The role of FFR in Coronary Artery Bypass Grafts

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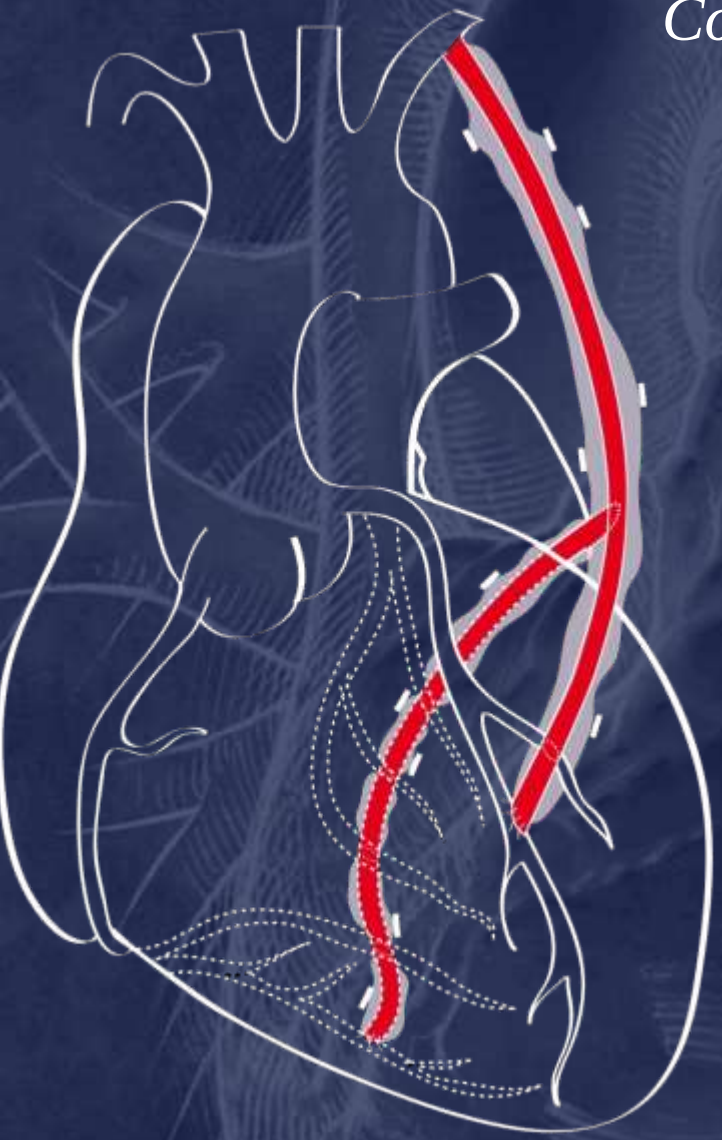
Fractional flow reserve (FFR) in coronary artery bypass grafts

FFR as an **index of resistance** along the different segments of the graft.

Calculated as the ratio of distal intragraft pressure divided by aortic pressure under maximal hyperemia

$$\mathbf{FFR} = \frac{\text{Distal Pressure}}{\text{Aortic/ Subclavian artery Pressure}}$$



Competitive flow is common in arterial grafting

Competition arises from

- *Equilibrium between the residual flow in the native artery and the flow given by the by pass*
- *Conductance in graft = conductance in native vessel*

