FFR in Bifurcation Lesions

: We Should be More Physiologic than FFR!

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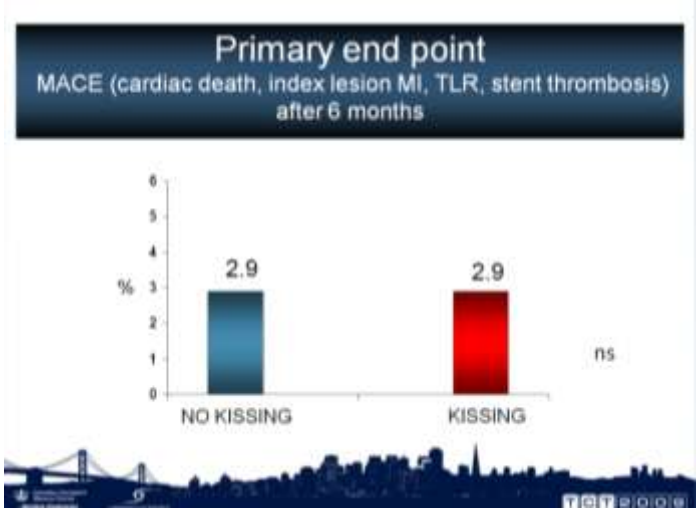
Bifurcation lesion: "The GREAT EQUALIZER"!

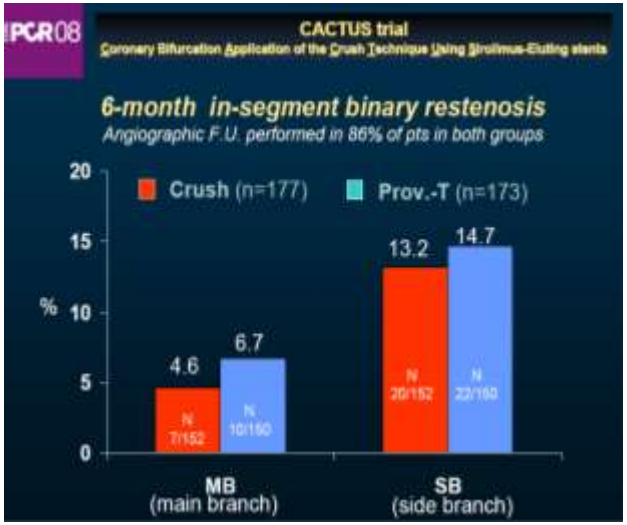
No intervention = *Balloon angioplasty* = *Stenting*

Most Conservative → **Most Aggressive**

NORDIC III	NORDIC I	CACTUS	CACTUS
(No tx)	(Angioplasty in <TIMI 3 flow)	(Angioplasty)	(SB stent)



NORDIC III: Leave it alone vs. Kissing



CACTUS: Crush vs. Provisional

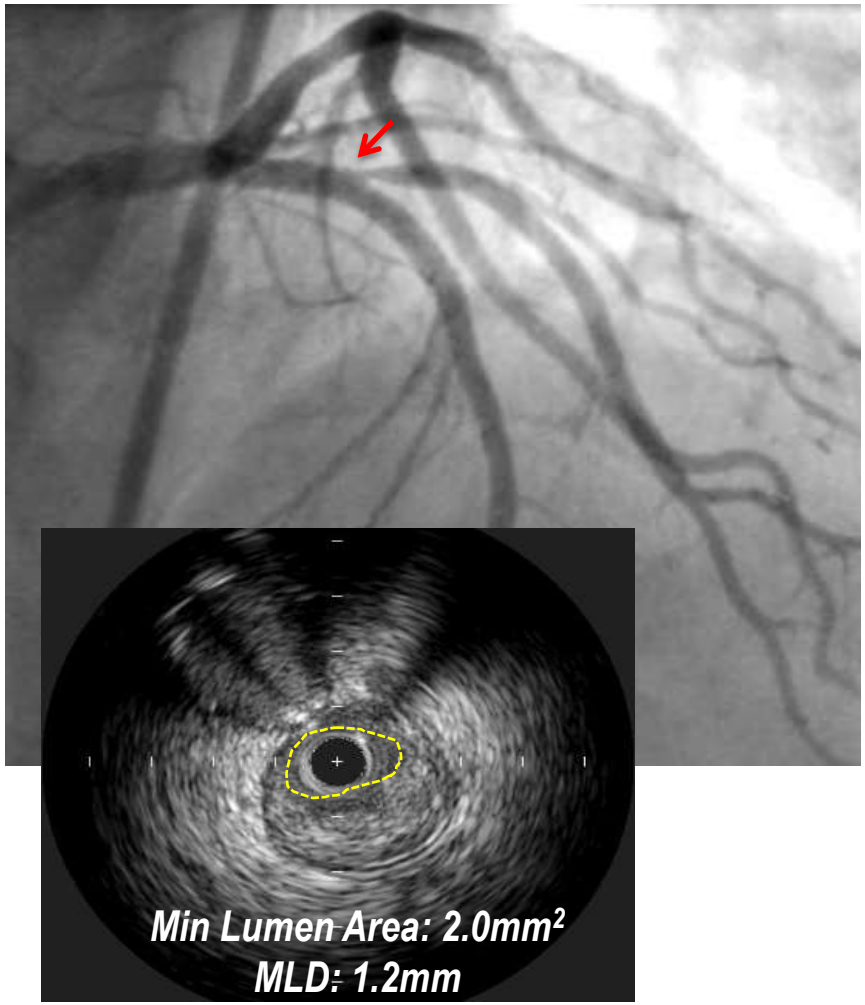
Why we can NOT improve the prognosis of a side branch with our revascularization?

Bifurcation puzzle

Significant stenosis?

- Anatomically!
- Physiologically!
- Clinically!
- Prognostically!

Significant lesion?



- **Anatomically!**
- Physiologically
- Clinically
- Prognostically

Why "physiologic evaluation" in bifurcation lesion?

