

Dr. Pascal MOTREFF

IVUS guidance or not for ULM
bifurcation stenosis

European Bifurcation Club



*Cardiology Department
University Hospital
Clermont-Ferrand, FRANCE*

Dr. Pascal MOTREFF

IVUS guidance or not for ULM
bifurcation stenosis

European Bifurcation Club



*Cardiology Department
University Hospital
Clermont-Ferrand, FRANCE*



ULM Bifurcation Stenting

Background :

- Unprotective Left Main bifurcation stenting



European Heart Journal (2011) 32, 2125–2134
doi:10.1093/eurheartj/ehr213

FASTTRACK CLINICAL

Comparison of coronary bypass surgery with drug-eluting stenting for the treatment of left main and/or three-vessel disease: 3-year follow-up of the SYNTAX trial

Arie Pieter Kappetein^{1*}, Ted E. Feldman², Michael J. Mack³, Marie-Claude Morice⁴, David R. Holmes⁵, Elisabeth Stähle⁶, Keith D. Dawkins⁷, Friedrich W. Mohr⁸, Patrick W. Serruys¹, and Antonio Colombo⁹

CLINICAL RESEARCH

Interventional Cardiology

Randomized Comparison of Percutaneous Coronary Intervention With Sirolimus-Eluting Stents Versus Coronary Artery Bypass Grafting in Unprotected Left Main Stem Stenosis

Enno Boudriot, MD,* Holger Thiele, MD,* Thomas Walther, MD,† Christoph Liebetrau, MD,* Peter Boeckstegers, MD,‡ Tilmann Pohl, MD,‡ Bruno Reichart, MD,§ Harald Mudra, MD,|| Florian Beier, MD,|| Brigitte Gansera, MD,¶ Franz-Josef Neumann, MD,# Michael Gick, MD,# Thomas Zietak, MD,** Steffen Desch, MD,* Gerhard Schuler, MD,* Friedrich-Wilhelm Mohr, MD†
Leipzig, Munich, and Bad Krozingen, Germany

ORIGINAL ARTICLE

Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease

Seung-Jung Park, M.D., Young-Hak Kim, M.D., Duk-Woo Park, M.D.,

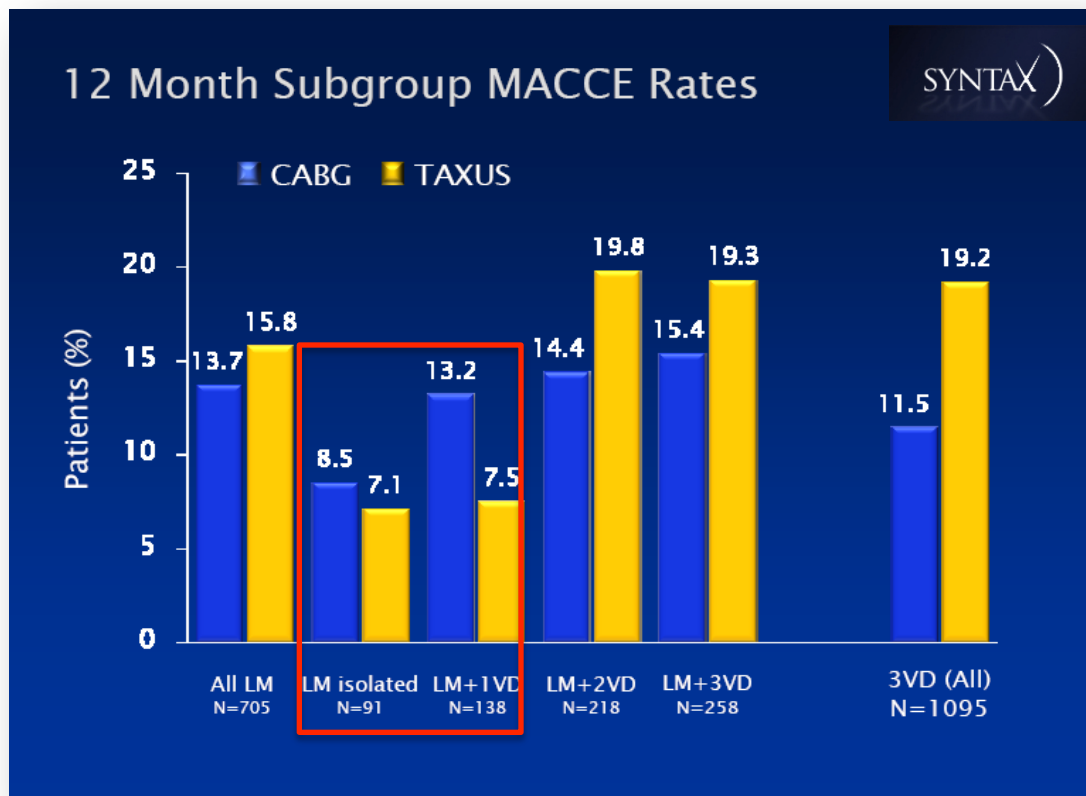
*Boudriot E, J Am Coll Cardiol 2011
Park SJ, N Engl J Med 2011
Kappetein AP, Eur Heart J 2011*



ULM Bifurcation Stenting

Background :

- Left Main bifurcation stenting



Subset of CAD by anatomy	Favours CABG	Favours PCI
IVD or 2VD - non-proximal LAD	IIb C	I C
IVD or 2VD - proximal LAD	I A	IIa B
3VD simple lesions, full functional revascularization achievable with PCI, SYNTAX score ≤ 22	I A	IIa B
3VD complex lesions, incomplete revascularization achievable with PCI, SYNTAX score > 22	I A	III A
Left main (isolated or IVD, ostium/shaft)	I A	IIa B
Left main (isolated or IVD, distal bifurcation)	I A	IIb B
Left main + 2VD or 3VD, SYNTAX score ≤ 32	I A	IIb B
Left main + 2VD or 3VD, SYNTAX score ≥ 33	I A	III B



ULM Bifurcation Stenting

Background :

- IVUS guidance remains controversial

No benefit of IVUS guidance in European Registries

Agostoni P, Am J Cardiol 2005

Biondi-Zoccai GG, Am Heart J 2008

IVUS-guided stent implantation may be considered for unprotected left main PCI.

IIb

C

Guidelines ESC 2010



ULM Bifurcation Stenting

Background :

- IVUS guidance remains controversial :

IVUS guidance seems to improve LM stenting results

Circulation American Heart Association
Cardiovascular Interventions *Learn and Live*
JOURNAL OF THE AMERICAN HEART ASSOCIATION

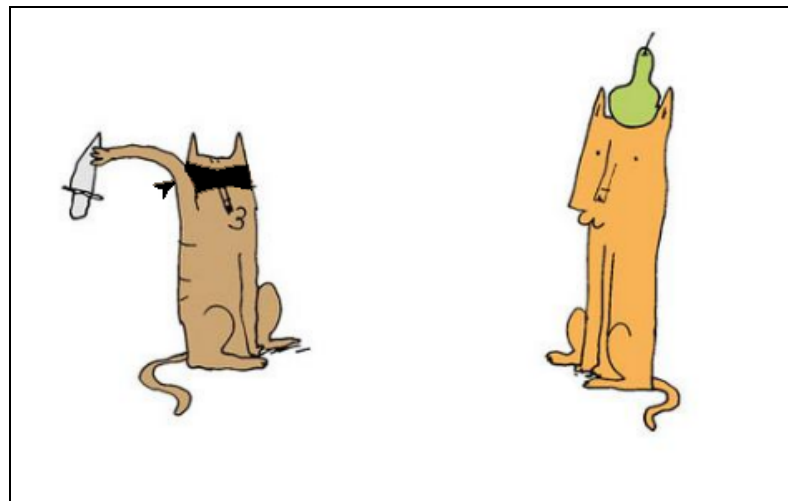
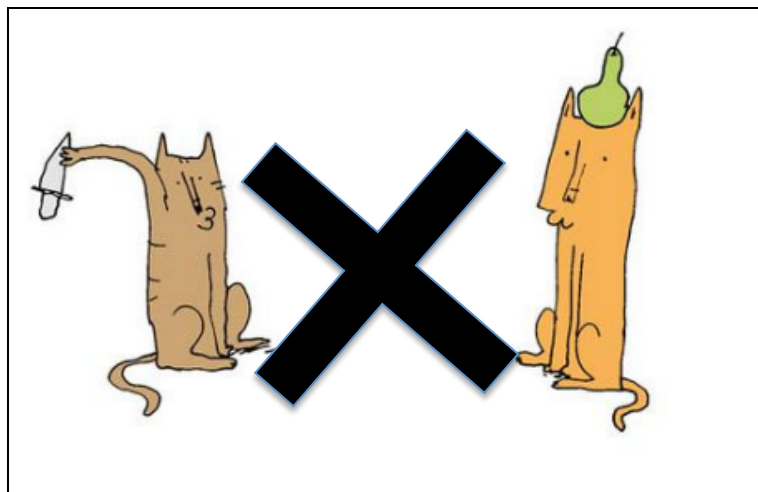
Impact of Intravascular Ultrasound Guidance on Long-Term Mortality in Stenting for Unprotected Left Main Coronary Artery Stenosis