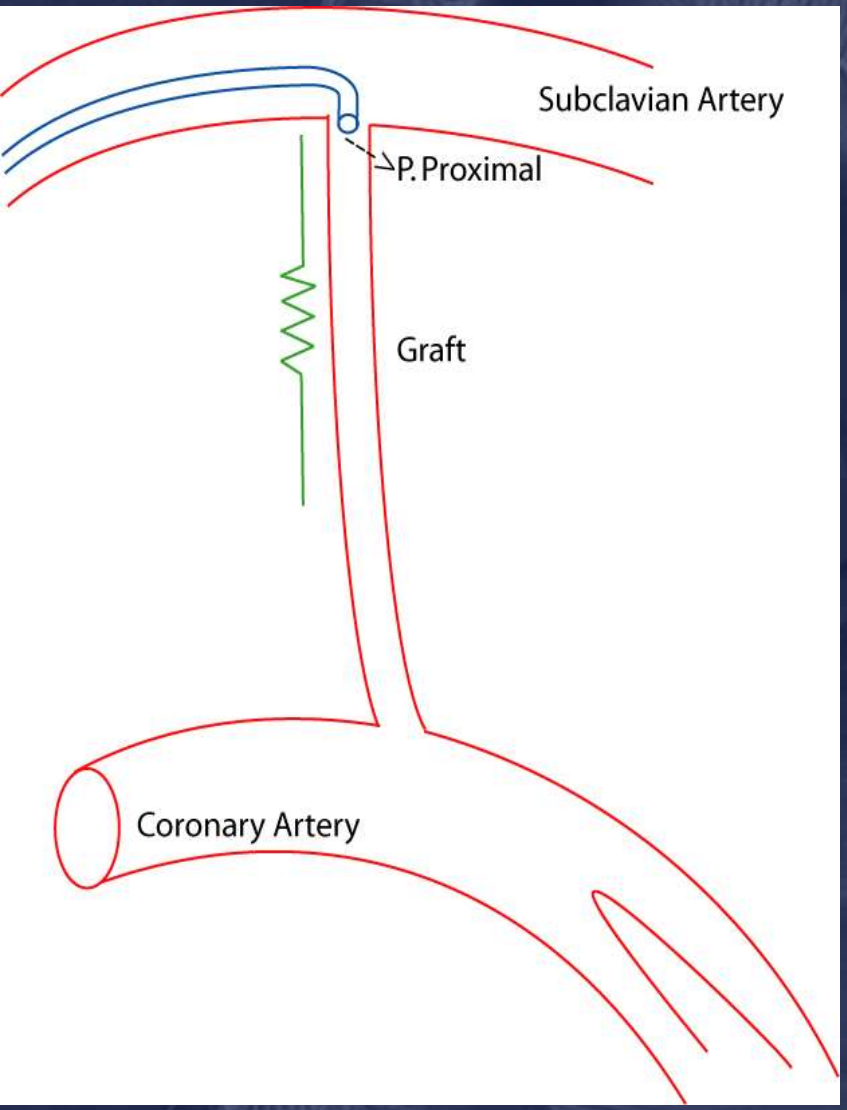
Functional capacity of bypass grafts depends on:

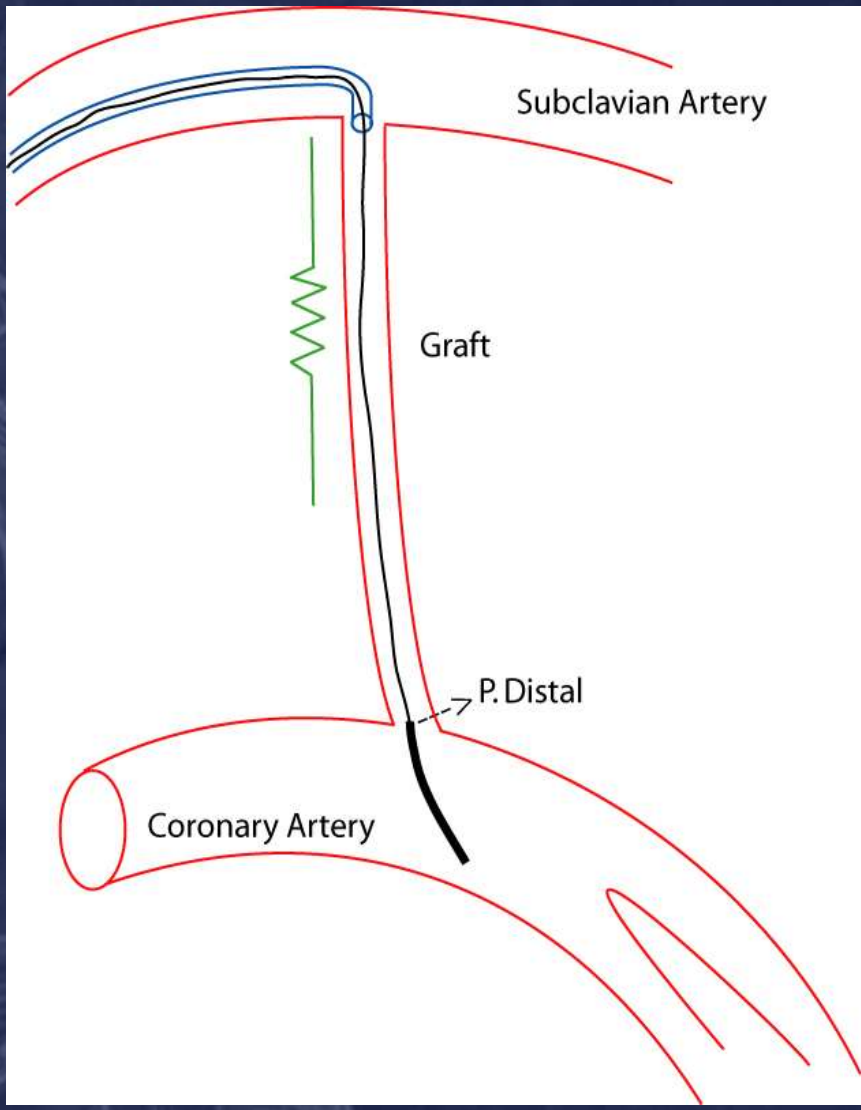
-graft properties (length and diameter, physiology, etc)