Pitfalls of anatomical evaluation

- **Angiography**
  - Single directional assessment
  - Variability in stenosis assessment
  - No validated criteria for intervention
  - Not physiologic
- **IVUS/OCT**
  - Difficult to perform in tight stenosis
  - No validated criteria for intervention
  - Not physiologic

Uniqueness of side branch lesions

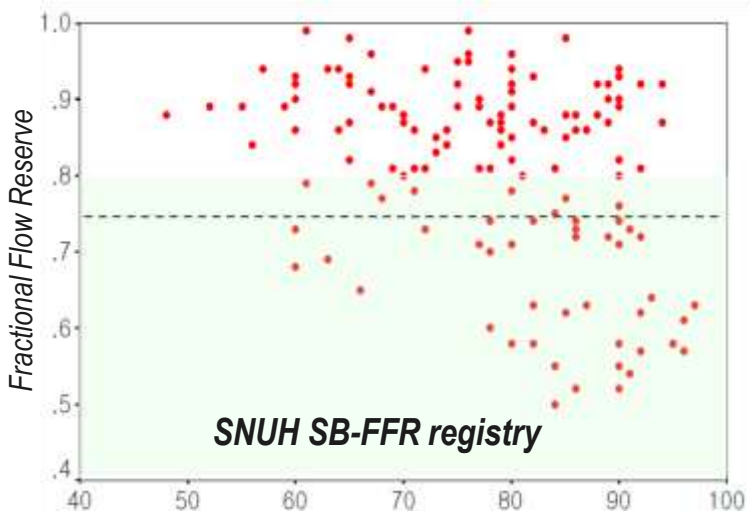
- Various size, various amount of myocardium
- Side branch stenosis is **unique and complex**
  - Underlying plaque → **Eccentric**
  - Remodeling → **Negative remodeling**
  - Complex mechanisms of side branch jailing

    Carina shift, plaque shift, stent struts, thrombus.....

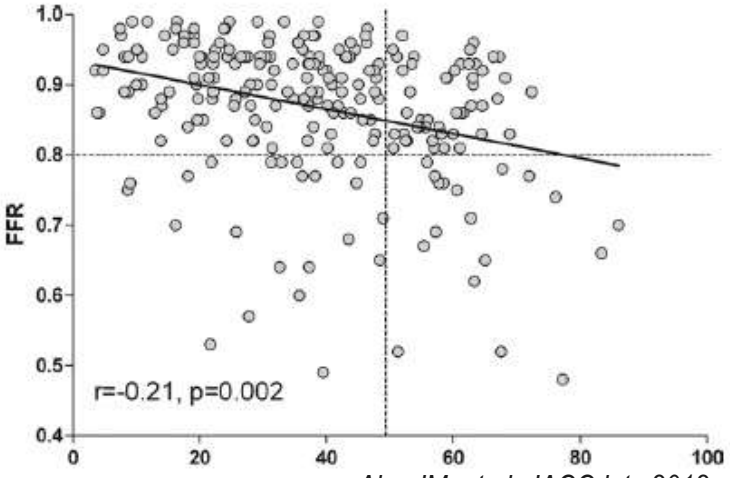
Koo BK & de Bruyne B, Eurointervention 2010

Anatomical severity ≠ Functional significance

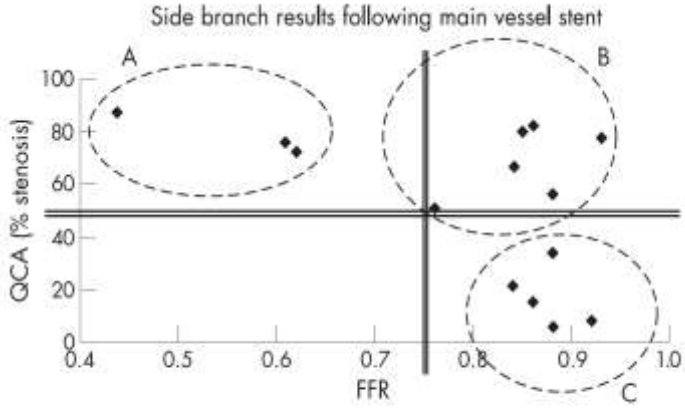
% diameter stenosis vs. FFR in Jailed side branches



