David J. Moliterno, MD
November 12, 2004

Functional and Anatomic Assessment of Left Main Disease

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Definition and Prevalence of LMT Lesions

- Angiographic DS ≥50%, less commonly ≥70%
- 5-10% of patients with CAD
- Isolated LMT disease in <1% of patients
- Commonly reflects very advanced CAD
  - 80% have 2 or 3 vessel disease
  - 50% have RCA disease
  - 50% have a total occlusion

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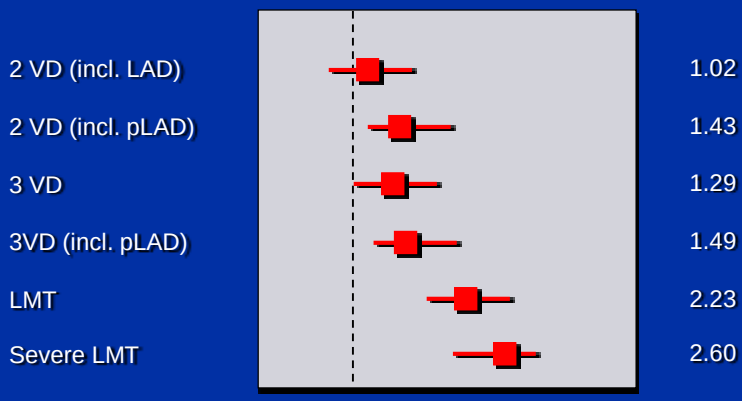
Prognostic Implications of LMT Disease

Angiographic Disease Severity and 5 Year Mortality
The APPROACH Registry (n = 11,661)



Dzavik, V et al. AHJ 2001;91:2335-2344

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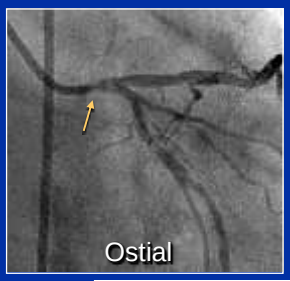
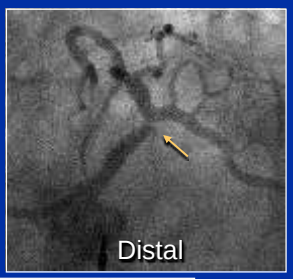
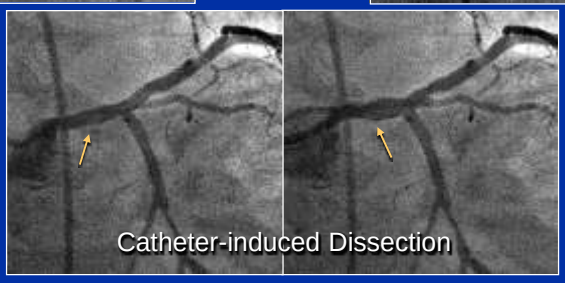
Angiographic Flavors of LMT Lesions







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Limitations of Angiography in LMT Disease

Assessment of LMT disease/ stenosis severity is one of the most difficult and least reproducible tasks for an angiographer. Anatomical features and technical considerations that lead to such suboptimal assessment include:

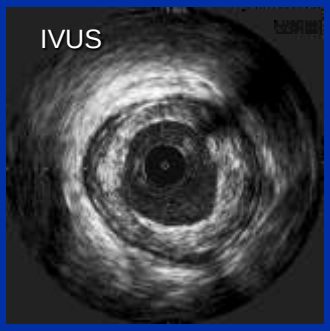
- Short trunk between cusp and bifurcation
- Bifurcation splitting in 2 different planes
- No reference segment for visual comparison
- Need "back flush" to visualize the ostium, but forceful injections result in disengagement

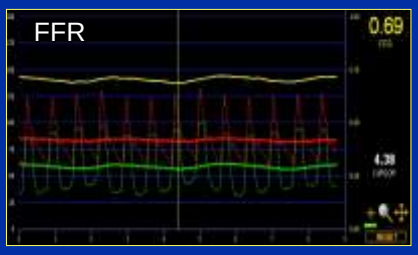
Ventricularization of Pressure in LMT Disease