Seung-Jung Park, MD, PhD*; Young-Hak Kim, MD, PhD*; Duk-Woo Park, MD, PhD;
Seung-Whan Lee, MD, PhD; Won-Jang Kim, MD, PhD; Jon Suh, MD; Sung-Cheol Yun, PhD;
Cheol Whan Lee, MD, PhD; Myeong-Ki Hong, MD, PhD; Jae-Hwan Lee, MD, PhD;
Seong-Wook Park, MD, PhD; for the MAIN-COMPARE Investigators

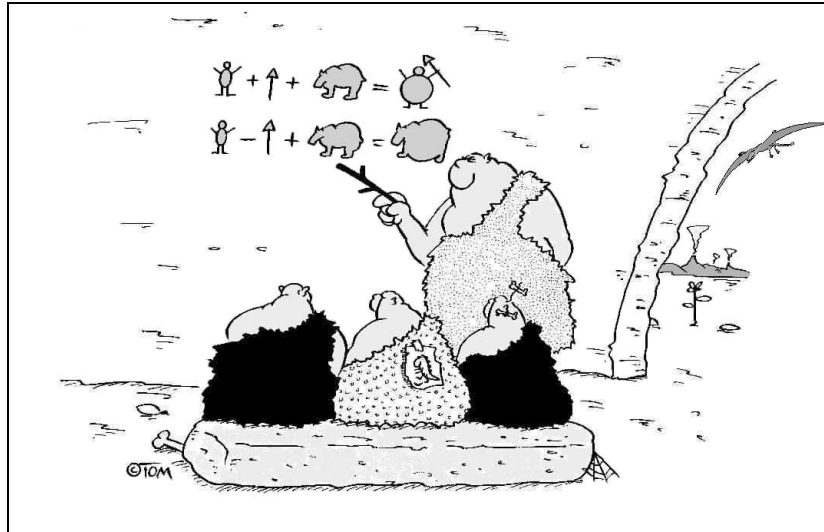


ULM Bifurcation Stenting

IVUS guidance can be avoided for the
Left Main lesion treatment ?

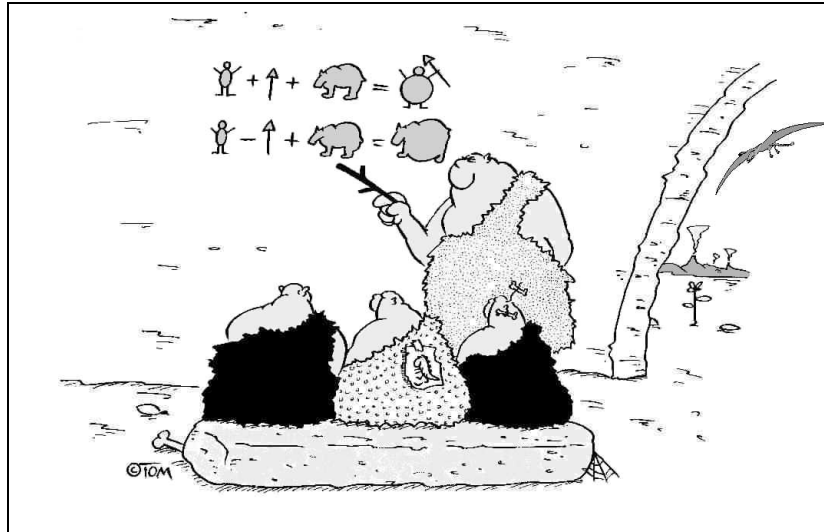


What did we learn from IVUS ?



1. Assessment of LM stenosis
2. Stenting strategy decision
3. Post-procedure IVUS assessment

What did we learn from IVUS ?



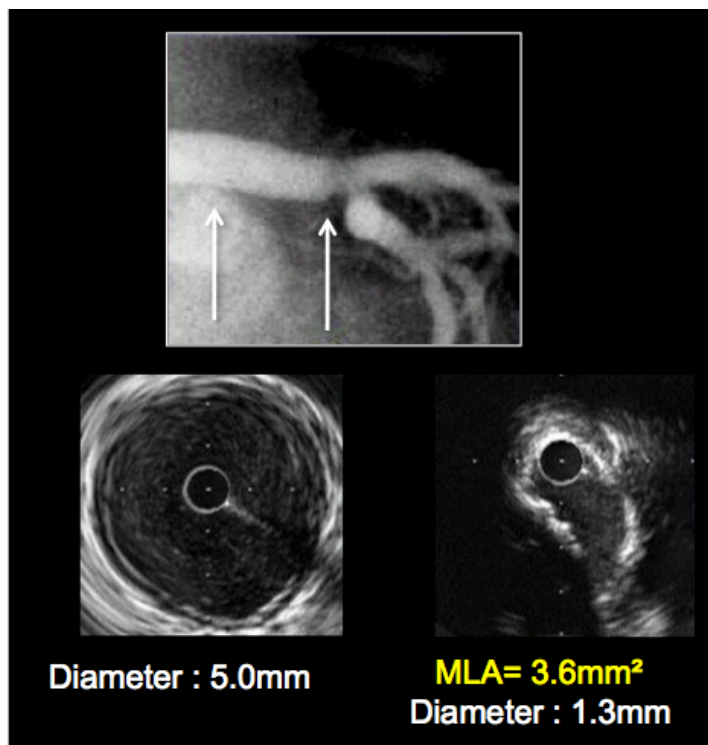
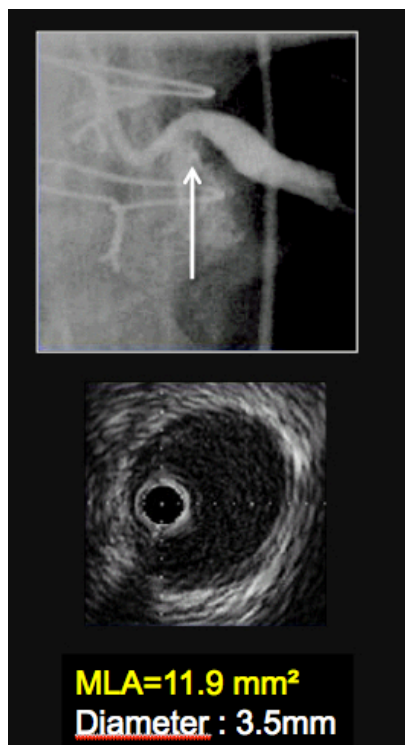
1. **Assessment of LM stenosis**
2. Stenting strategy decision
3. Post-procedure IVUS assessment



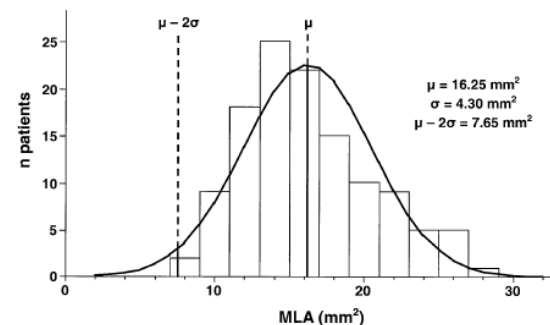
Assessment of LM stenosis

Angiographic Limitations :

- Often short lesion, angulation
- Lack of normal segment for comparison
- Underestimation of severity in excentric or diffuse atherosclerotic lesion
- Lesion involving bifurcation...