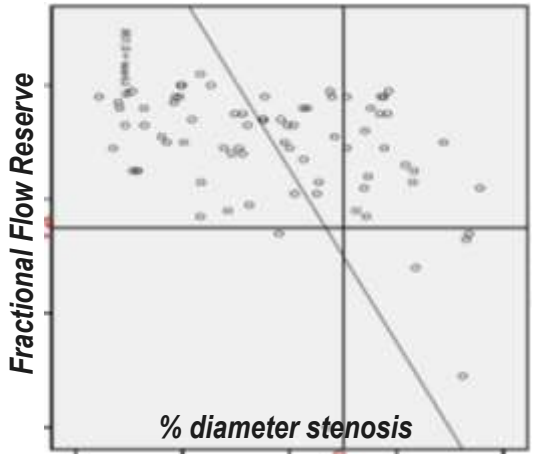
Park SH & Koo BK, J Ger Cardiol 2012



Ahn JM, et al. JACC intv 2012



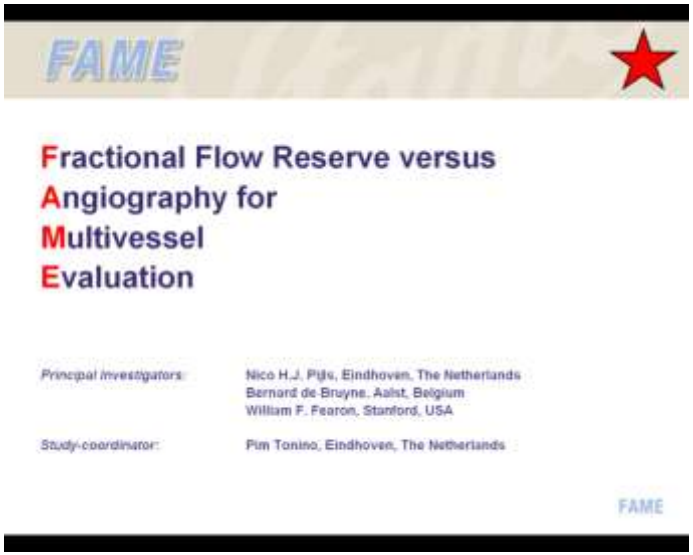
Bellenger, et al. Heart 2007

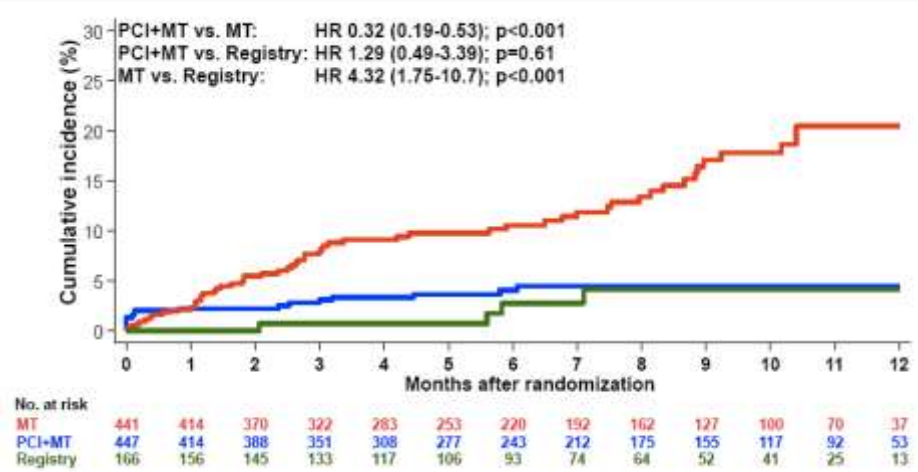


Kumsars I, et al. Eurointervention 2011

Anatomical severity ≠ Functional significance

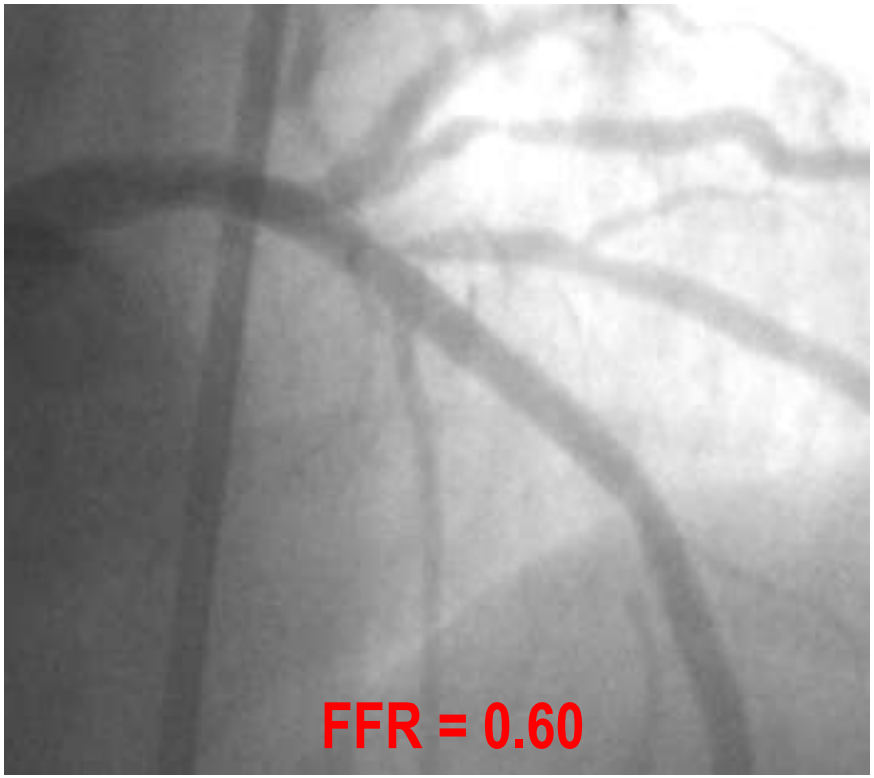
Can FFR (or iFR)-guided SB intervention strategy improve patients' outcome like FAME I & II?





Probably, NOT in general bifurcation lesions……

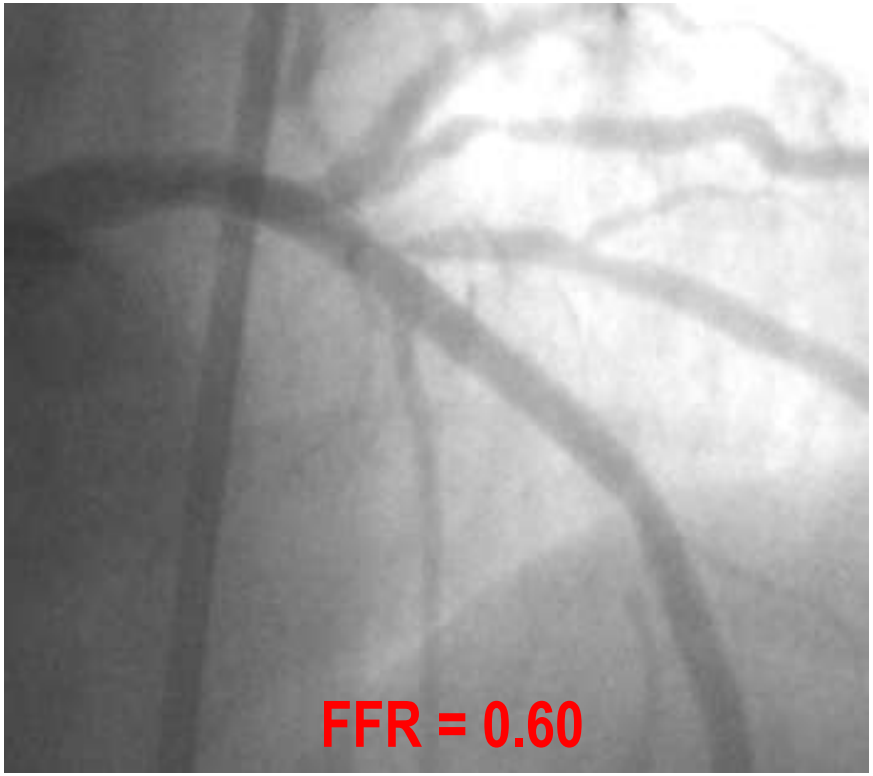
Significant stenosis?