Distorted arterial waveform with slight decrease in systolic and marked decrease in diastolic pressures

- A hybrid waveform between aortic pressure and coronary wedge pressure
- Resulting from partial obstruction of the left main lumen by the catheter
- Differential diagnosis includes suboptimal position of the catheter tip against the wall of the artery (e.g. JL4 in short relatively young female)

Adjunctive Tools to Assess LMT Disease





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FFR Assessment of Left Main Coronary Lesions

- 54 patients, LMT stenosis 40-60%
- FFR measured in all,
  - < 0.75 → CABG
  - > 0.75 → Medical Rx
- After 29 months of f/u, no difference in MACE between medical Rx and CABG

Bech G et al. Heart 2001, 86: 547-52

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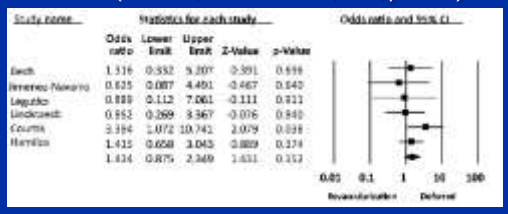
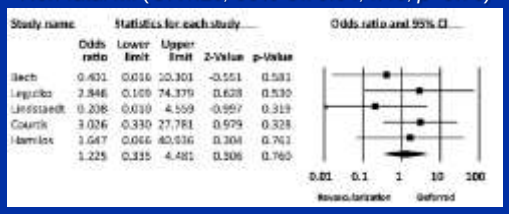
Prognostic Implications of FFR Guidance in LMT

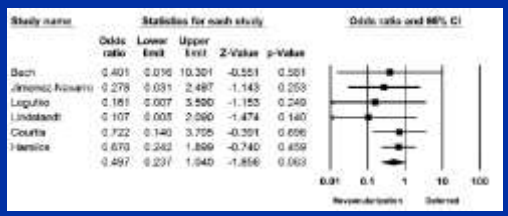
MACE (OR1.43, 95% CI: 0.88,2.35, *p*=0.15)



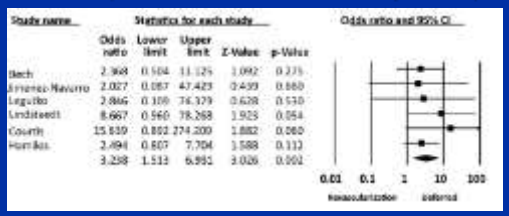
Non-fatal MI (OR1.23, 95% CI: 0.34,4.48, *p*=0.76)



Mortality (OR 0.50, 95% CI: 0.24,1.04, *p*=0.06)



Revasc (OR: 3.24, 95% CI: 1.51,6.93, *p*=0.002)



Mallidi J et al. Catheter Cardiovasc Interv 2015;86:12–8

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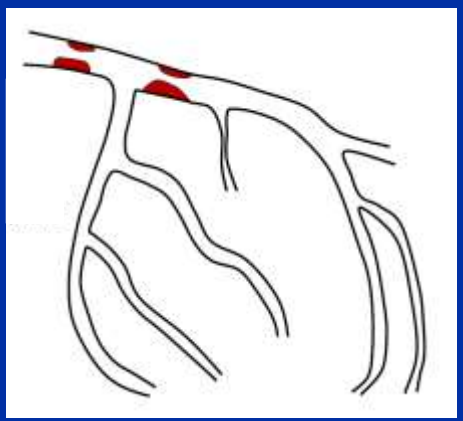
Effect of Downstream Disease on FFR of LMT

The influence of a distal stenosis on the FFR of the LMT depends on the extent to which hyperemic flow across the LMT stenosis will be decreased by this downstream stenosis