MLA Cut-off = 6mm²



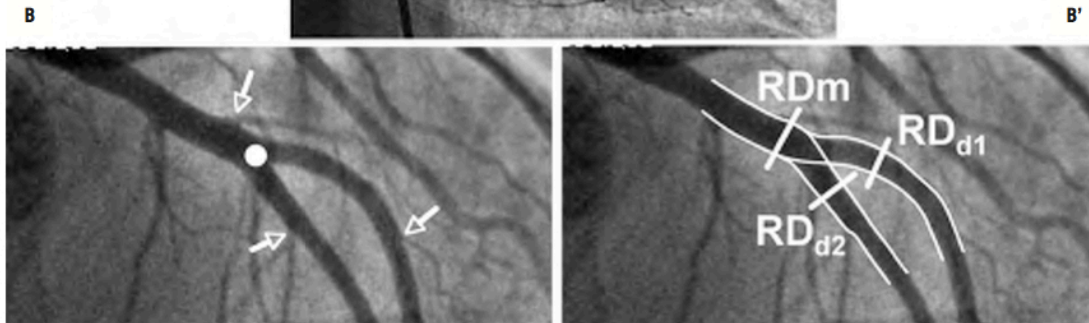
*Fassa AA,
J Am Coll Cardiol 2005*



Assessment of LM stenosis

Fractal geometry of arterial coronary bifurcations: a quantitative coronary angiography and intravascular ultrasound analysis

Gerard Finet*, MD PhD; M. Gilard, MD; B. Perrenot; G. Rioufol, MD PhD; P. Motreff, MD;
L. Gavit, PhD; R. Prost, PhD



Finet's Fractal Formula

$$D_m = 0.678 (D_{d1} + D_{d2})$$



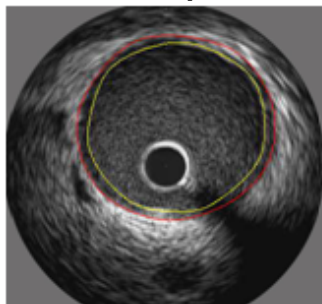
Assessment of LM stenosis

Diffuse atherosclerotic left main coronary artery disease unmasked by fractal geometric law applied to quantitative coronary angiography: an angiographic and intravascular ultrasound study

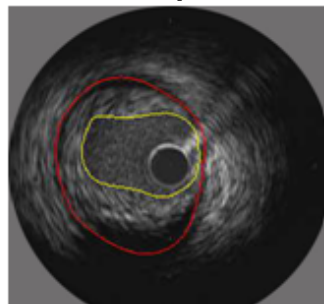
Pascal Motreff^{1*}, MD, PhD; Gilles Rioufol², MD, PhD; Martine Gilard³, MD, PhD; Christophe Caussin⁴, MD, PhD; Lemlih Ouchchane⁵, MD, PhD; Geraud Souteyrand¹, MD; Gerard Finet, MD, PhD

IVUS classification in 3 groups (n=52)

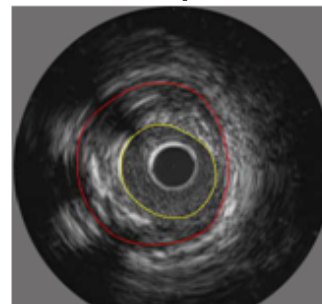
Group A



Group B



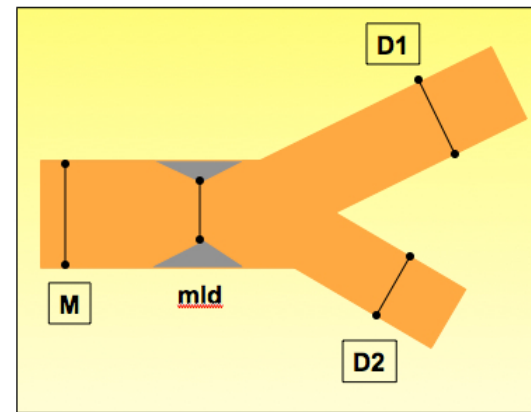
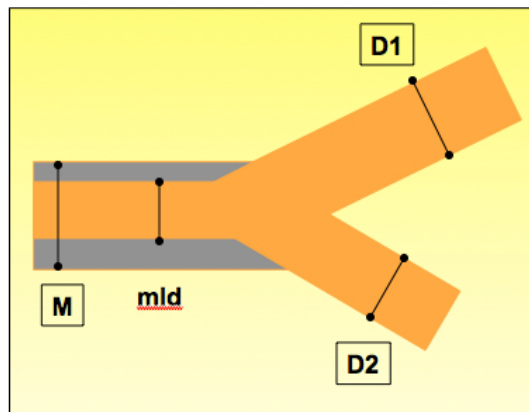
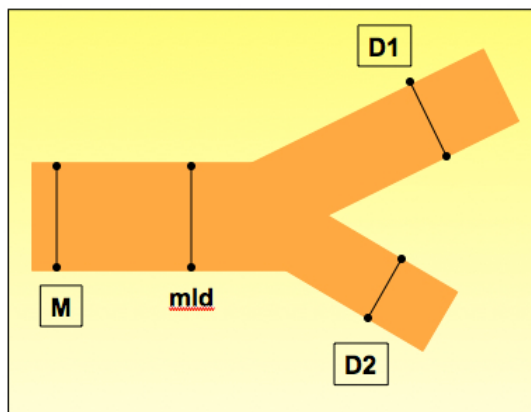
Group C



A : « normal LM »
B : Diffuse LM lesion
C : Focal LM lesion



Assessment of LM stenosis



	Ex.1 (group A)	Ex.2 (group B)	Ex.3 (group C)
LMDref (A) (mm)	4.80	2.69	4.09
LMMLD (B) (mm)	4.70	2.62	2.58
Diameter Stenosis (%)	2	3	37
LADref (C) (mm)	3.93	3.32	3.72
LCxref (D) (mm)	3.17	2.28	3.13
LMDfractal (E) (mm)	4.81	3.80	4.64
Diameter Stenosis fractal (%)	2	31	44
LMDref-LMDfractal (mm)	-0,01	-1,11	-0,55

Ratio from reference diameter

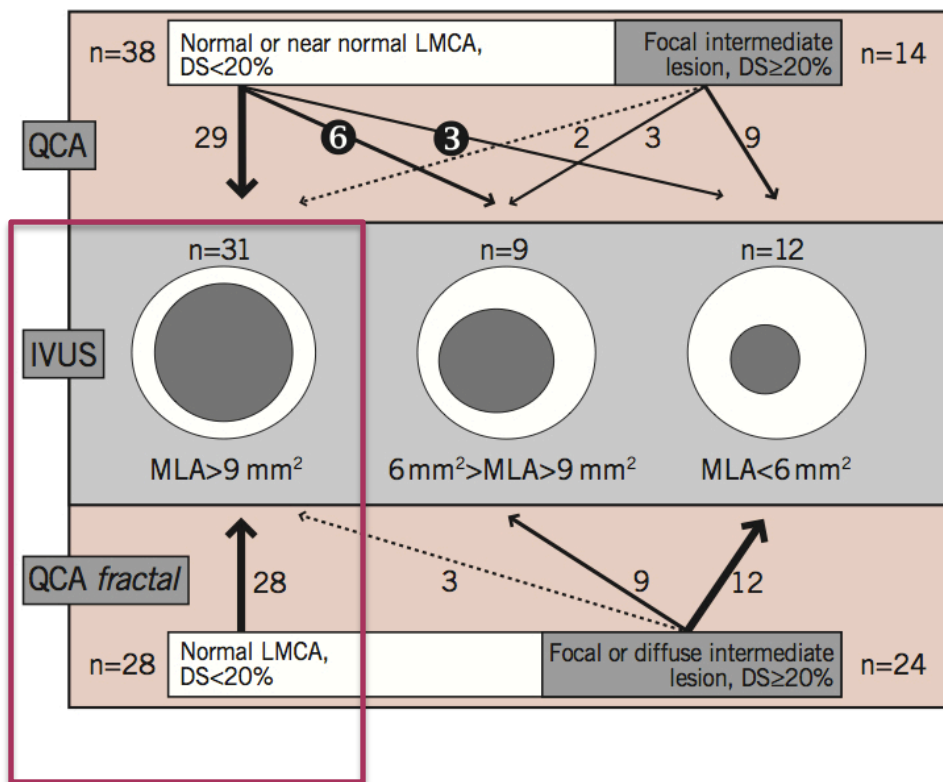
Ratio from reference diameter calculated by FFF