- **Anatomically!**
- **Physiologically** (by FFR)**!**
- **Clinically?**
- **Prognostically?**

We need to be more "physiologic" than simple use of physiologic indices.

Clinically significant?



Determinants

- Presence of ischemia
- Amount of ischemia
- Symptom
- Arrhythmic potential

Clinical significance: Main vs. Side branch

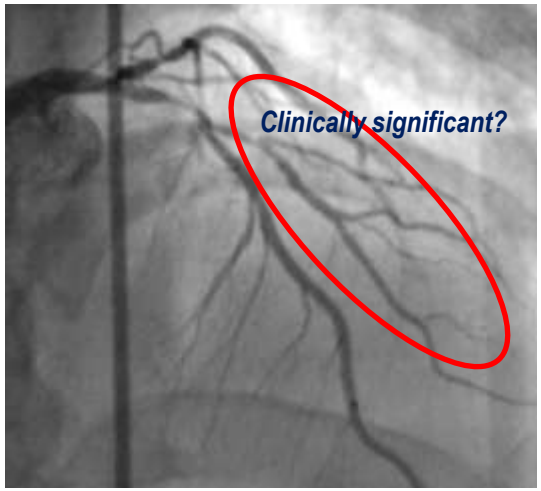
- Responses to 1-minute balloon occlusion -

	LAD	Diagonal	P value
Chest pain (VAS score)	5	2	<0.0001
ST elevation ≥ 1mm	92.3%	35.4%	0.001
QTc interval, msec	454.0±45.4	440.4±35.7	0.07
QTc dispersion, msec	83.8±39.2	70.7±28.5	<0.0001

Side branch has much less clinical relevance in terms of symptom, ischemia and arrhythmic potentials

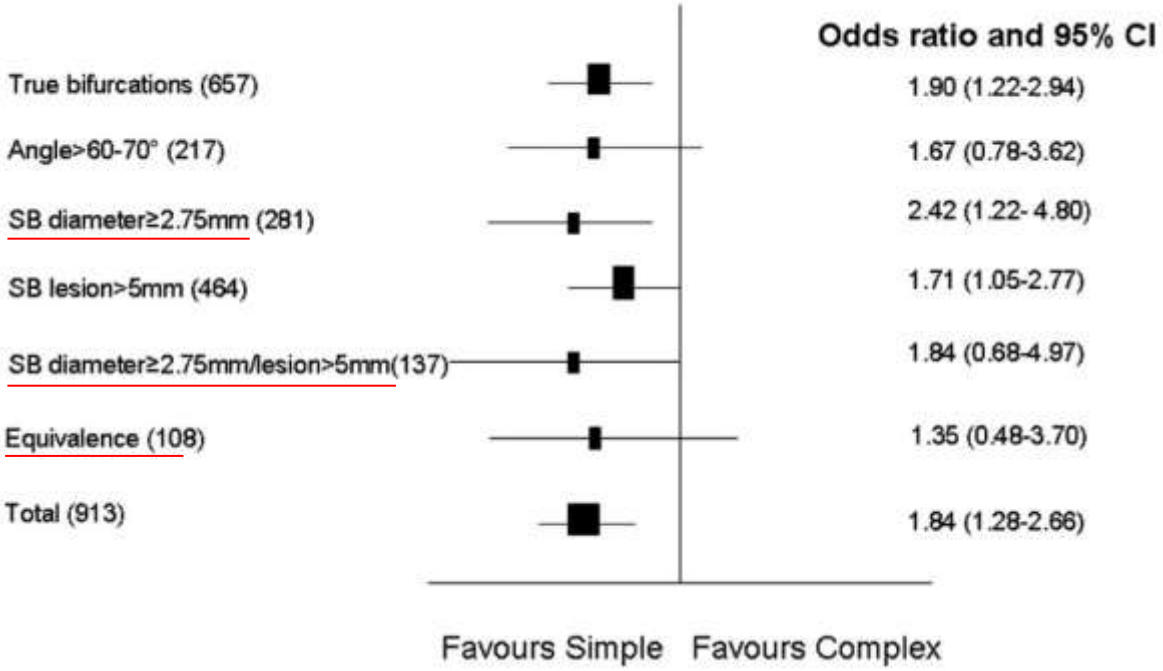
Koo BK, et al., JACC Intv, 2012

How can we find the clinically significant side branch?