Hyperemic flow will most likely be affected with severe stenoses and/or large volume of myocardium supplied (i.e. proximal more than distal and LAD more than LCX)



Courtesy of Bernard De Bruyne, MD, PhD

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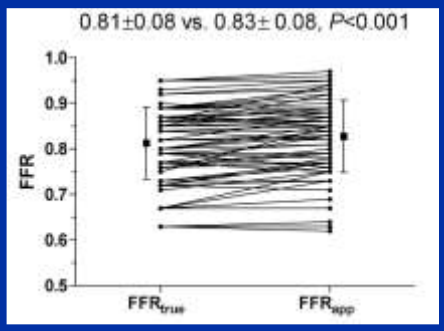
Effect of Downstream Disease on FFR of LMT



When FFR_{app} is >0.85, FFR_{true} is >0.80 in 100% of cases

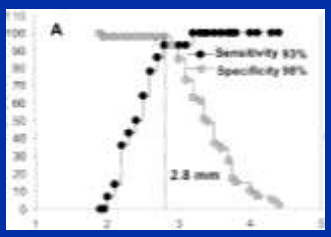
Practical Recommendations

First measure FFR in the least diseased vessel, preferably the LAD, with a pullback

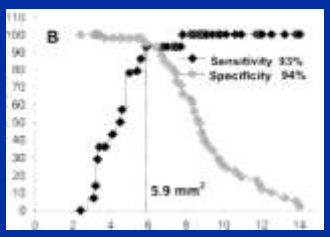
- If FFR < 0.80, then revascularize
- If FFR >0.85, then treat medically
- If FFR between 0.80 and 0.85 and there is significant downstream epicardial disease in the other epicardial vessel, then can consider IVUS

Fearon WF et al. J Am Coll Cardiol Intv 2015;8:398-403

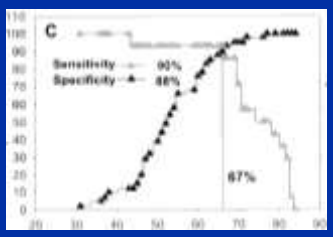
Correlation Between IVUS and FFR in LMT



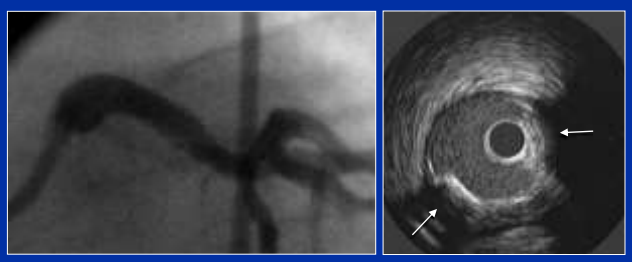
MLD (mm)



MLA (mm²)

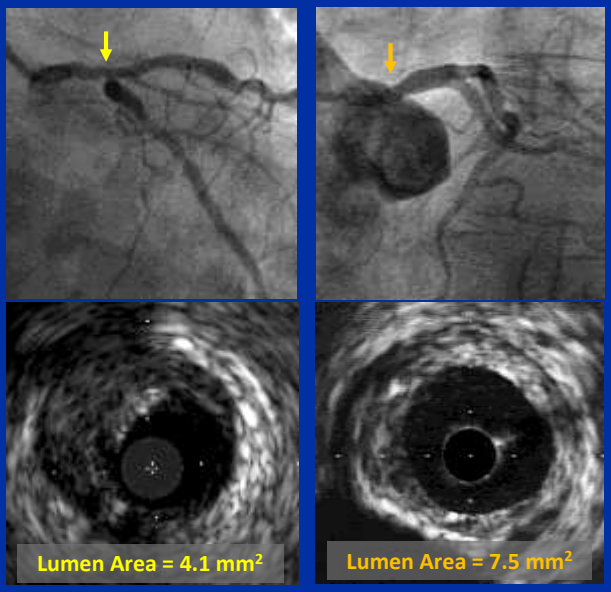


CSN (%)