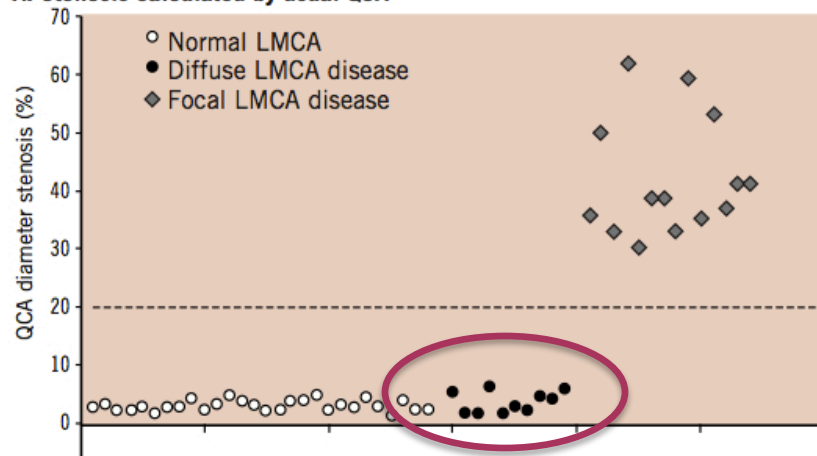


Assessment of LM stenosis

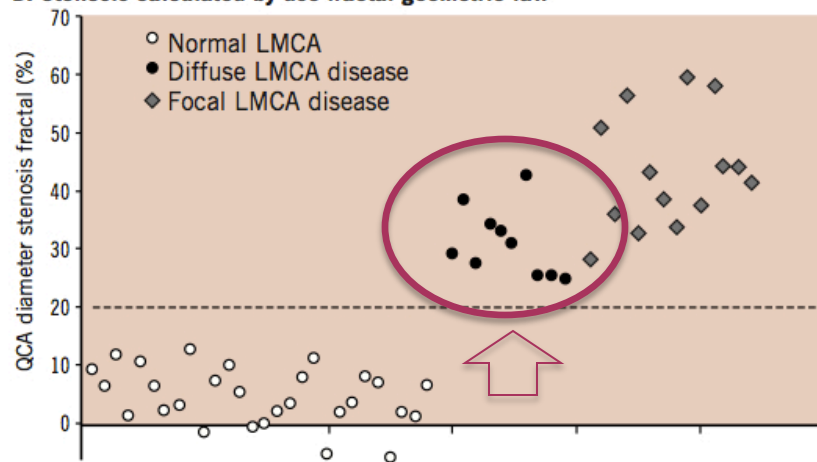
Fractal geometric law **may unmask** diffuse atherosclerotic lesion...



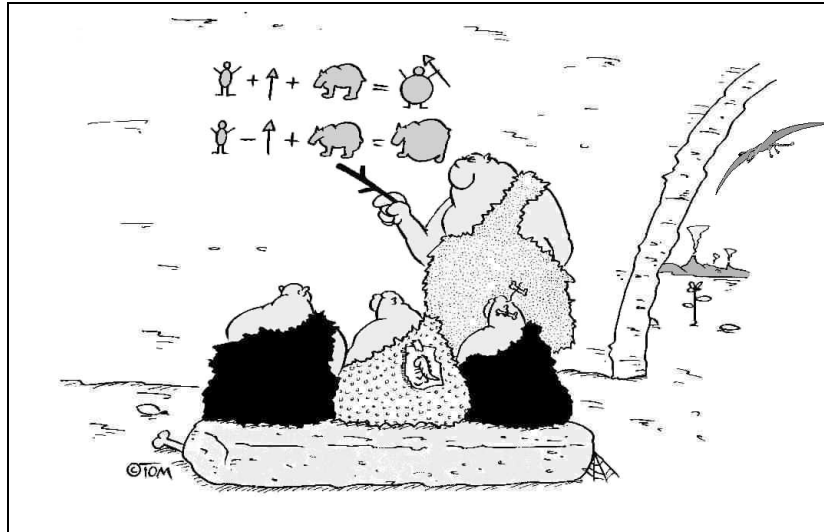
A. Stenosis calculated by usual QCA



B. Stenosis calculated by use fractal geometric law



What did we learn from IVUS ?



1. Assessment of LM stenosis
2. **Stenting strategy decision**
3. Post-procedure IVUS assessment



Stenting strategy decision

« Strategy inspired by French Team »

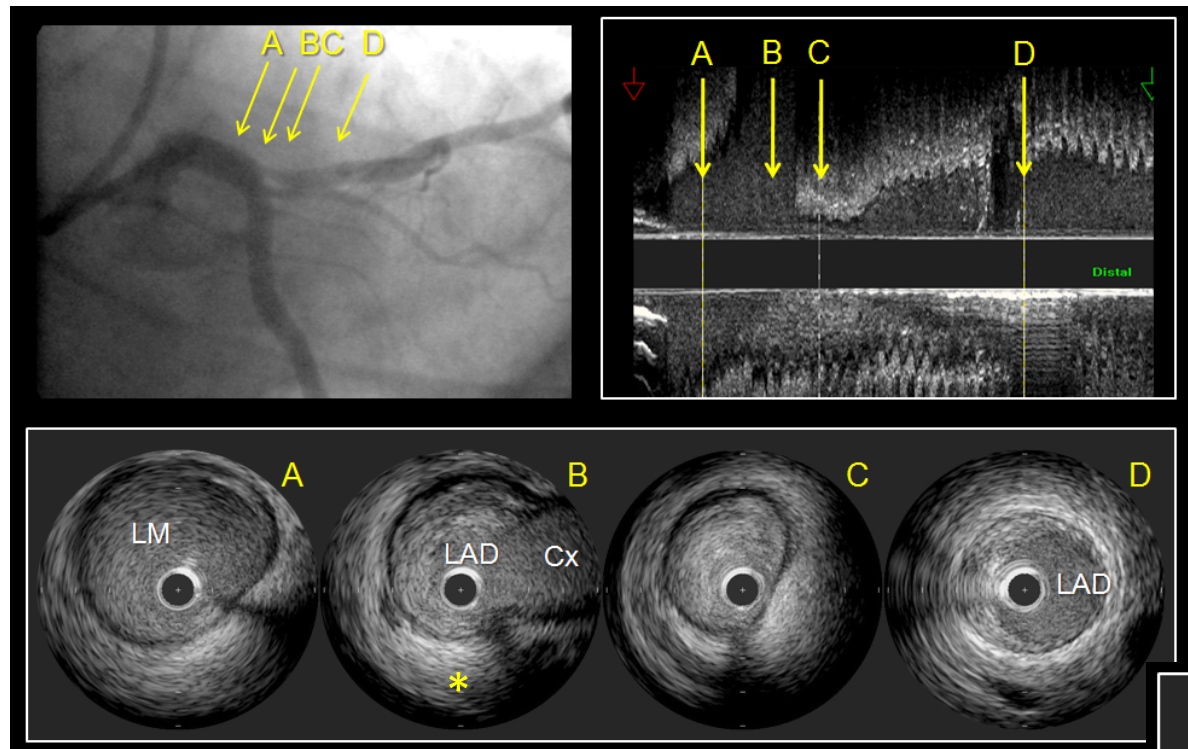


- Single stent strategy, DES (Carrié), no systematic jailed Wire
- Stent diameter chosen from proximal LAD (or Cx) and respect of Fractal Law (Finet)
- Stenting coverage since LM ostium (Louvard)
- Proximal Optimisation Technique (Darremont)
- Daughter branch crossing through the most distal cell (Lefevre)
- Final Kissing Balloon
- Provisional T-Stenting (Lefevre)

Strategy for > 90% LM stenting



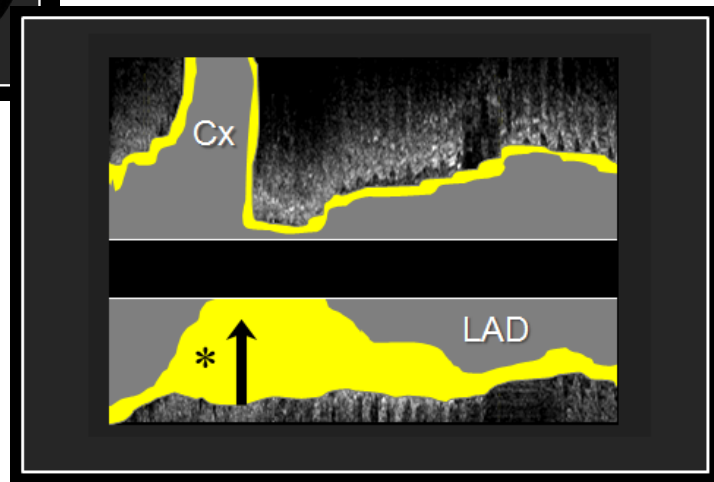
Stenting strategy decision



Medina 0.1.0 ?