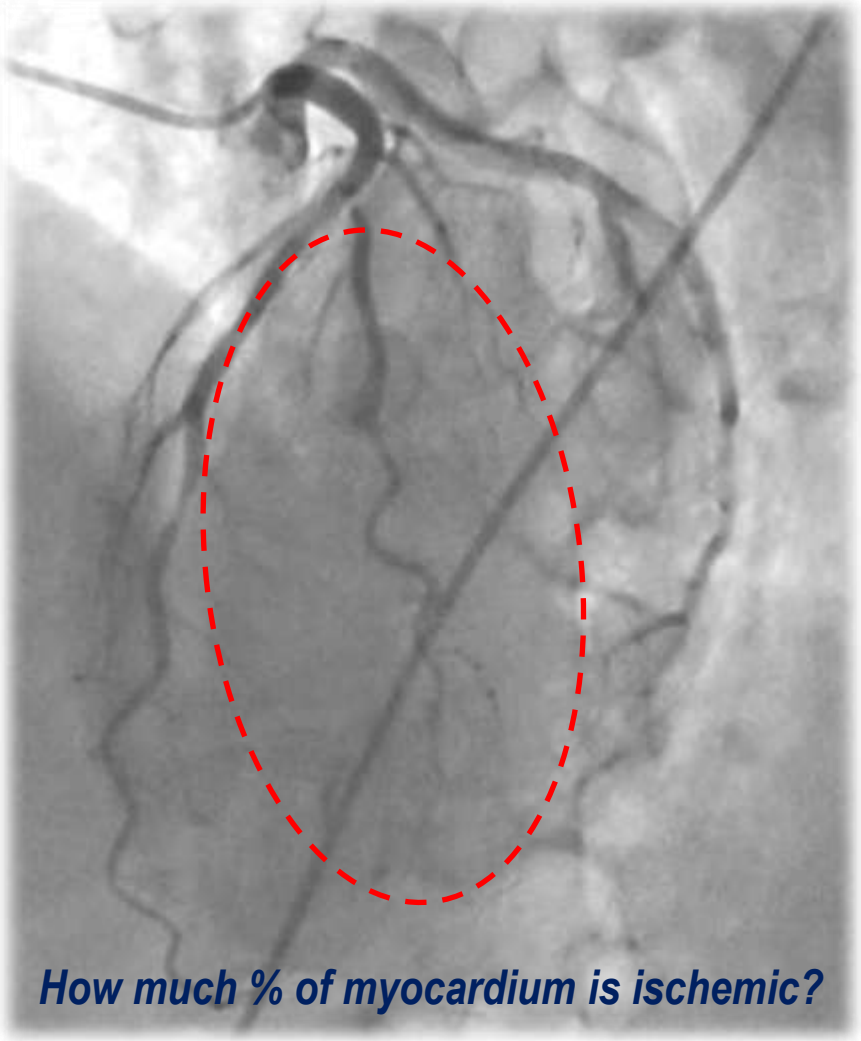
BBC+NORDIC study

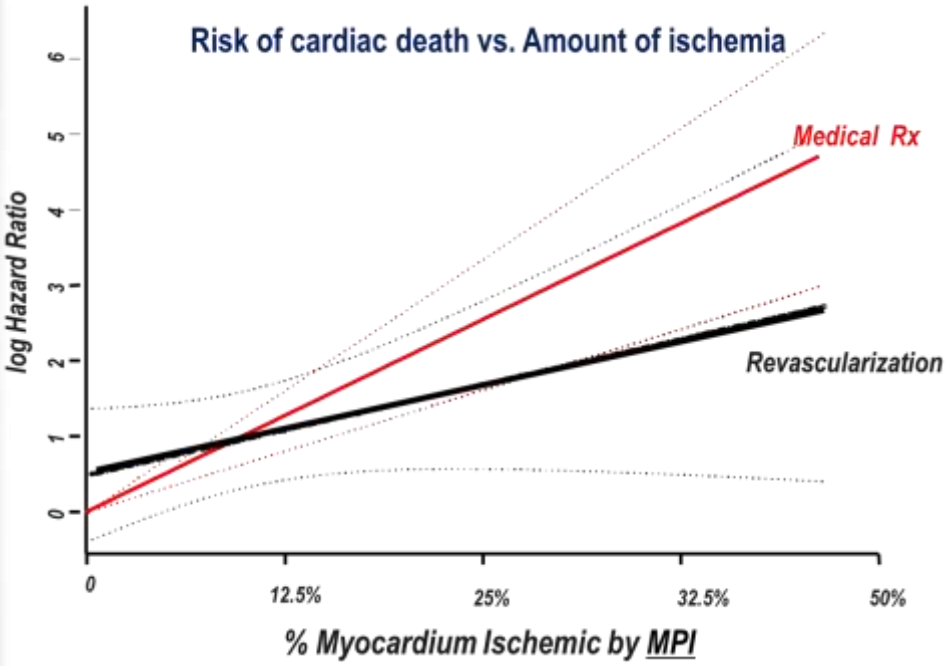
: provisional better, at any discrimination parameter



How can we find the clinically significant side branch?

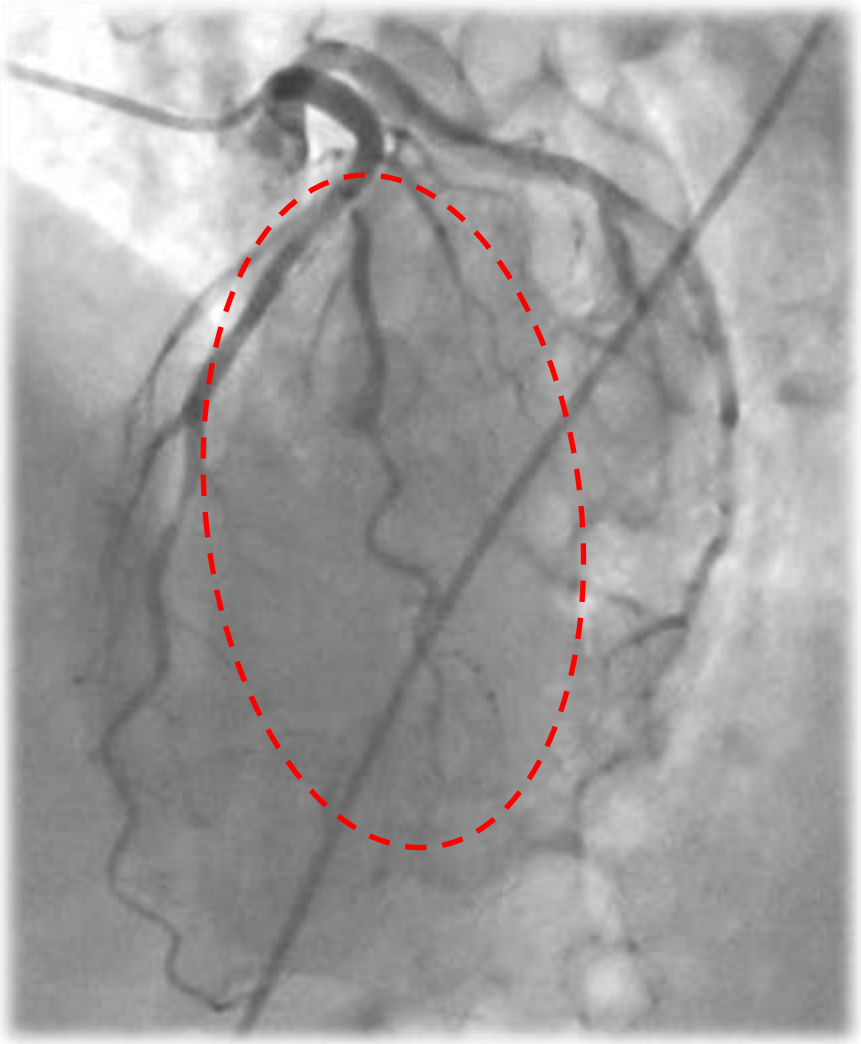
Focus more on "myocardial mass at risk" than angiographic parameters