Jasti V et al. *Circulation*. 2004;110:2831-2836

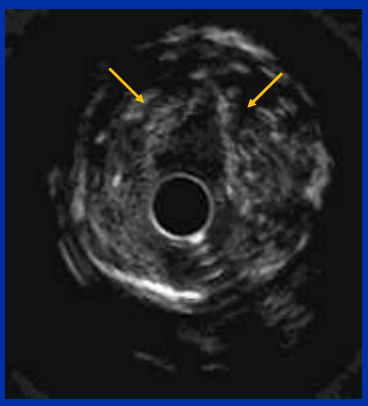
Intermediate LMT Lesions Are Difficult to Assess



Ambiguous Morphology

Diagnostic Angiography

Guiding Catheter Placement



IVUS of Left Main Trunk

Role of IVUS Imaging in LMT Stenting

- Pre-procedure Planning
  - Vessel Sizing
  - Plaque Composition and Distribution
  - Need for Lesion Preparation
  - State of The Bifurcation and the Ostia
- Post-procedure Assessment
  - Stent Expansion
  - Strut Apposition
  - Edge Dissections
  - Missed Lesions

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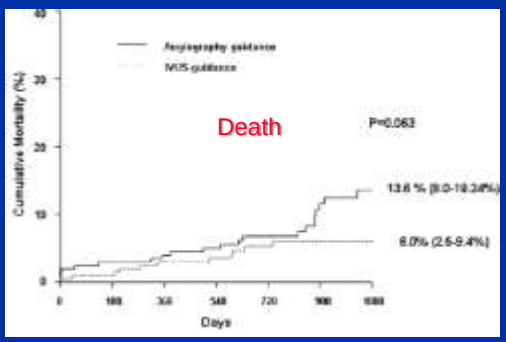
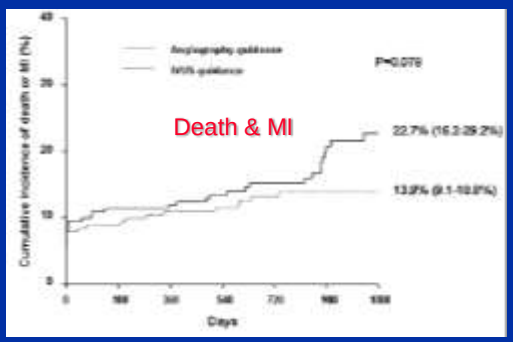
Role of IVUS Imaging in LMT Stenting

Propensity matched cohorts (LMT PCI with and without IVUS guidance) from MAIN-COMPARE Trial





SJ Park et al. Circ Cardiovasc Interv. 2009;2:167-177

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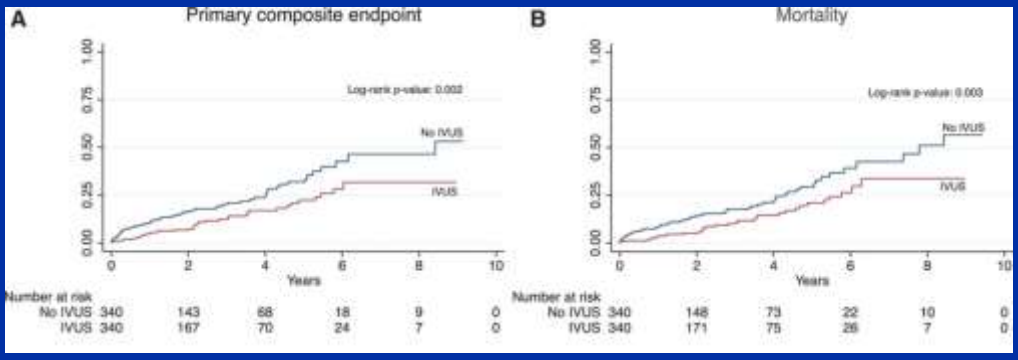
Role of IVUS Imaging in LMT Stenting

Propensity matched cohorts (LMT PCI with and without IVUS guidance) from the SCAAR Registry