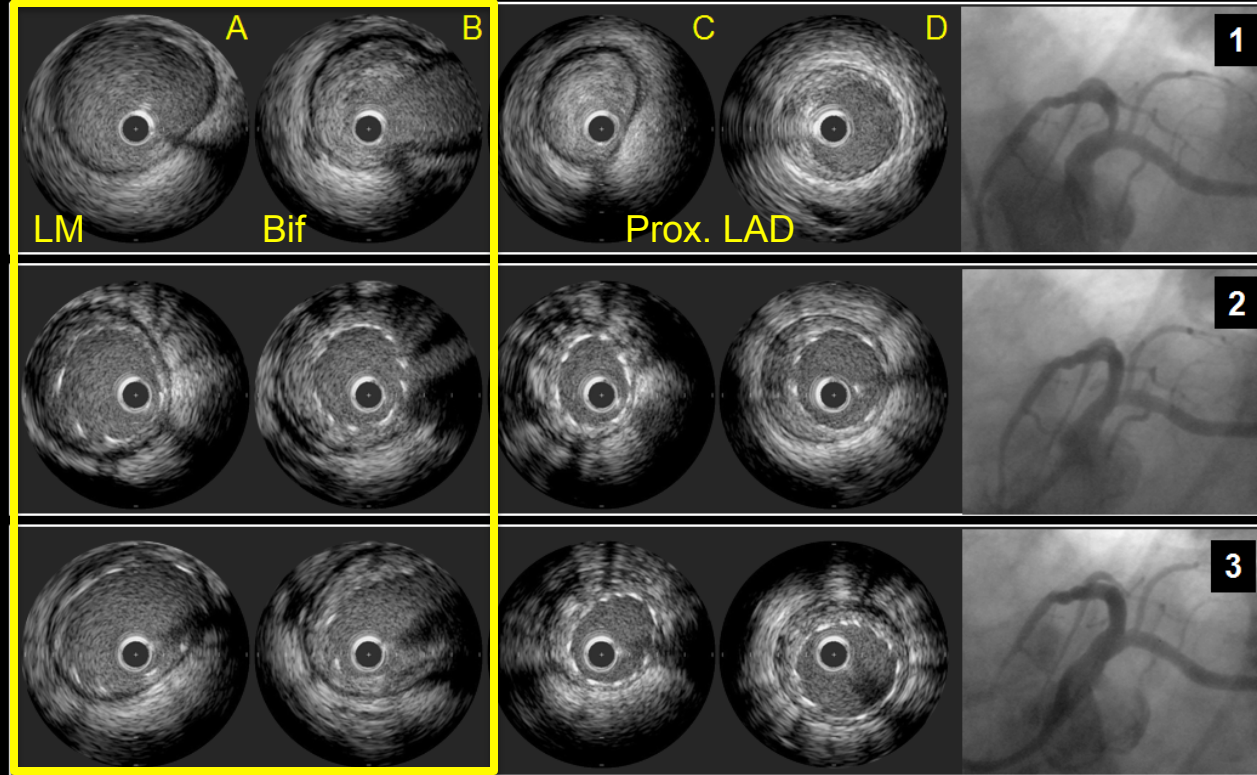
Medina 1.1.0

We need to treat the Left Main!





Stenting strategy decision



Role of Final Kissing Balloon :

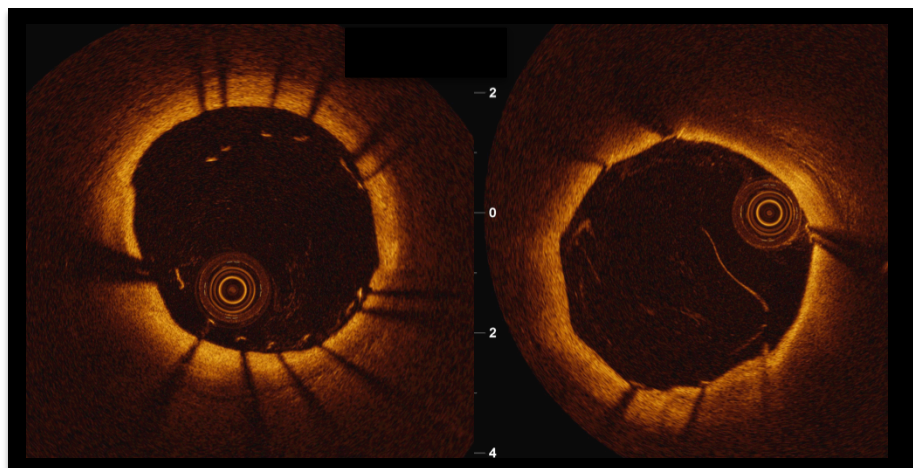
- opening struts in Cx direction
- best proximal apposition



Stenting strategy decision

Role of POT technique :

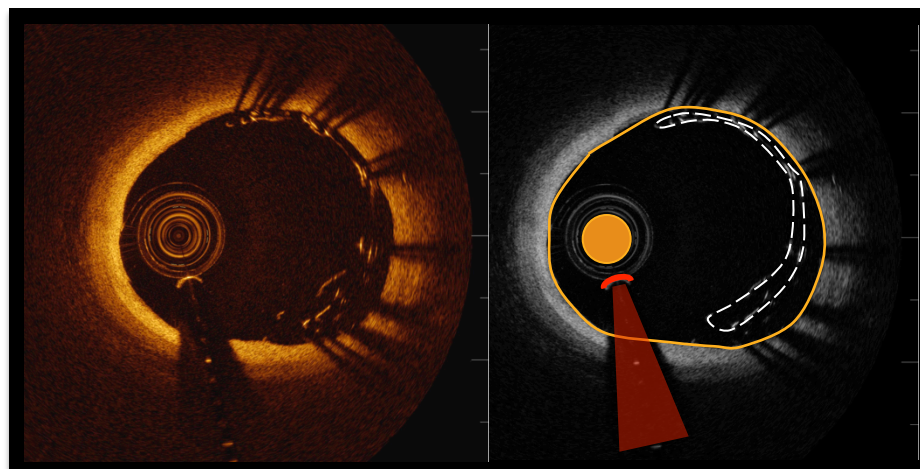
- facilitate daughter branch crossing
- avoid crush stenting



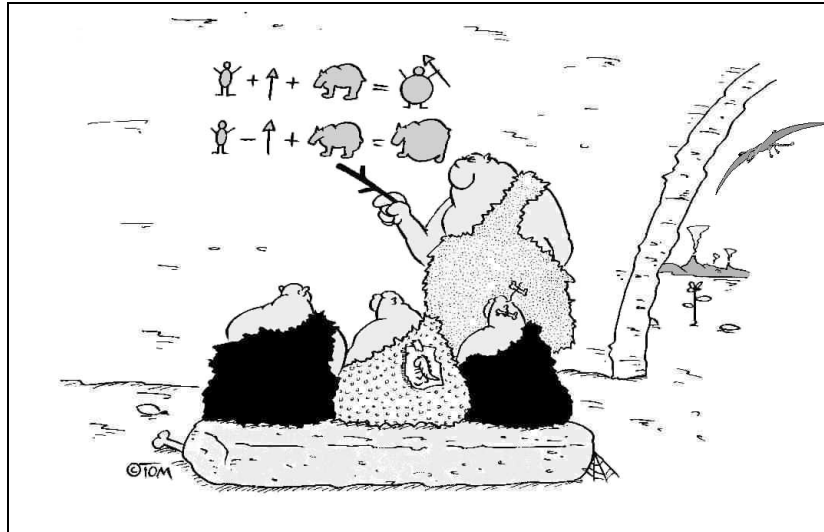
Before POT

After POT

Unfortunate stent crush



What did we learn from IVUS ?



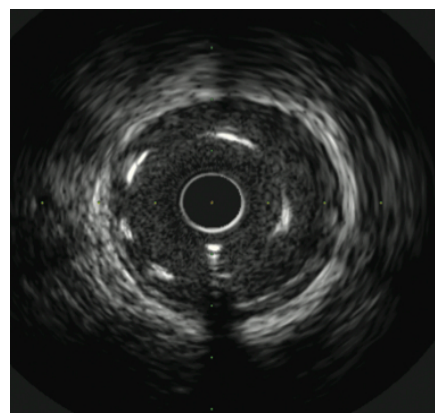
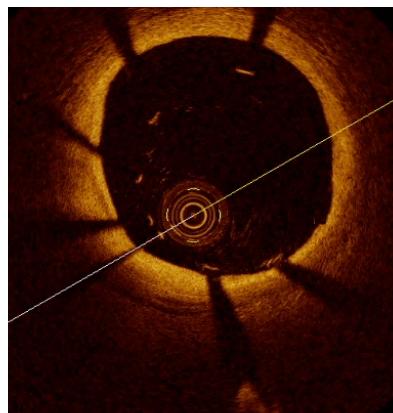
1. Assessment of LM stenosis
2. Stenting strategy decision
3. **Post procedure IVUS assessment**



Post Procedure Assessment

«In addition to the actual assessment of LMCA lesions before a procedure, IVUS is very helpful to obtain an **adequate expansion** of the DES, to prevent **stent inapposition**, and to achieve **full lesion coverage** with the DES»

Park SJ, World J Cardiol 2010



IVUS guidance may reduce long-term mortality...