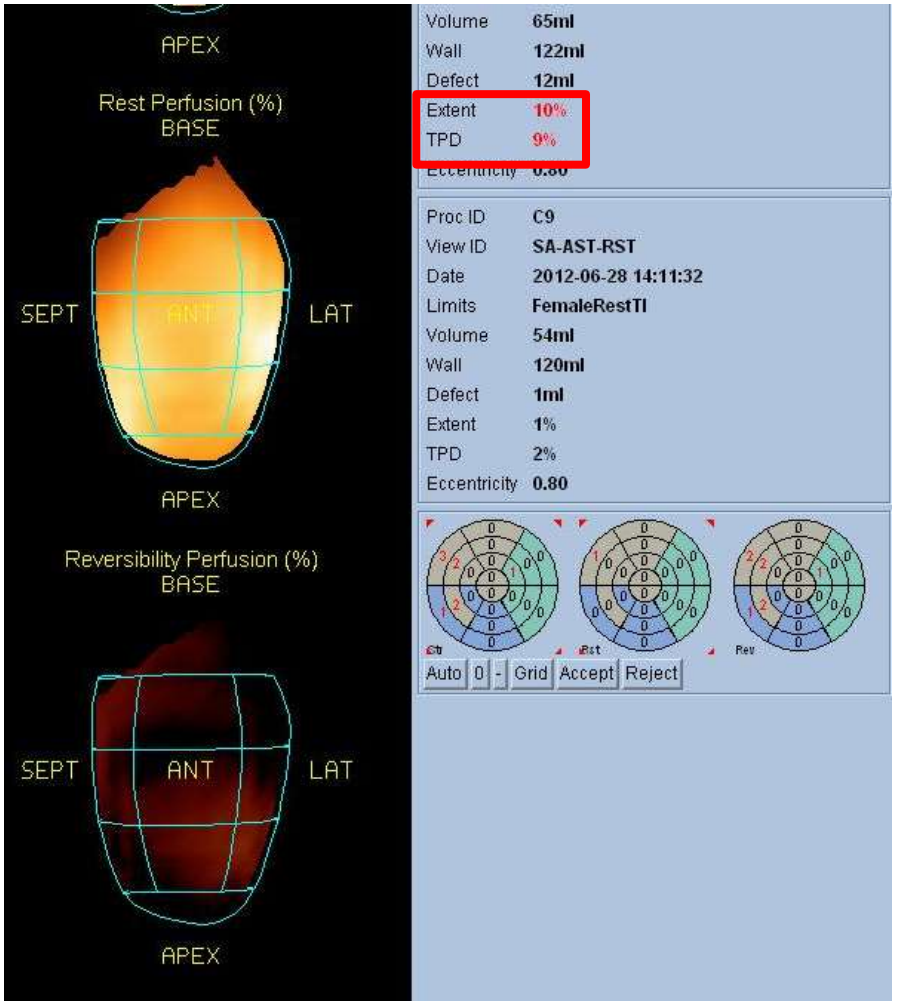




Hachamovitch, Circulation 2003

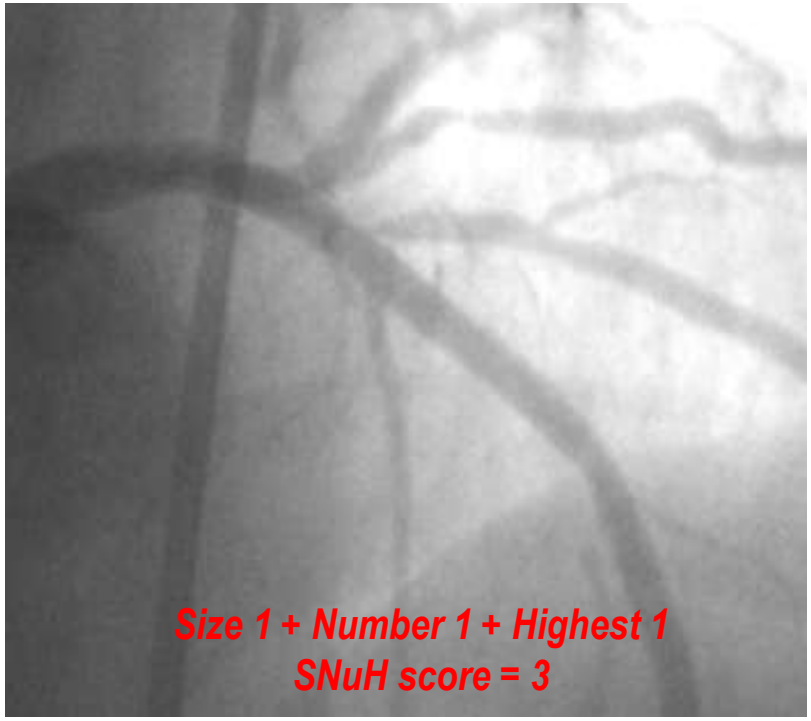
How much % of myocardium is ischemic?





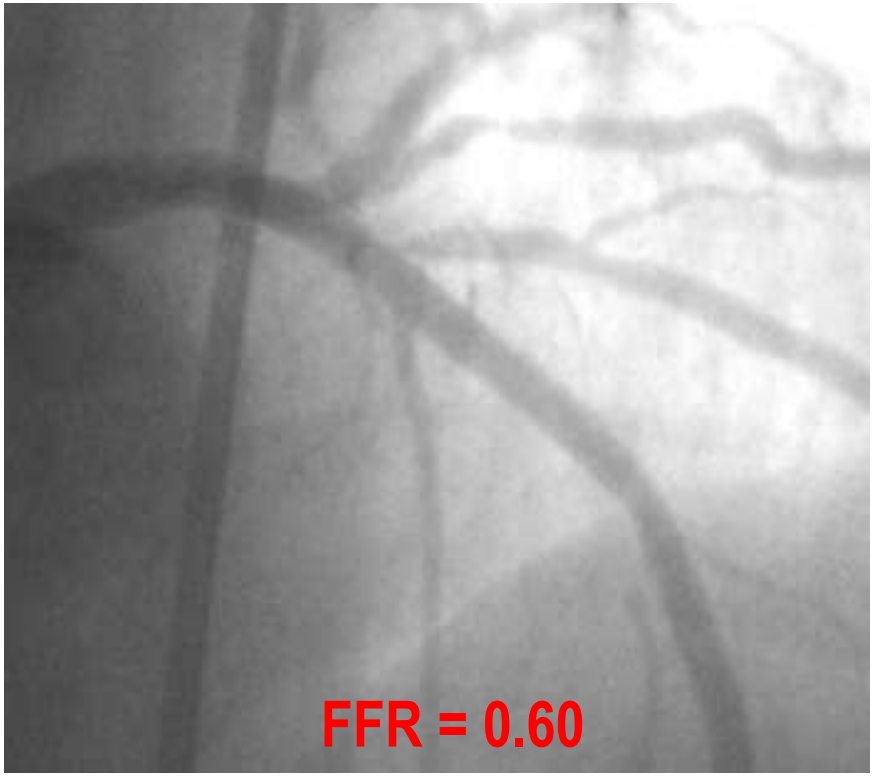
Scoring system for diagonal branches
- SNuH score -