-severity of native vessel stenosis

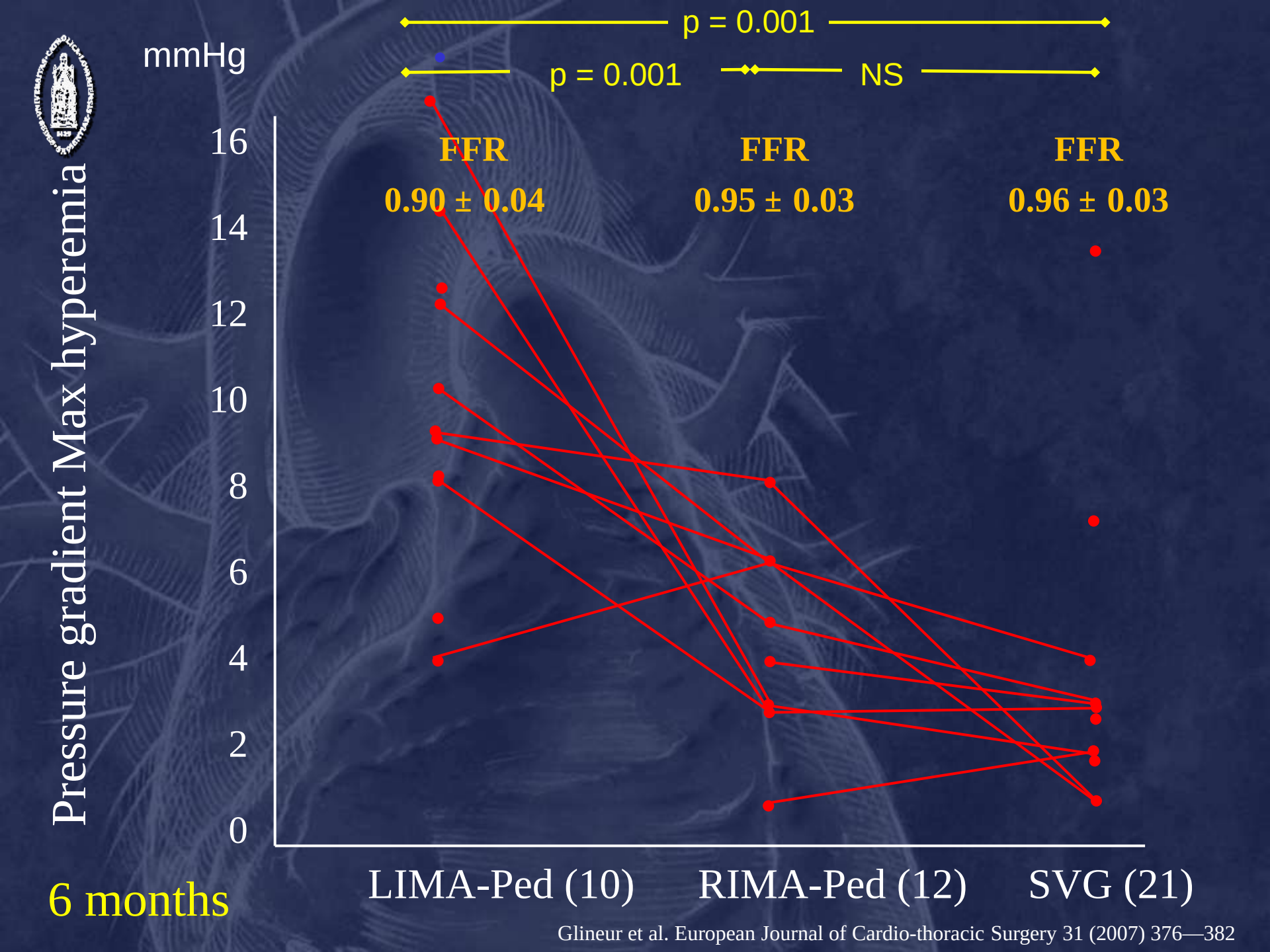
FFR = index of resistance along the graft

