- Measurement of 2D images is the current standard of QCA.
- The standard way to present the degree of stenosis.
- The QCA outcomes has a close relation with clinical outcomes.
- But, it has many limitations to be resolved.

Interpolated Reference

- MLD = 1.3
- Mean reference: (3.5+2.2) / 2 = 2.85
  DS = (2.85-1.3) / 2.85 X 100 = 54.4%
- Interpolated reference: 3.2
  DS = (3.2-1.3) / 3.2 X 100 = 59.4%

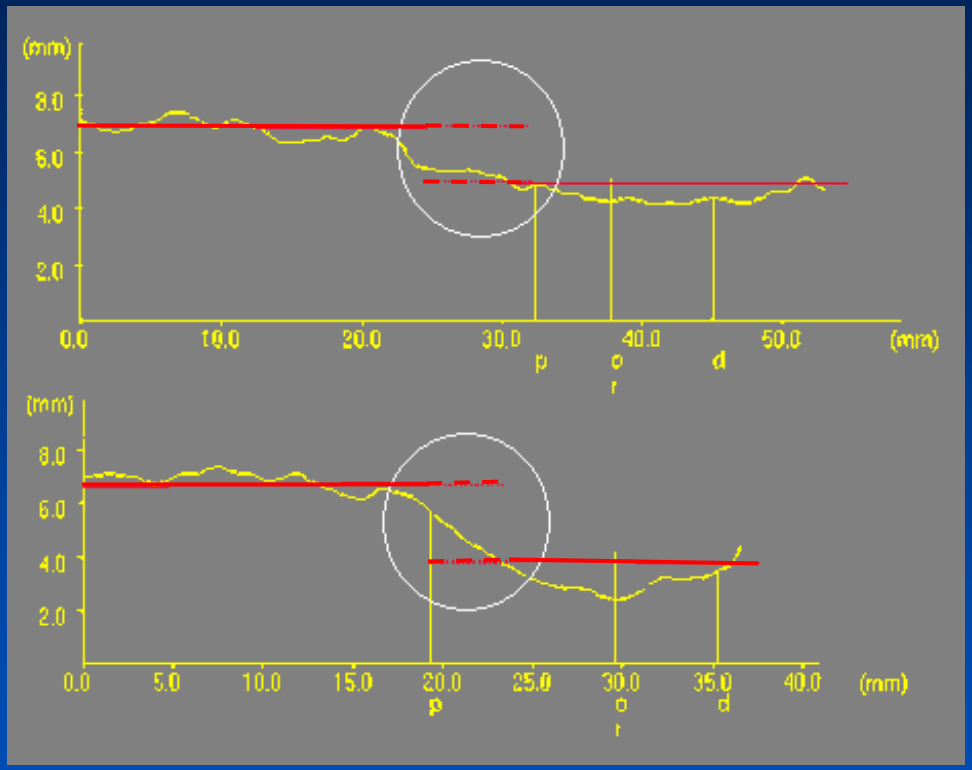
- MLD = 0.5
- Mean reference: (3.5+2.2) / 2 = 2.85
  DS = (2.85-0.5) / 2.85 X 100 = 82.5%
- Interpolated reference: 2.5
  DS = (2.5-0.5) / 2.5 X 100 = 80.0%