Variables	Description	Score
Size (**S**)	Vessel diameter ≥ 2.25~2.5mm	1
Number (**Nu**)	Number of diagonal branches ≤ 2	1
Highest (**H**)	No branch below the target branch	1



Koo BK, et al., JACC Intv, 2012

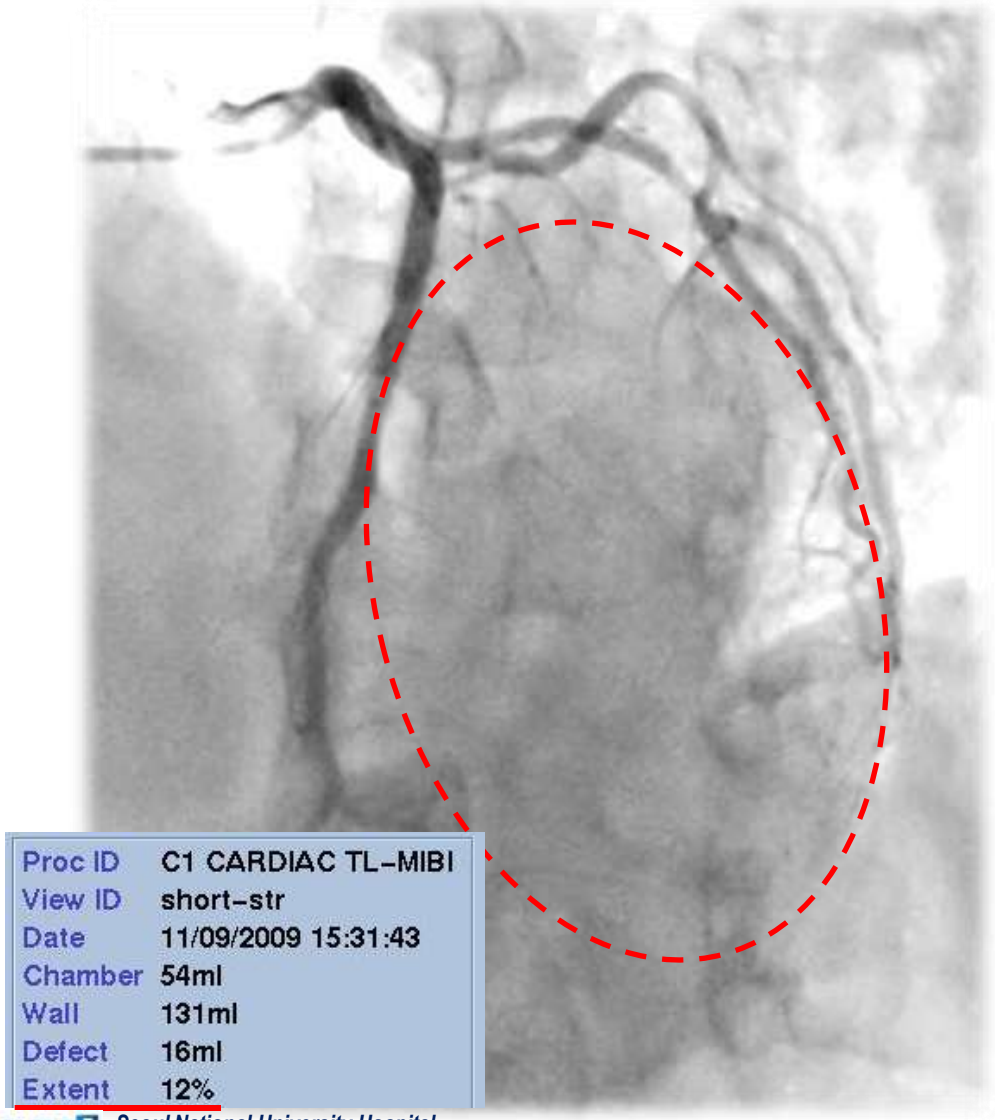
Significant stenosis?



- **Anatomically!**
- **Physiologically!**
- **Clinically!**
- **Prognostically?**