Post Procedure Assessment



Stenting strategy decision

« Strategy inspired by French Team »



- Single stent strategy, DES, no systematic jailed Wire
- Stent diameter chosen from prox LAD (or prox Cx) and respect of Fractal Law (Finet)
- Stenting coverage since LM ostium (Louvard)
- Proximal Optimisation Technique (Darremont)
- Daughter branch crossing through the most distal cell (Lefevre)
- Final Kissing Balloon
- Provisional T-Stenting

Strategy for > 90% LM stenting

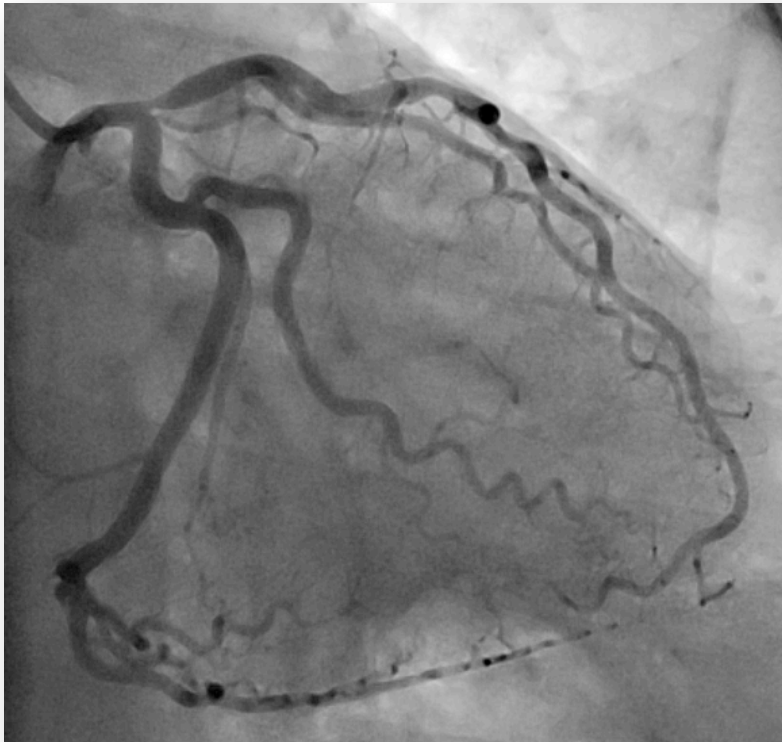


If we fully stick to learnings coming from IVUS experimentation, what is the impact of guidance by endocoronary imaging ?



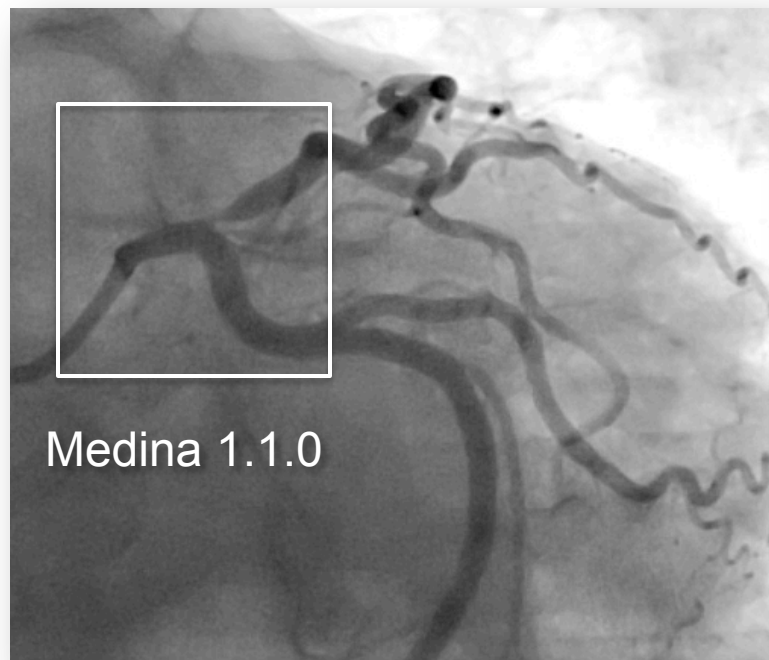
Angiography is enough...

Mr B, 60 years-old, smoker
Severe angina

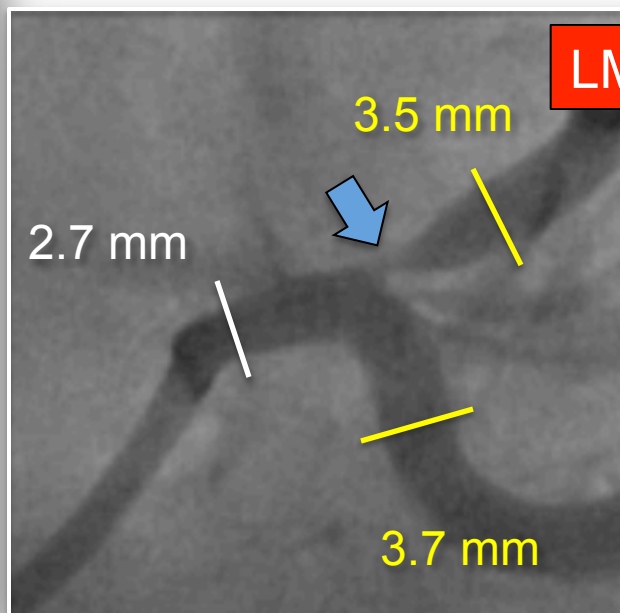




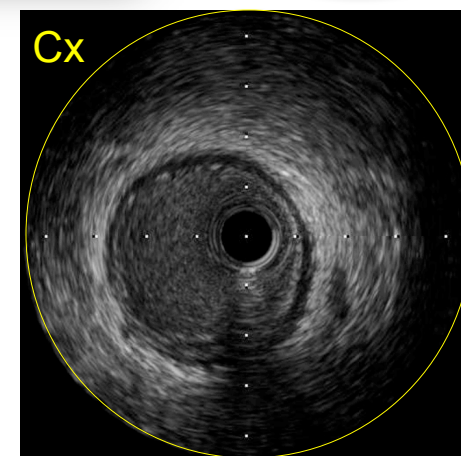
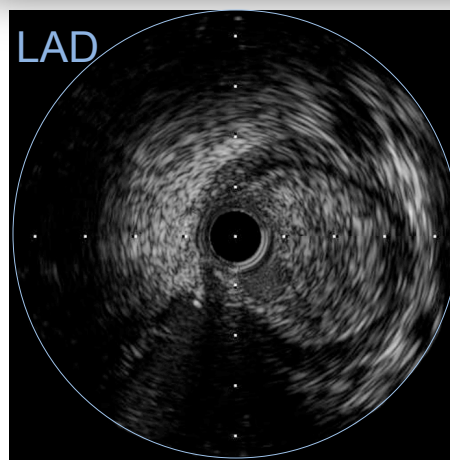
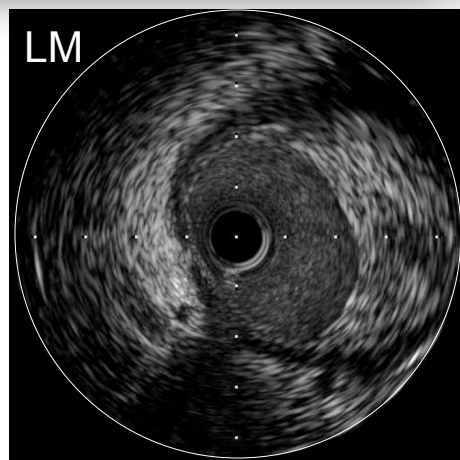
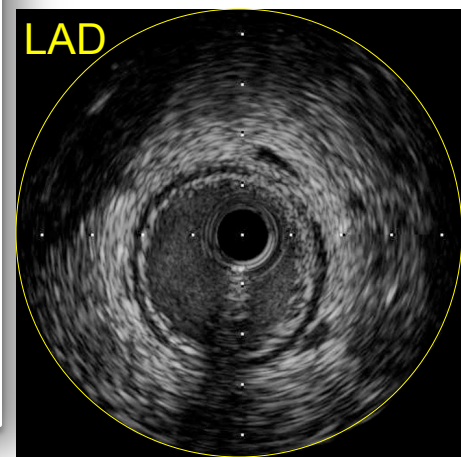
Angiography is enough...