Courtesy of YH Kim

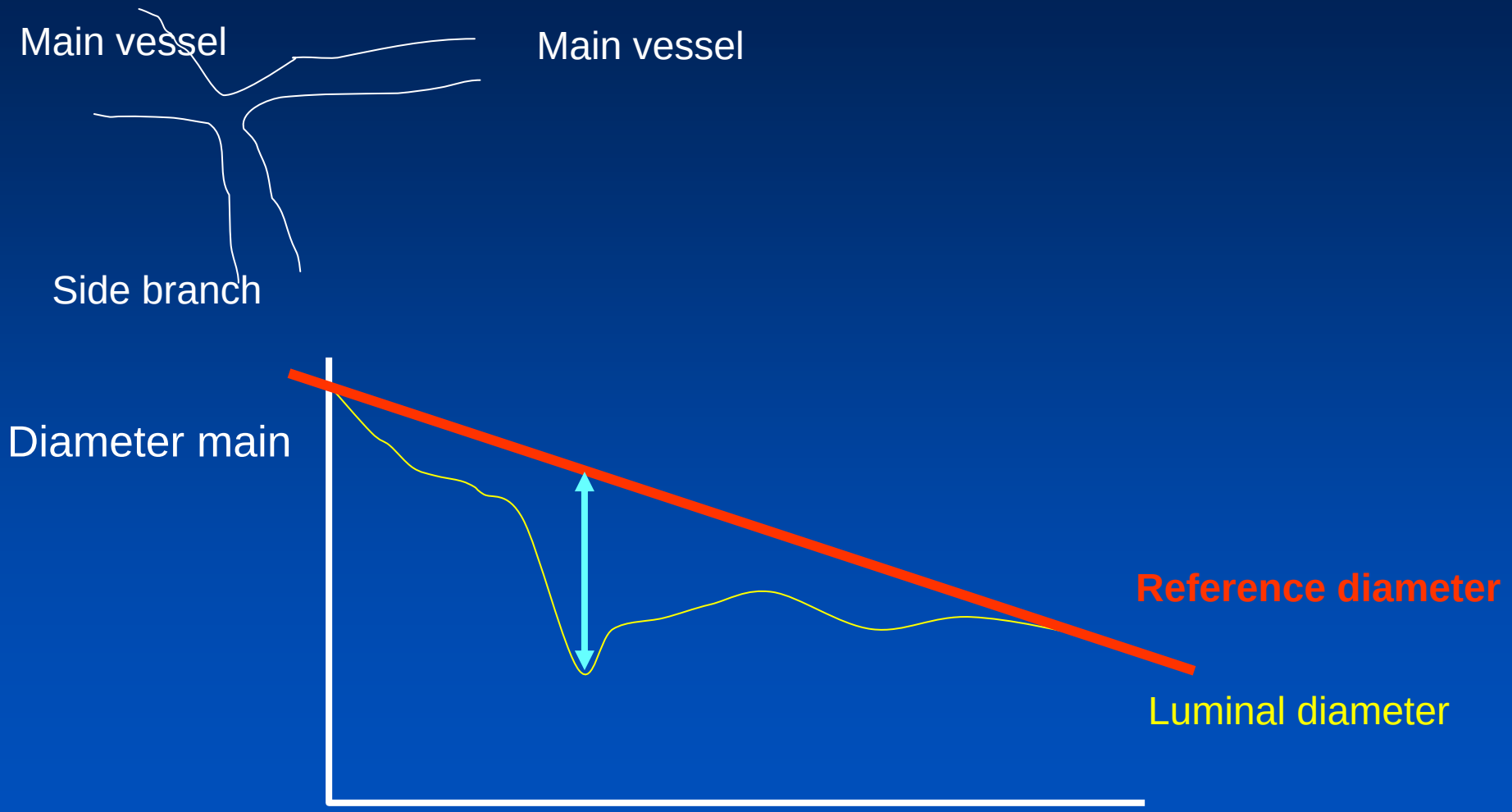
limitations of Bifurcation QCA

Method to determine the proper reference diameter for each individual segment

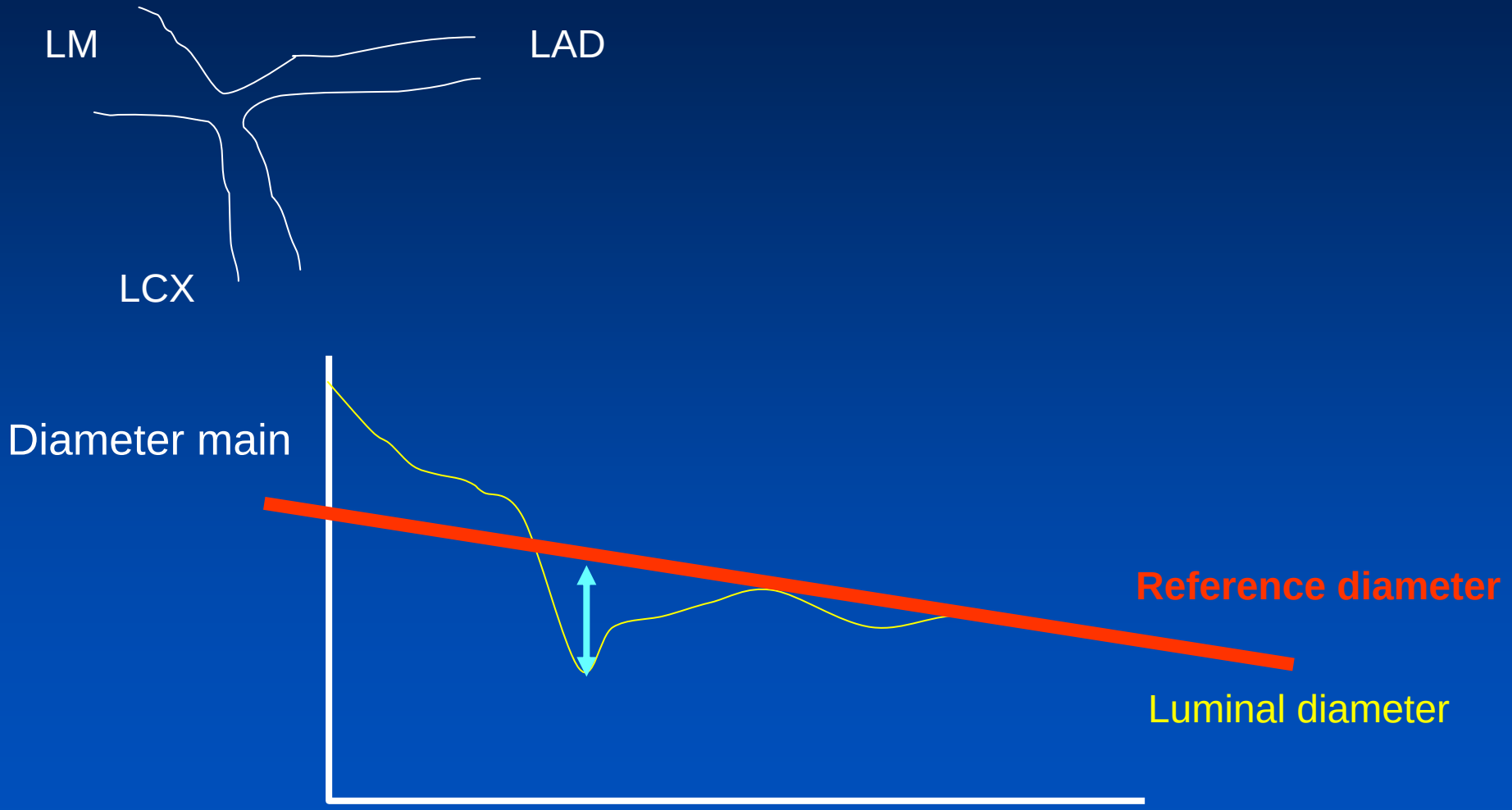