Pedicled in situ LIMA vs RIMA vs SVG





Glineur et al. European Journal of Cardio-thoracic Surgery 31 (2007) 376—382



Glineur et al. European Journal of Cardio-thoracic Surgery 31 (2007) 376—382

Conclusions

- SVG are non-resistive
- LIMA has higher index of resistance than RIMA

European Journal of Cardio-thoracic Surgery 31 (2007) 376—382

Hypothesis

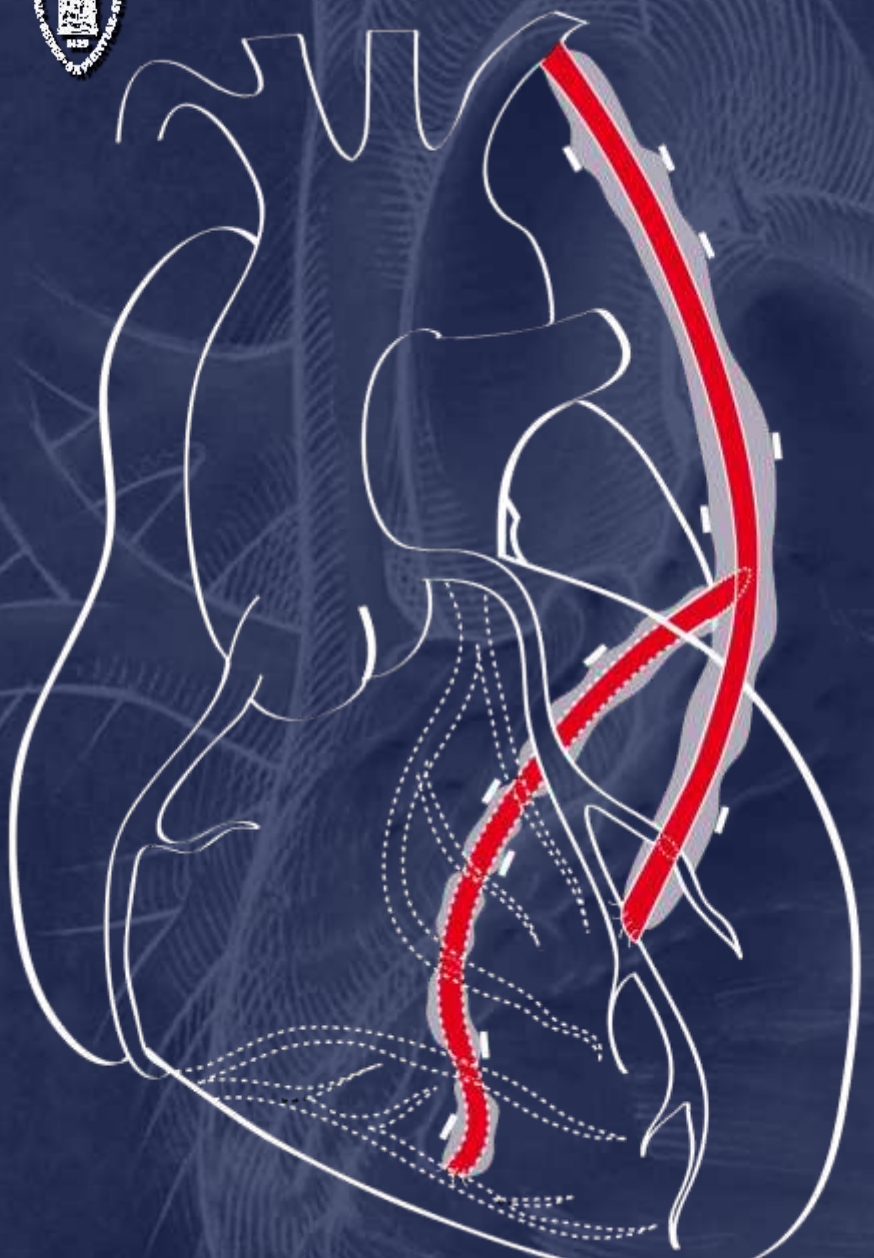
The higher pressure drop through the left IMA reflects larger interactions between flow and vessel wall and larger frictional forces likely to induce a more effective release of endothelial factors.

A more effective stimulation of these endothelial mechanisms in left IMA graft, as a combined result of superior endothelial cell function and favorable hemodynamic conditions, could contribute to the better long-term results of this conduit over the right IMA in coronary bypass surgery.