$$(3.5 + 3.7) \times 0.678 = 4.8 \text{ mm}$$

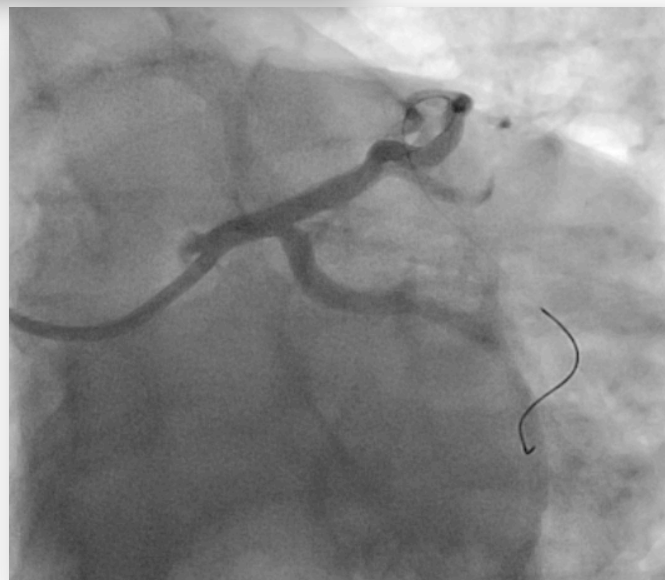
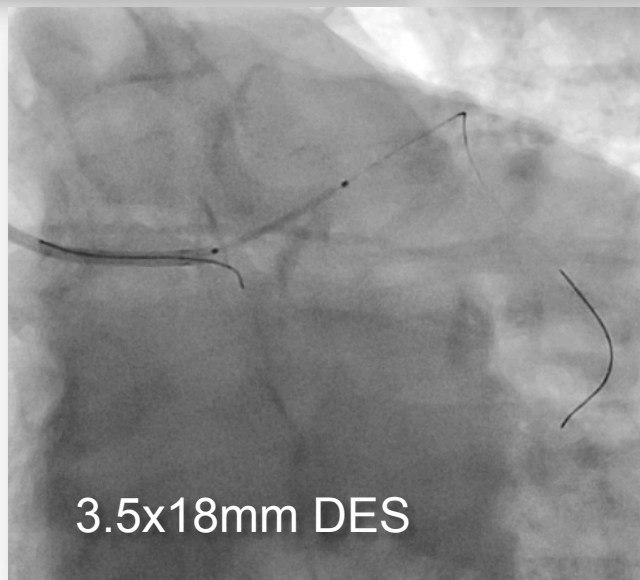


LM stenosis = 44%



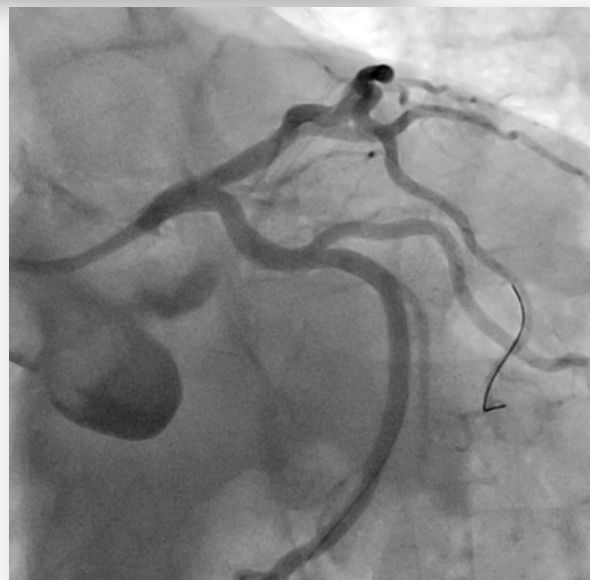
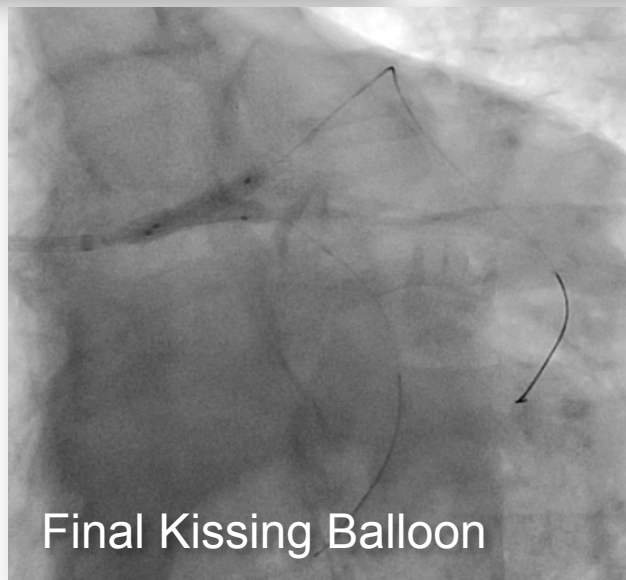
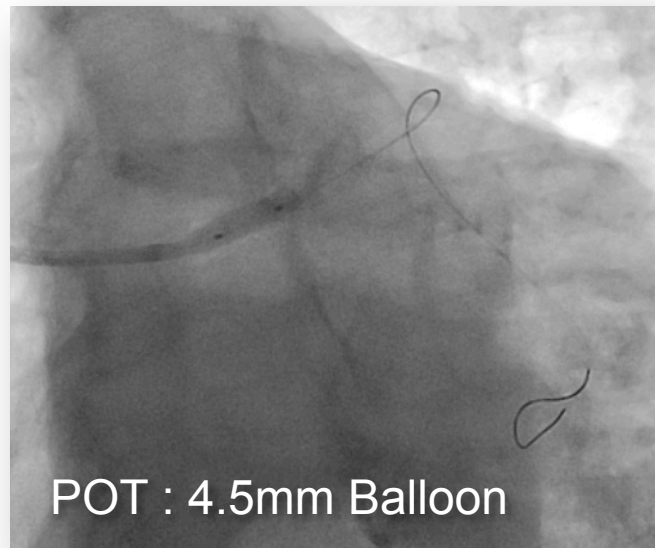
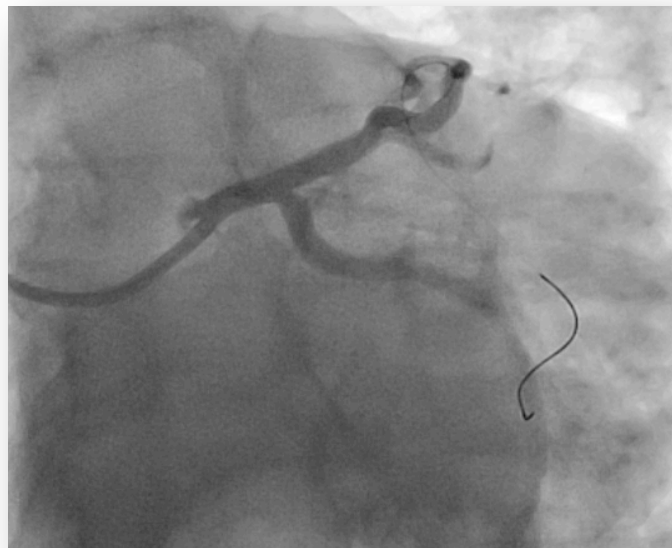


Angiography is enough...