The “Step down” phenomenon is a major limitations of Standard QCA when applied to bifurcation analyses

Overestimation of Reference

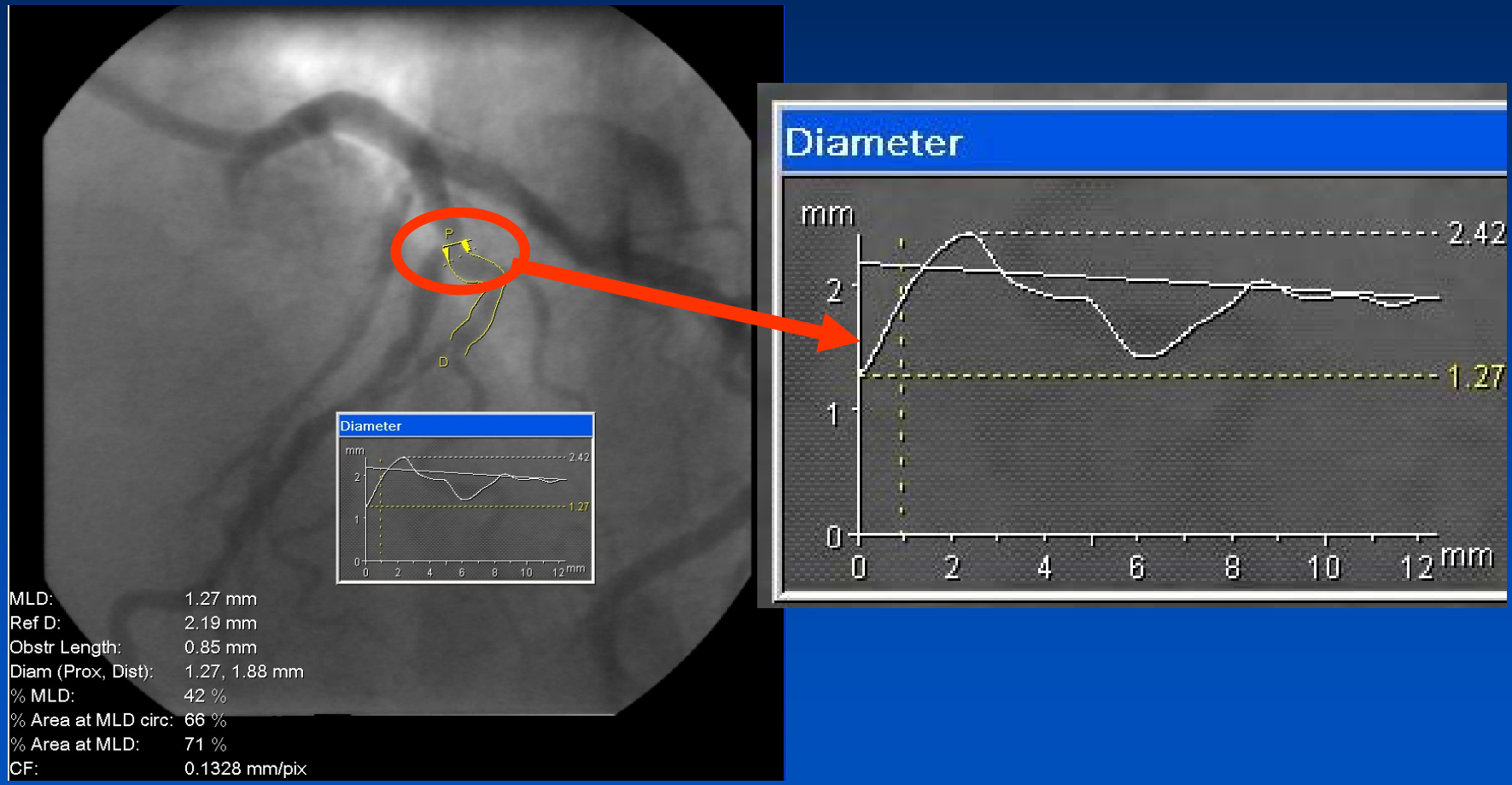


Underestimation of reference
If the index is the distal segment.