Composite BIMA Y

RIMA Composite – LCX

LIMA - LAD



PRO

Complete Myocardial Revascularization with IMA's

CON

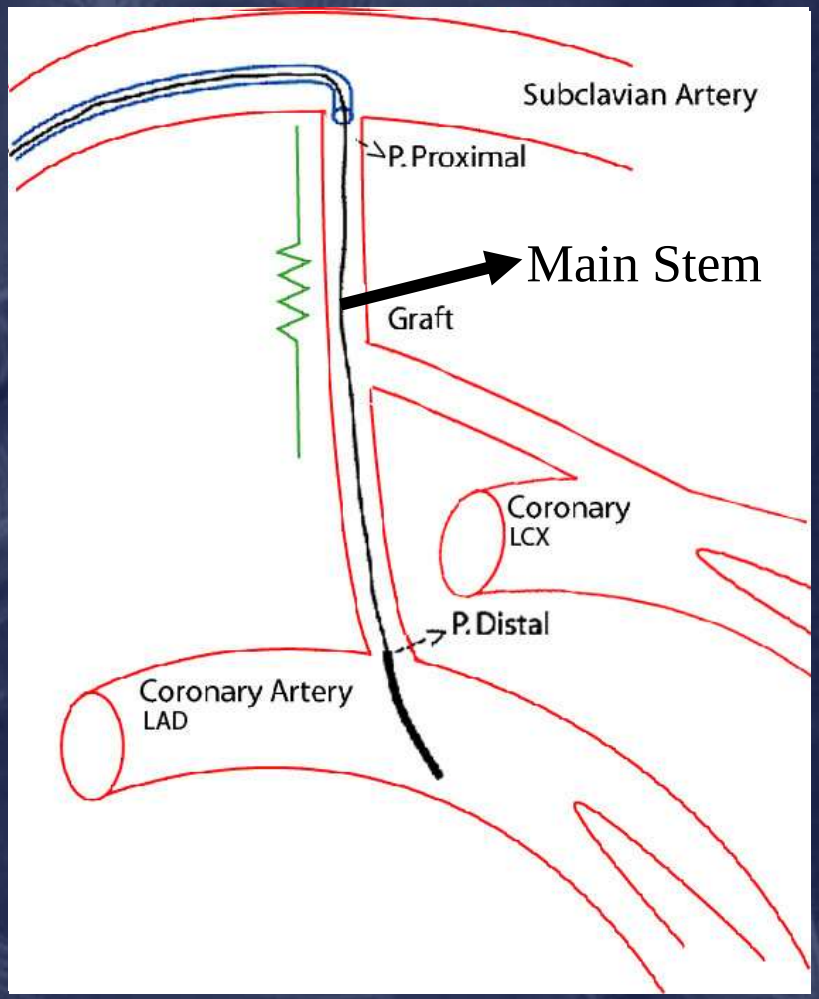
All Blood Suply from LIMA

One crucial anastomose

Flow competition ?

Composite BIMA: Y

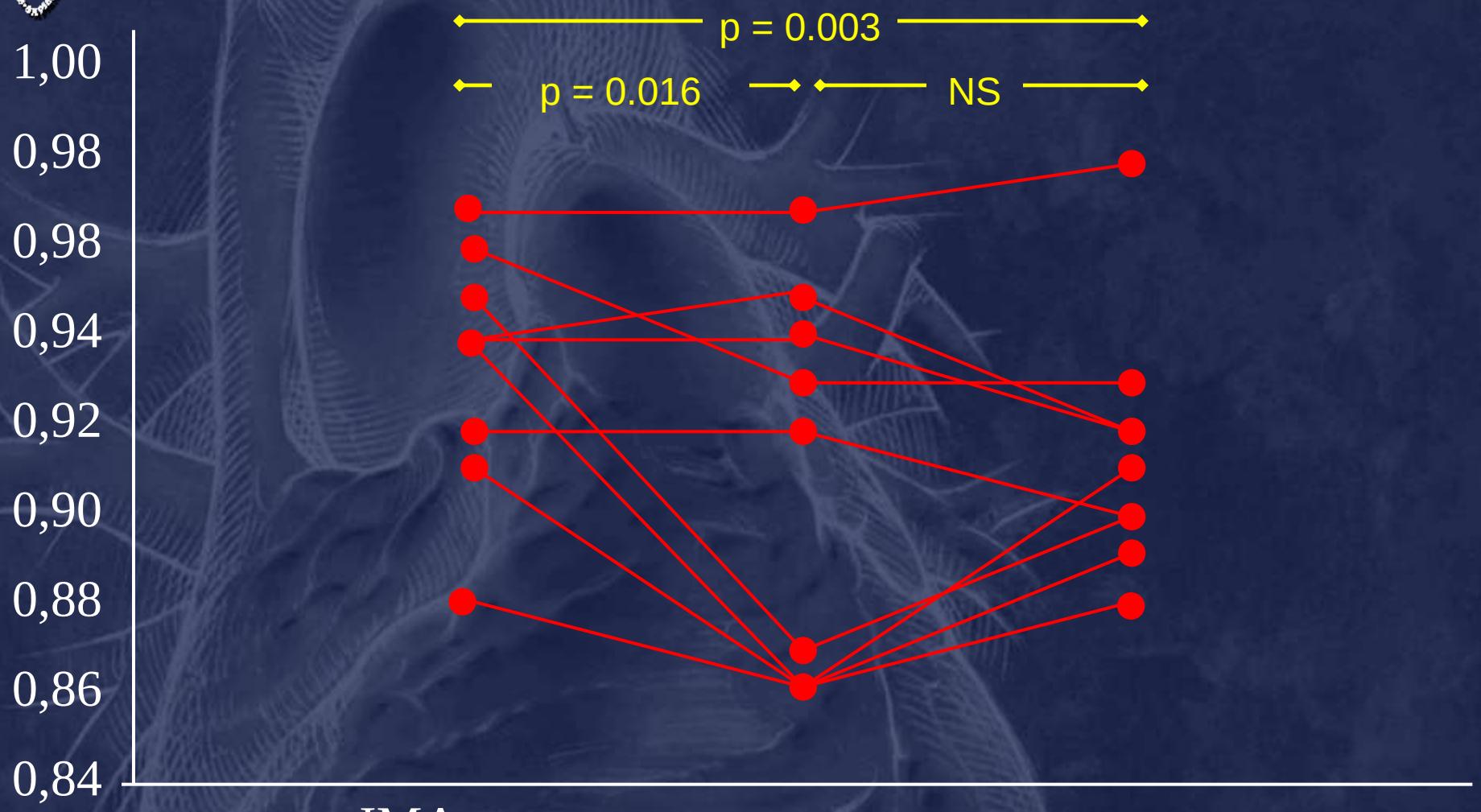
using a 0.0014-inch pressure wire (RADI®)
under maximal hyperaemia