Andell P et al. Circ Cardiovasc Interv. 2017;10:e004813

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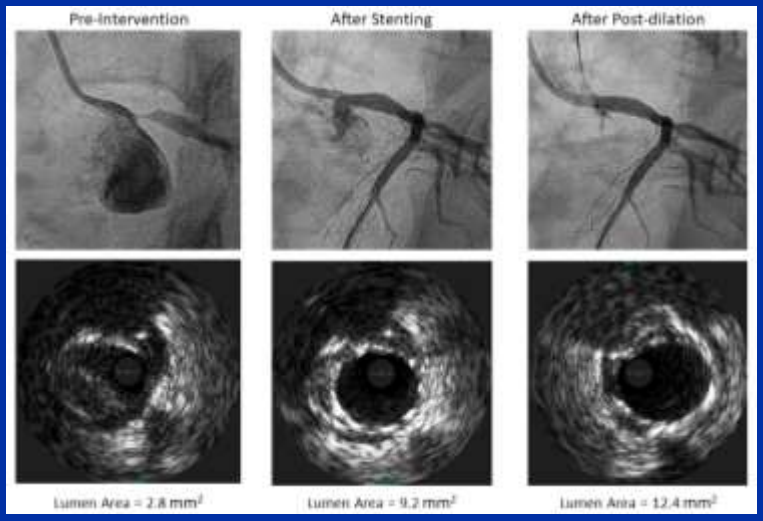
IVUS Guidance of PCI Is Strongly Recommended



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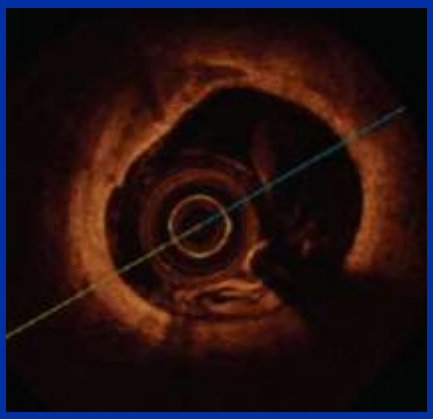
OCT Imaging in Left Main Disease

- Technically challenging due to need for contrast flush during imaging – specially when ostium needs interrogation
- Minimal data exist regarding parameters and thresholds of hemodynamic significance and stent size that offers the best long term outcome



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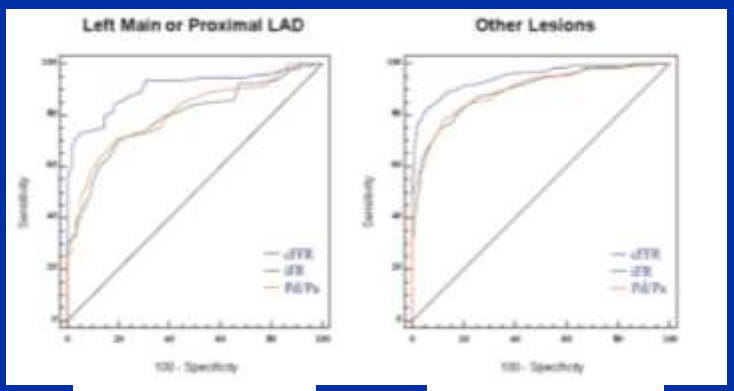
iFR in Left Main Disease



Kobayashi Y et al. JACC Cardiovasc Interv. 2016;9(23):2390-2399

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Conclusions

- Left main trunk lesions are serious and have to be identified or suspected early
- Angiography is notoriously inaccurate in diagnosing and quantifying severity of LMT disease
- FFR is an excellent tool that can be used to identify significant lesions, but accuracy maybe affected slightly by proximal and relatively severe lesions in LAD or LCX
- IVUS imaging can be useful for diagnostic and interventional applications, with growing evidence supporting its role in guiding PCI (reduced risk of death and MI over thy ensuing years)