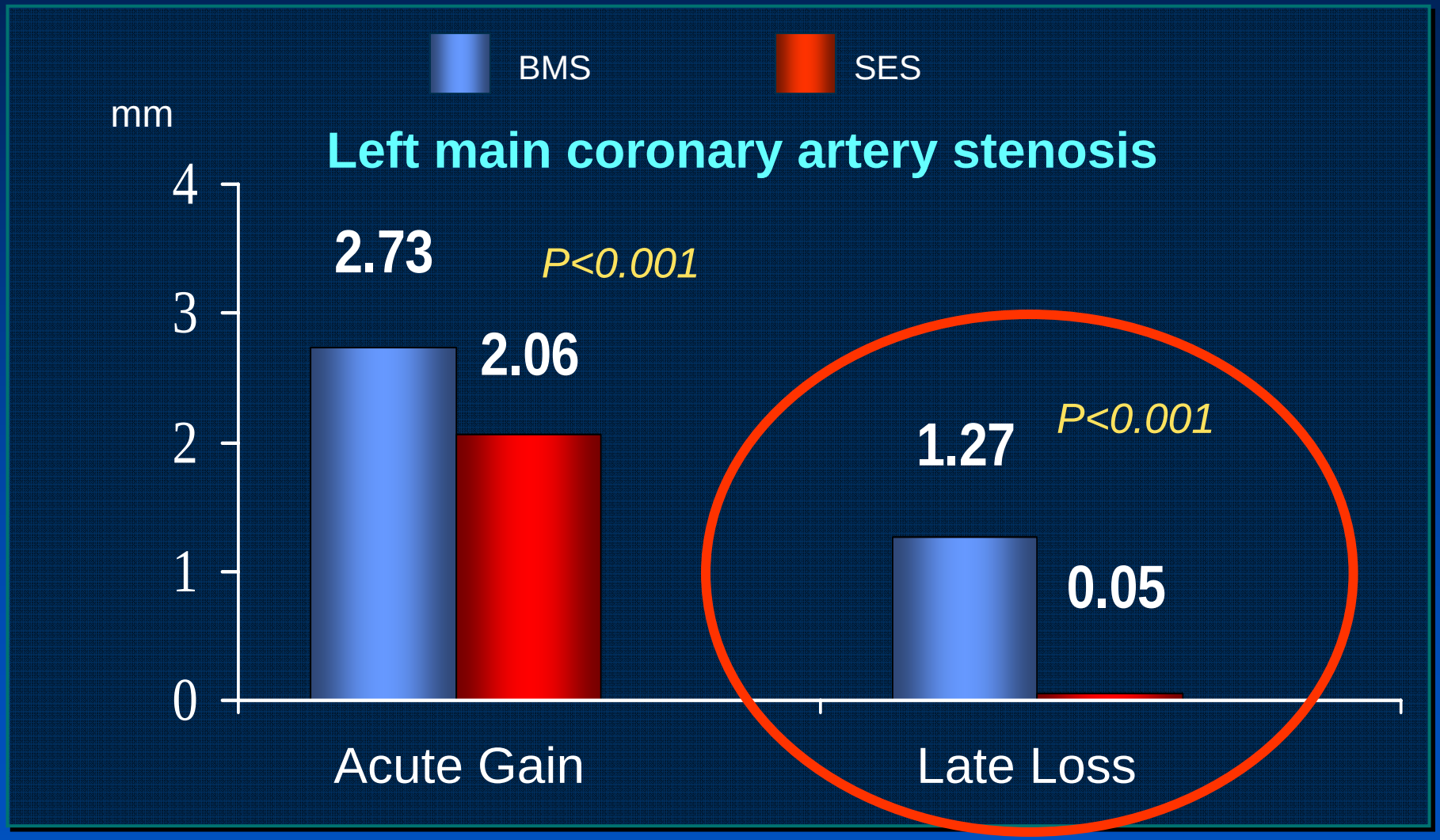


Courtesy of YH Kim

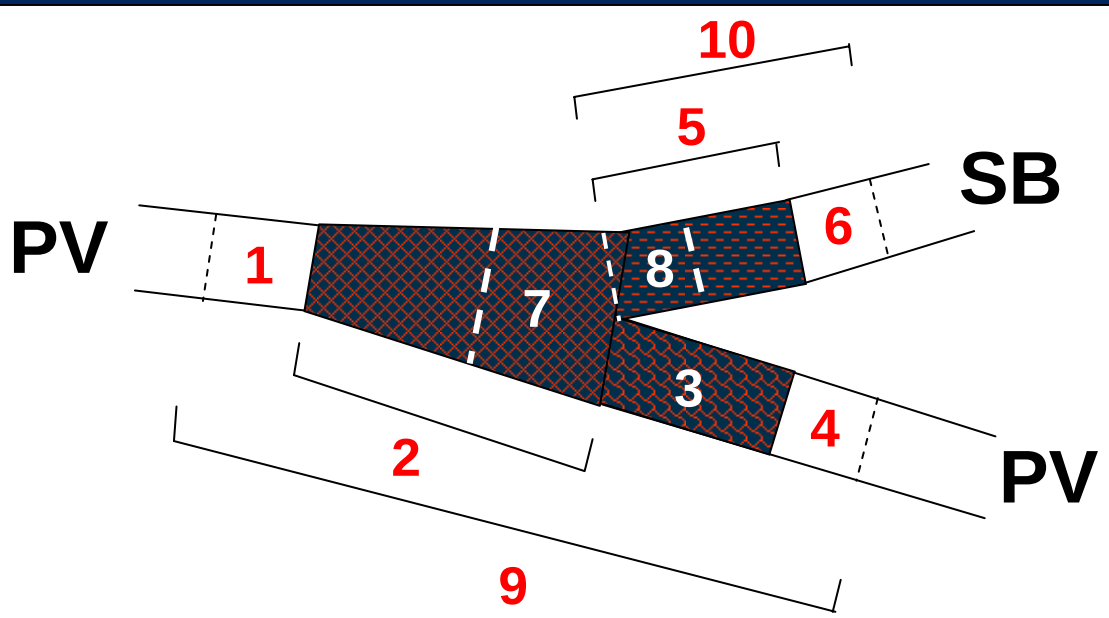
Underestimation of Side Branch Reference



How we present late loss in bifurcation ?
What does it mean?



Late loss is only meaningful if the segment analyzed is specified