RIMA

Glineur D et al. Circulation 2005;112:I281-1285

FFR (11 patients – 1 year))



Glineur D et al. Circulation 2005;112:I281-1285

CONCLUSIONS

Answers controversies

An IMA **Y-graft** configuration **allows:**

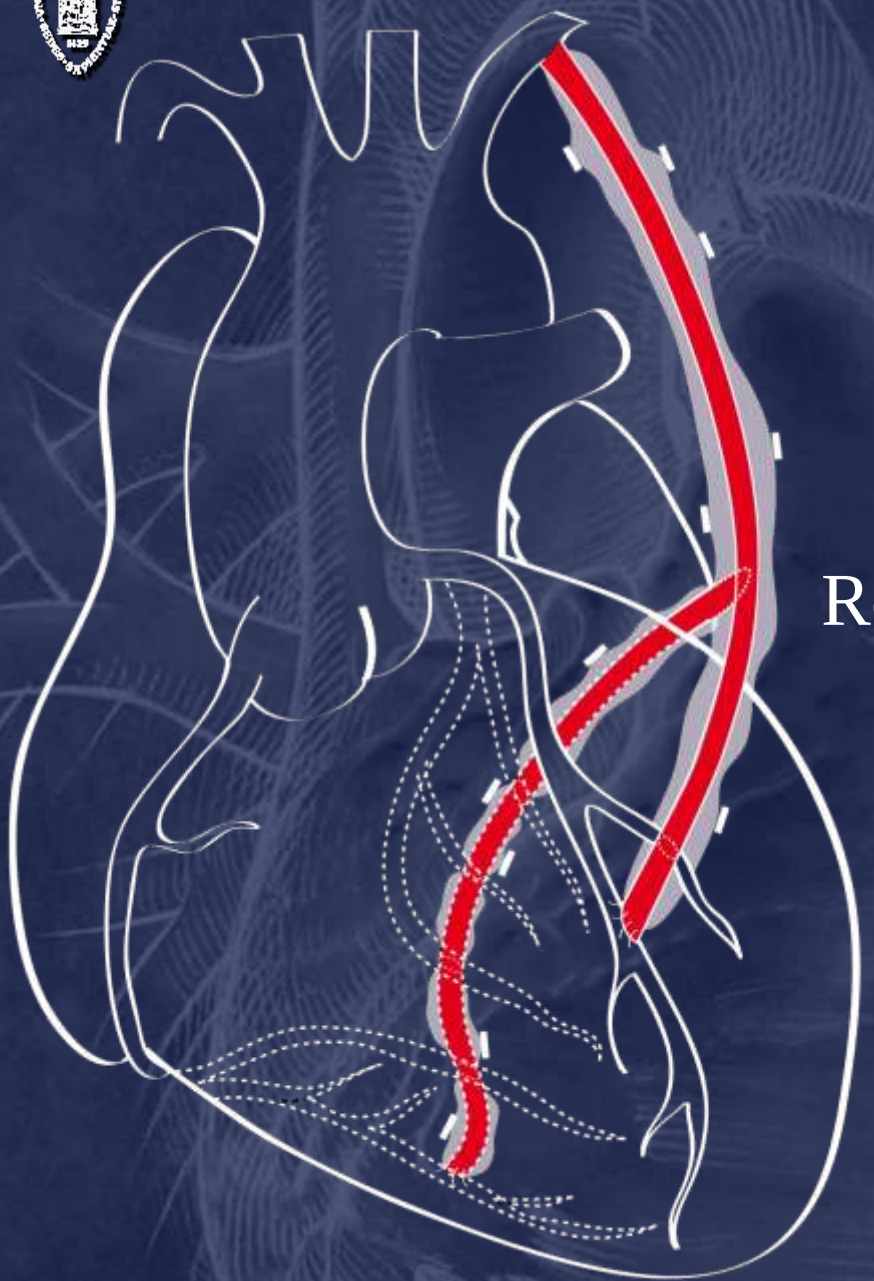
- **Adequate revascularization** of the whole left coronary system,
- **Equal distribution** of perfusion pressure in both distal branches (no steal phenomenon from one IMA to the Other)