Determinants of prognosis

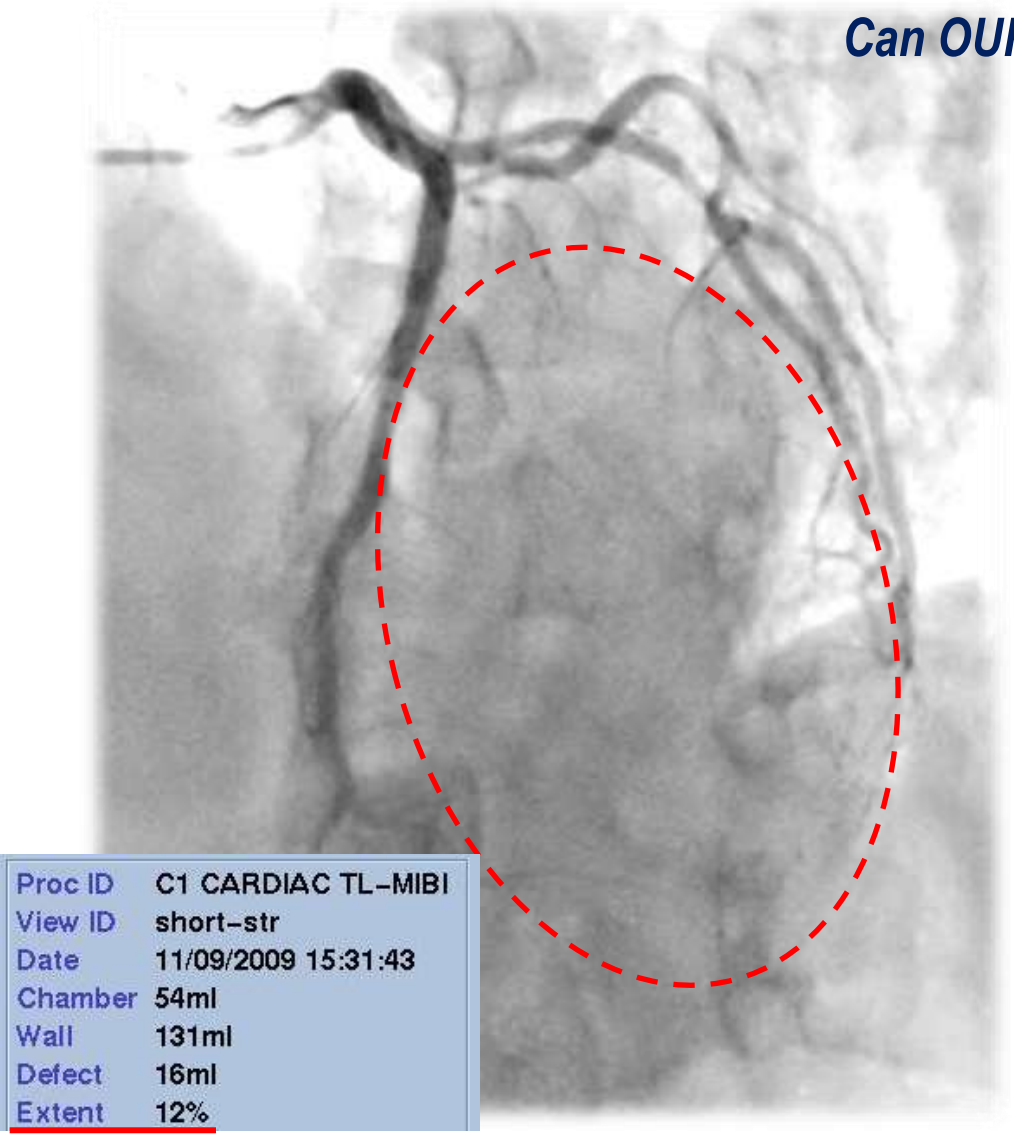
: Ischemic burden, collateral recruitability and treatment strategy



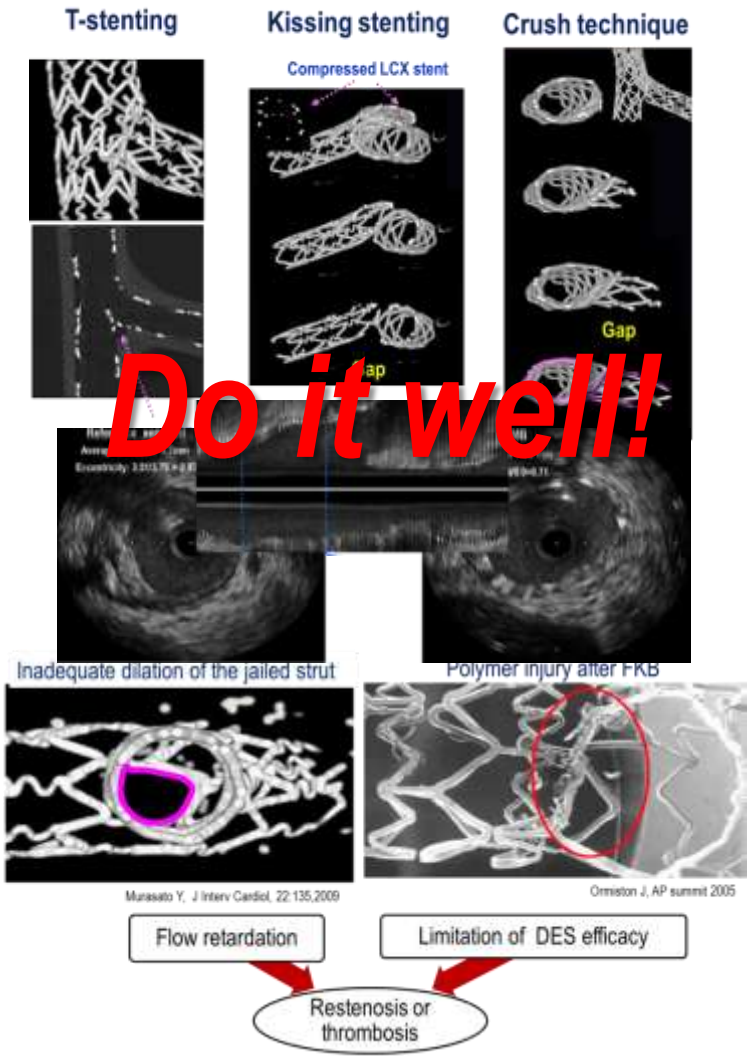
Determinants of prognosis

: Ischemic burden, collateral recruitability and treatment strategy

Can OUR revascularization improve the prognosis?



Proc ID	C1 CARDIAC TL-MIBI
View ID	short-str
Date	11/09/2009 15:31:43
Chamber	54ml
Wall	131ml
Defect	16ml
Extent	12%



When you evaluate the bifurcation lesions…

- Don't believe too much in anatomical severity, it may mislead you.
  → **When doubtful, measure FFR.**
  → **However, be aware that "physiologic evaluation" is more important than physiologic index itself.**

- Before intervention or FFR measurement, assess myocardial mass at risk.

- Consider the possibility that the side branch is naturally protected

- If you decide to stent the side branch,
  → **Use IVUS and Do it (very) well.**

The key of "Physiologic Evaluation" of bifurcation lesion is to understand that side branch is different from main branch in terms of anatomy, physiology, clinical relevance and prognosis.