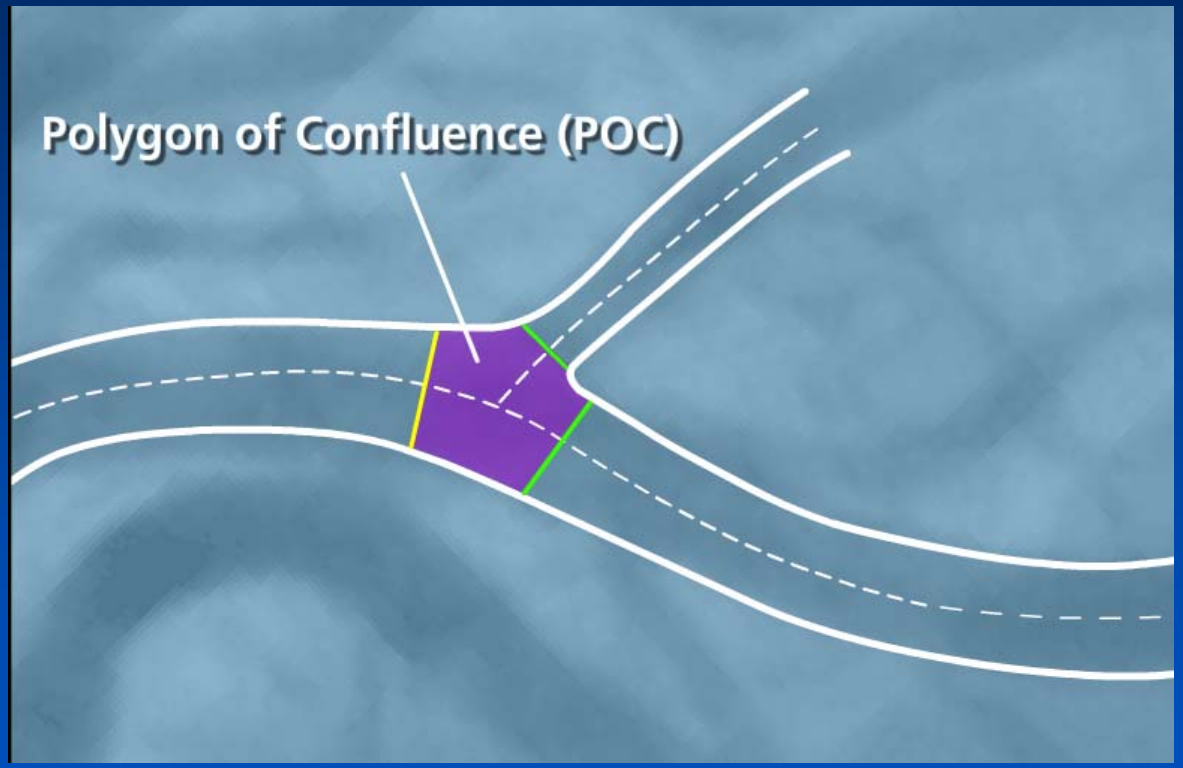


1 – Proximal Edge of the Prox PV Stent
2 – Prox PV Stent
3 – Distal PV Stent*
4 – Distal Edge of the PV Stent
5 – SB Stent*
6 – Distal Edge of the SB Stent*
7 – Carina
8 – Ostium of the SB (5mm)
9 – PV In-Lesion
10 – SB In-Lesion