The diversion of blood flow from a high resistance to a low resistance branch during hyperemia

Composite BIMA Y

SVG Composite – LCX

LIMA - LAD



PRO

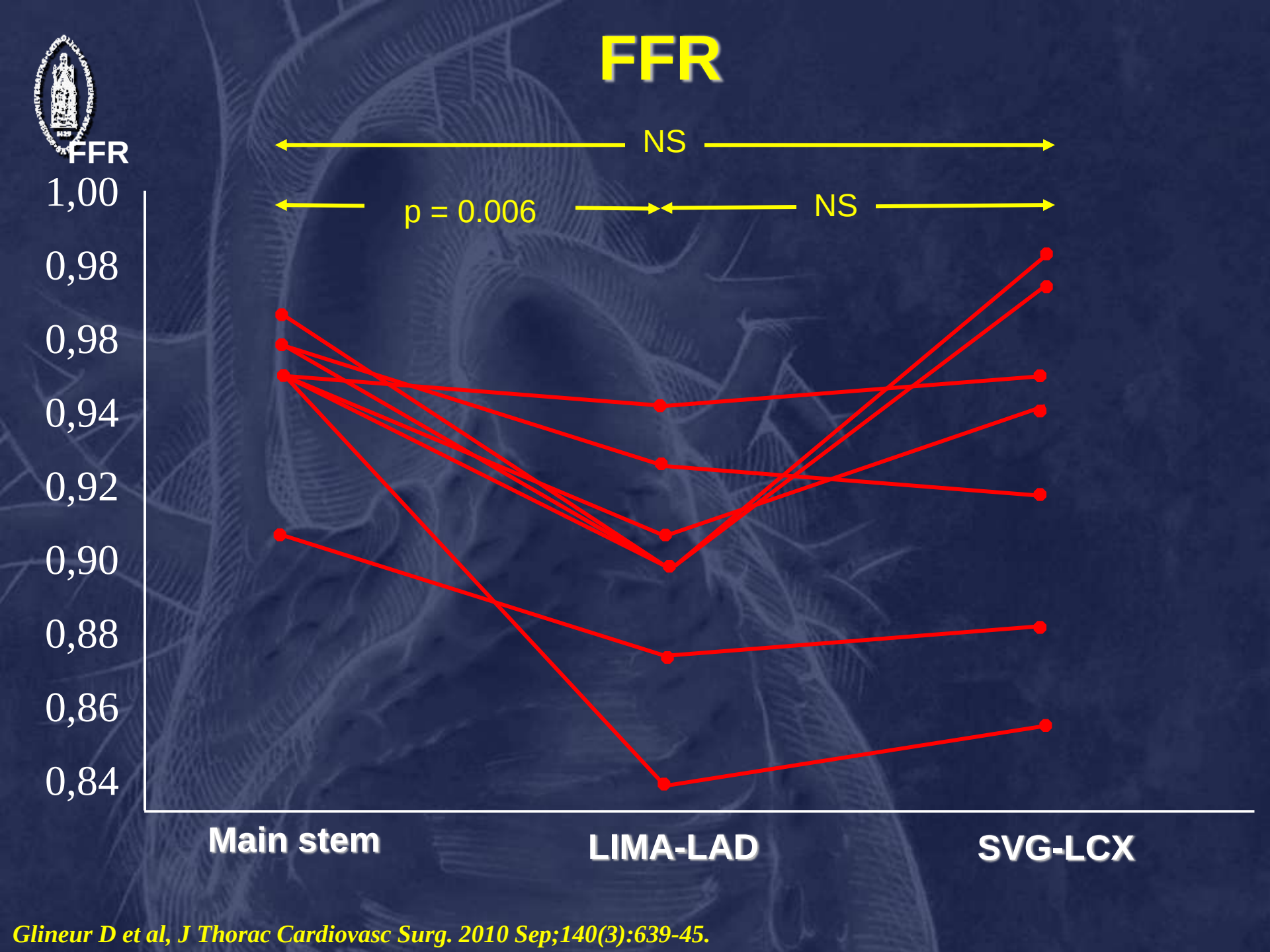
Complete Myocardial Revascularization None touch aortic technique