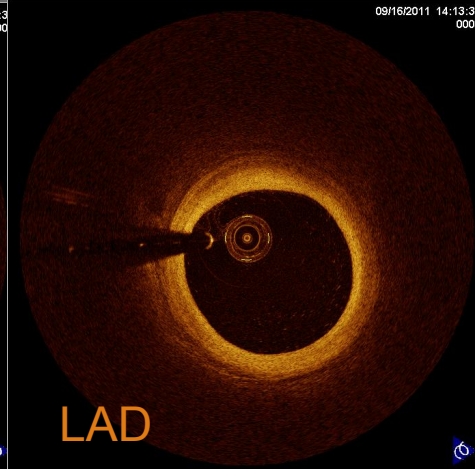
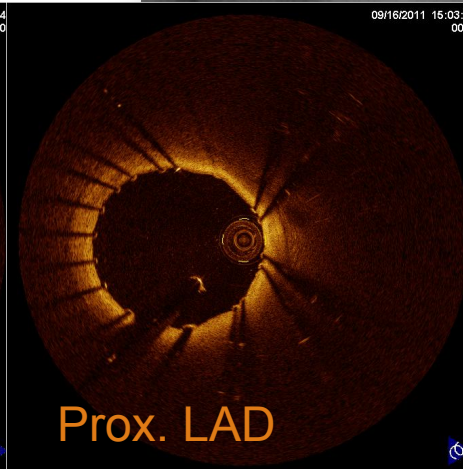
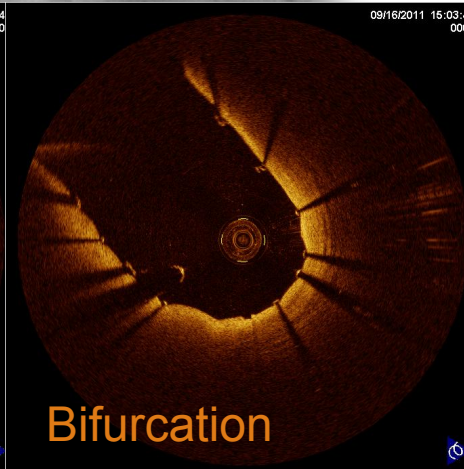
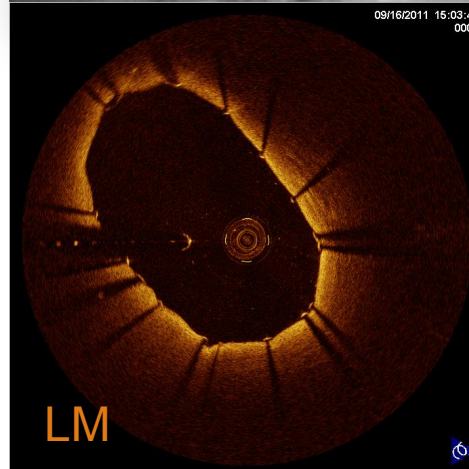
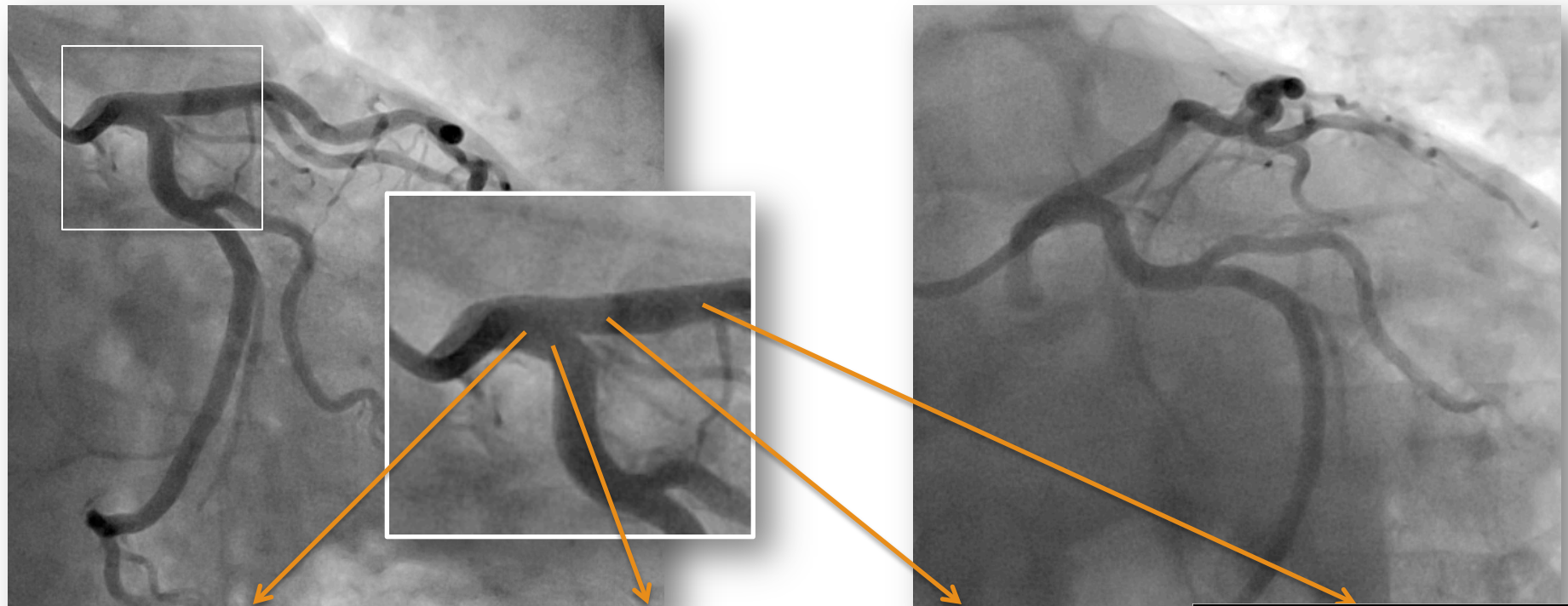


Angiography is enough...





Angiography is enough...





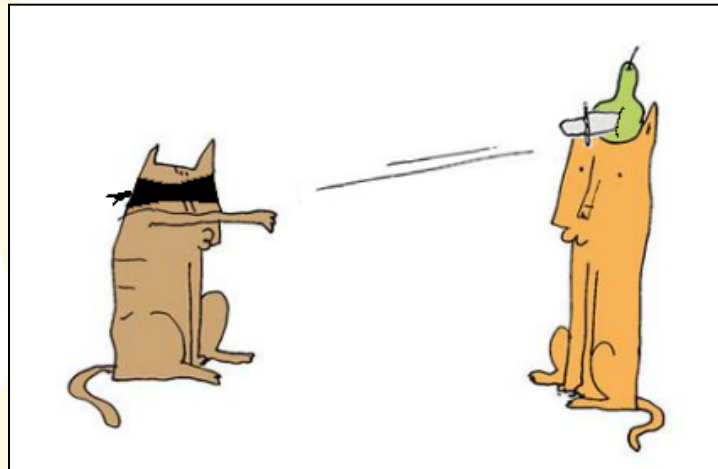
Conclusion (1)

IVUS or OCT guidance in LM stenting

- **Could be helpful :**
 - most complex lesions or ambiguities
 - suboptimal immediate angiographic result
 - assessment of new dedicated stents
- **Not in routine...**

Conclusion (2)

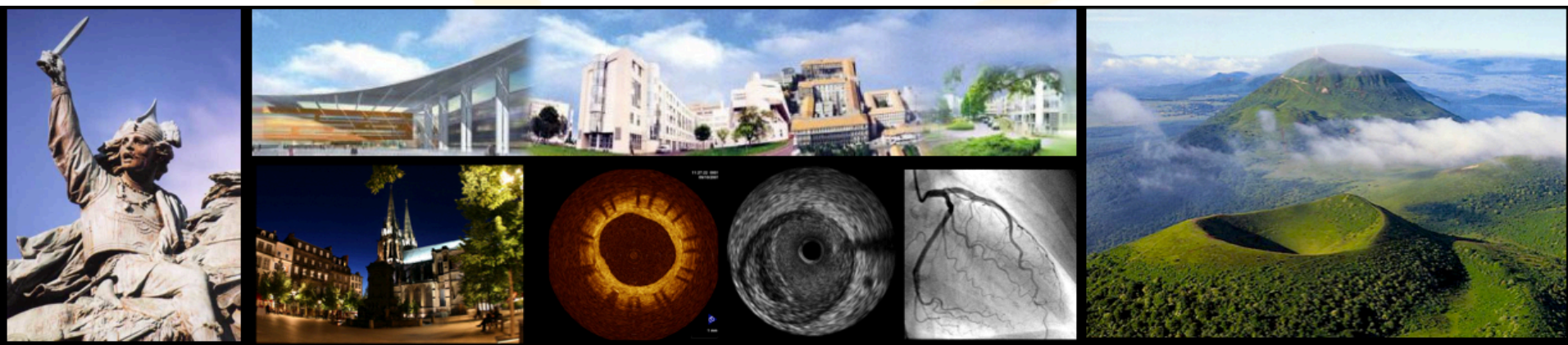
- IVUS guidance is not mandatory in LM stenting
- **but**
- Use of knowledge from endoconary imaging are essential to improve our angiographic vision





Thank you for your attention

Cardiology Department , University Hospital, Clermont-Ferrand, FRANCE



pmotreff@chu-clermontferrand.fr