**if additional stent(s) placed*

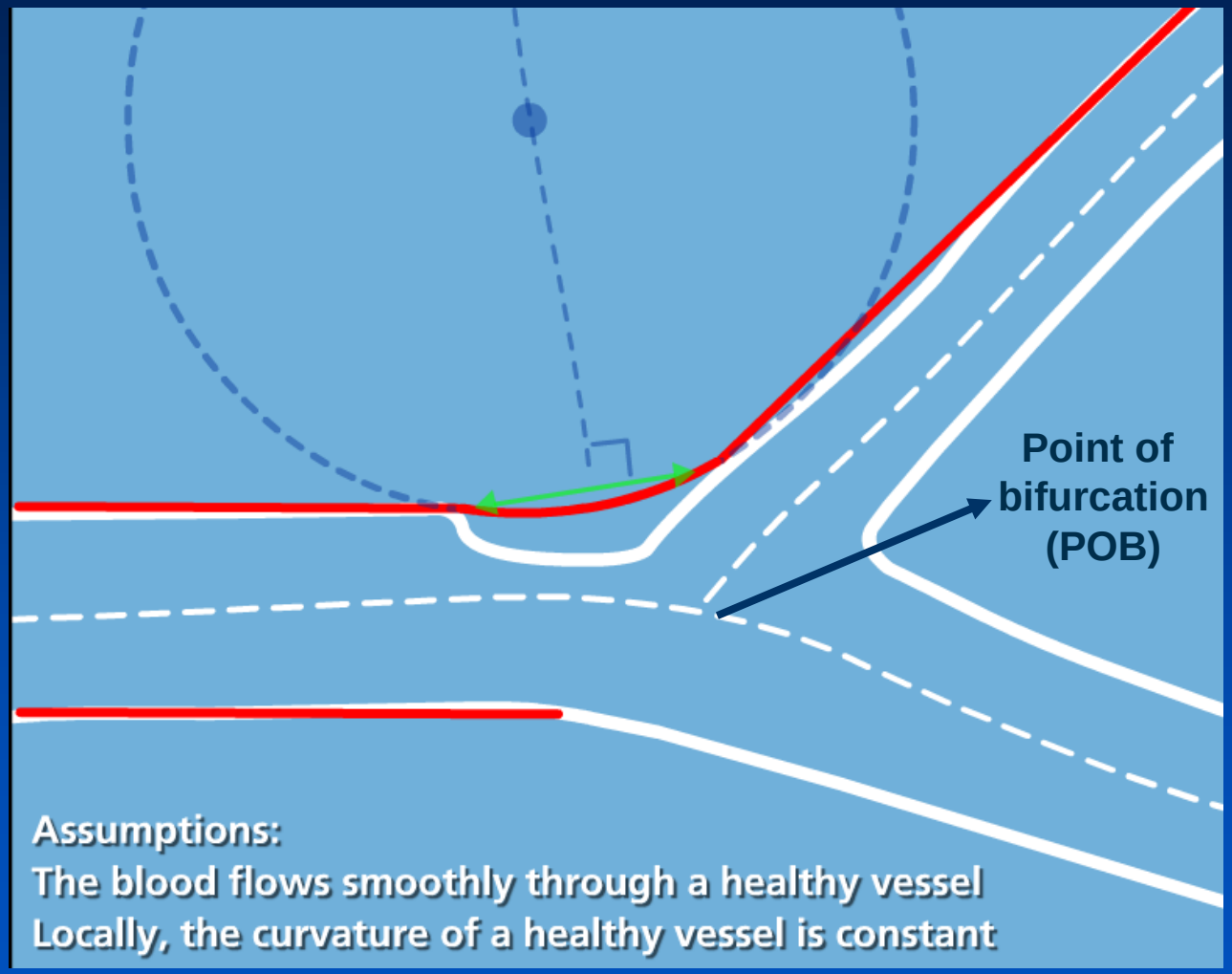
Gorktekin O et al. Catheter Cardiovasc Interv 2007;69:172

Polygon of Confluence by CASS-QCA
: Innovative Method of Bifurcation QCA

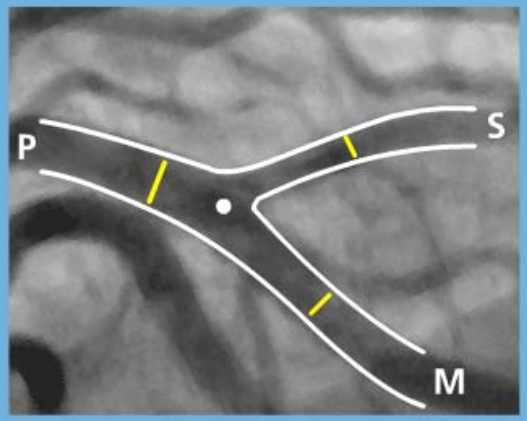


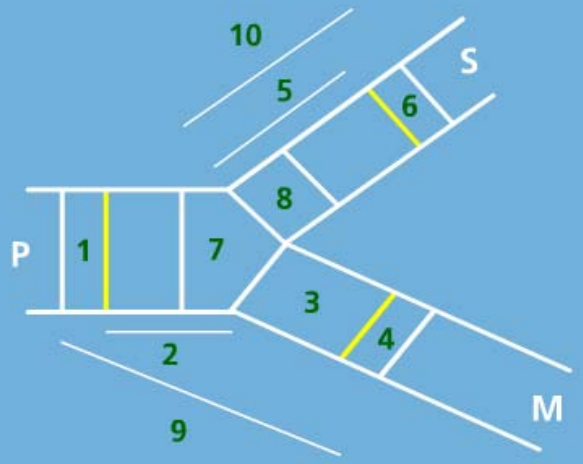
Ramcharritar S et al. Eurointervention 2008;3:553

Reference Line Interpolated



Description of Bifurcation QCA





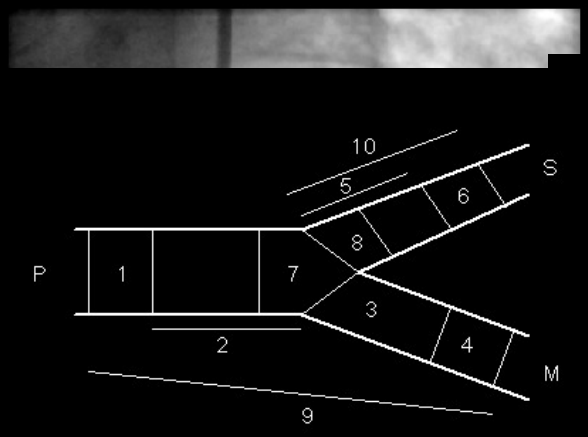
1. Proximal edge (5mm)
2. Proximal main stent
3. Distal main stent
4. Distal edge main (5mm)
5. Side branch stent
6. Distal edge side (5 mm)
7. Polygon of confluence
8. Ostium of side branch (5mm)
9. Main vessel stent + edges
10. Side branch stent + distal edge

Presenting results in segmental model

Ramcharritar S et al. Eurointervention 2008;3:553

Bifurcation QCA

Bifurcation Segment Model



JEONG HYEONG JIN
ID 27258695
Birthdate 1931-4-8
Physician
Hospital Asan Medical Center/4411...
Acquisition Date 2006-9-7
Patient Orientation L\F
II Size 16.00 cm
Segment
Trial Name
Intervention
Analysis type Nonostial
Cal. Factor 0.1339 mm/pix
Cal. Object 7.00 French Catheter

Car
Rat
Mur
Fin

1
2
3
4
5
6
7 M
7 S
8
9
10

	Ref A (mm²)	Plaque A (mm²)	%A (%)
Carina	4.55	0.53	12

Ratio Dist/Prox at Ostium	Luminal	Reference
Murray	-	-
Finet	-	-

	Prox pos (mm)	Length (mm)	%D (%)	Min D (mm)	Max D (mm)	Mean D (mm)	Ref D (mm)
1	0.00	4.97	7.16	1.88	2.46	2.21	2.03
2	4.97	2.59	4.56	1.40	2.39	2.07	1.46
3	7.56	8.23	38.29	0.83	1.40	1.08	1.34
4	15.80	4.98	16.54	1.24	1.75	1.54	1.48
5	7.67	5.91	19.84	1.03	1.46	1.28	1.28
6	13.58	5.00	11.07	1.20	1.37	1.29	1.35
7 Main	5.13	2.43	4.56	1.40	-	-	1.46
7 Side	5.13	2.54	4.56	1.40	-	-	1.46
8	7.67	2.03	19.84	1.03	1.36	1.20	1.28
9	0.00	20.78	38.29	0.83	2.46	1.57	1.34
10	7.67	10.91	19.84	1.03	1.46	1.28	1.28

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Bifurcation QCA Between LM vs. Non-LM

Between APR 2003 and SEP 2004 in Patients Treated with Main-Branch SES Alone

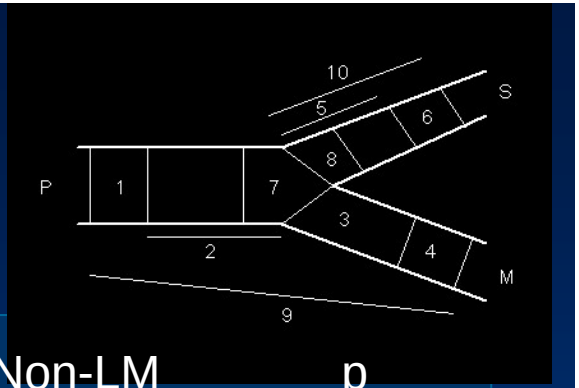
	LM	Non-LM
No. of lesions	16	99
Location		
LM	16	93
LAD - Diag		6
LCX - OM		0
RCA - PDA		0

LM vs. Non-LM

Kissing Balloon Inflation and MEDINA Class

	LM (N=16)	Non-LM (N=99)	p
Kissing balloon inflation	3 (19)	48 (49)	0.031
MEDINA class			0.034
1.1.1 	3 (19)	**31 (31)**	
1.1.0. 	**8 (50)**	**27 (27)**	
1.0.1. 	2 (13)	5 (5)	
0.1.1. 	0	13 (13)	
1.0.0. 	2 (13)	1 (1)	
0.1.0. 	1 (6)	20 (20)	
0.0.1 	0	1 (1)	

LM vs. Non-LM
Baseline QCA



	LM (N=16)	Non-LM (N=99)	p
Proximal main branch (seg.# 2)			
Reference (mm)	3.52 ± 0.58	3.07 ± 0.60	**0.006**
Minimal lumen diameter (mm)	1.58 ± 0.59	1.54 ± 0.72	0.827
Diameter stenosis (%)	52.6 ± 20.2	49.3 ± 21.2	0.558
Distal main branch (seg.# 3)			
Reference (mm)	3.06 ± 0.96	2.74 ± 0.58	0.073
Minimal lumen diameter (mm)	1.94 ± 0.66	1.20 ± 0.56	**<0.001**
Diameter stenosis (%)	37.6 ± 23.9	54.9 ± 20.1	**0.004**

LM vs. Non-LM
Baseline QCA

	LM (N=16)	Non-LM (N=99)	p
Side branch (seg.# 5)			
Reference (mm)	2.79 ± 0.47	2.54 ± 0.75	0.197
Minimal lumen diameter (mm)	2.26 ± 0.79	1.64 ± 0.93	**0.013**
Diameter stenosis (%)	31.1 ± 12.6	38.0 ± 25.4	0.354
Angles			
Proximal (°)	125.5 ± 22.7	133.7 ± 31.0	0.317
Distal (°)	74.8 ± 19.0	60.9 ± 24.5	**0.032**

LM vs. Non-LM
Post-procedural QCA in Pts Without Kissing

	LM (N=13)	Non-LM (N=51)	p
Proximal main branch (seg.# 2)			
Reference (mm)	4.02 ± 0.90	3.46 ± 0.63	**0.012**
Minimal lumen diameter (mm)	3.23 ± 0.50	3.02 ± 0.49	0.169
Diameter stenosis (%)	16.3 ± 10.5	12.7 ± 9.0	0.245
Length (mm)	11.0 ± 4.0	13.5 ± 6.2	0.178
Distal main branch (seg.# 3)			
Reference (mm)	2.97 ± 0.69	2.94 ± 0.56	0.834
Minimal lumen diameter (mm)	2.93 ± 0.54	2.65 ± 0.48	0.073
Diameter stenosis (%)	10.8 ± 6.5	11.1 ± 9.2	0.940
Length (mm)	13.4 ± 12.3	18.3 ± 12.4	0.991

LM vs. Non-LM
Post-procedural QCA in Pts Without Kissing

	LM (N=16)	Non-LM (N=99)	p
Side branch (seg.# 5)			
Reference (mm)	2.76 ± 0.52	2.55 ± 0.77	0.366
Minimal lumen diameter (mm)	1.94 ± 0.66	1.67 ± 0.78	0.264
Diameter stenosis (%)	31.0 ± 15.0	36.7 ± 21.2	0.365
Length (mm)	6.7 ± 4.4	6.7 ± 4.4	0.991

LM vs. Non-LM

Gain and Loss : Proximal Main-Branch

	LM (N=13)	Non-LM (N=51)	p
Proximal main branch			
Gain (mm)	1.79 ± 0.87	1.44 ± 0.62	0.096
Loss (mm)	-0.01 ± 0.23	0.03 ± 0.35	0.656
Distal main branch			
Gain (mm)	1.15 ± 0.83	1.42 ± 0.61	0.182
Loss (mm)	0.21 ± 0.46	0.17 ± 0.40	0.730
Side branch			
Gain (mm)	-0.19 ± 0.31	-0.11 ± 0.55	0.640
Loss (mm)	0.03 ± 0.50	-0.11 ± 0.44	0.299

Conclusion

- The new dedicated software of bifurcation coronary system is a novel way to determine the lesion characteristics together with the angulation of the bifurcation.
- In addition, it provides more insights into the change of regional luminal diameter in bifurcation segments.
- In the limited patients, the regional late losses in proximal and distal MB, and SB were comparable between the LM and non-LM coronary lesions treated with simple SES implantation.
- Further studies with this software will help to assess the mechanisms of restenosis after DES implantation for bifurcation coronary lesions.