CON

SVG none resistive

Steal phenomenon

FFR

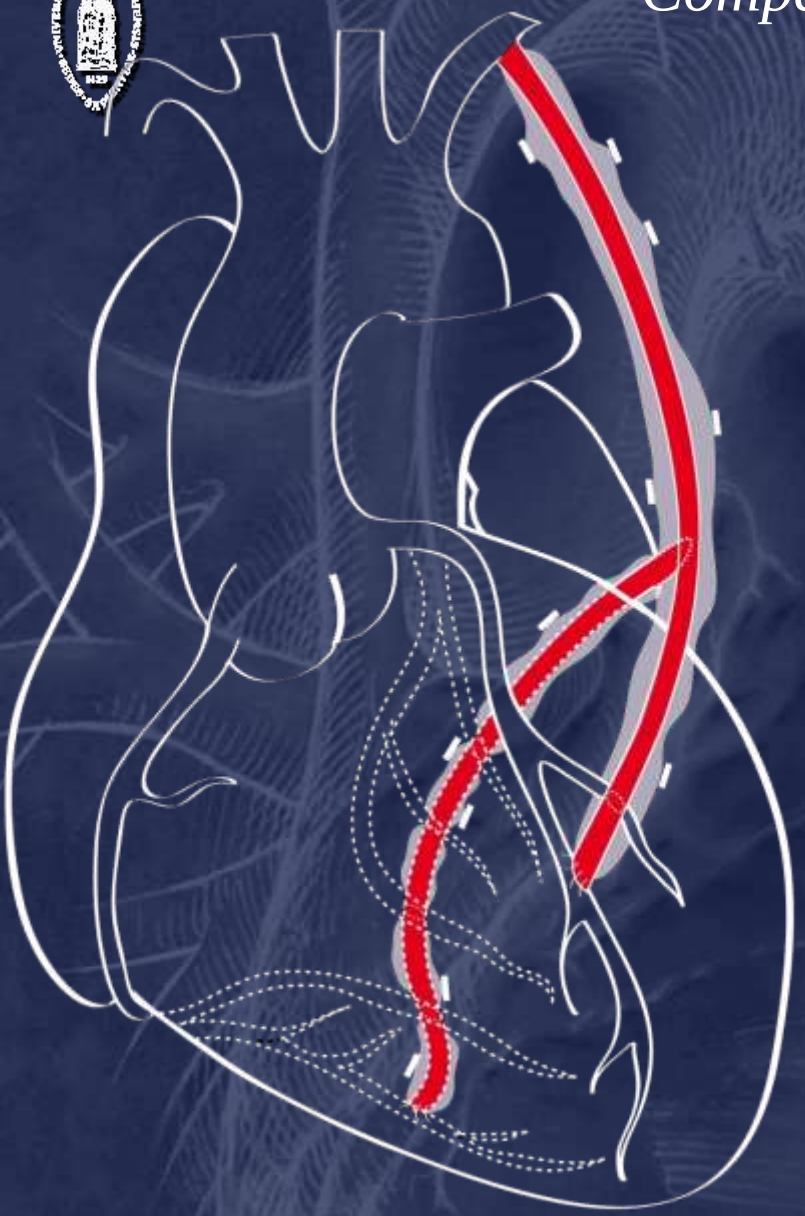


Glineur D et al, J Thorac Cardiovasc Surg. 2010 Sep;140(3):639-45.

CONCLUSIONS

A arterio-veinous **Y-graft** configuration **allows:**

- **Adequate revascularization** of the whole left coronary system,
- **Equal distribution** of perfusion pressure in both distal branches.
- **Alternative** in elderly with Off pump
- **LAD lesion !**



Competitive flow is common in arterial grafting

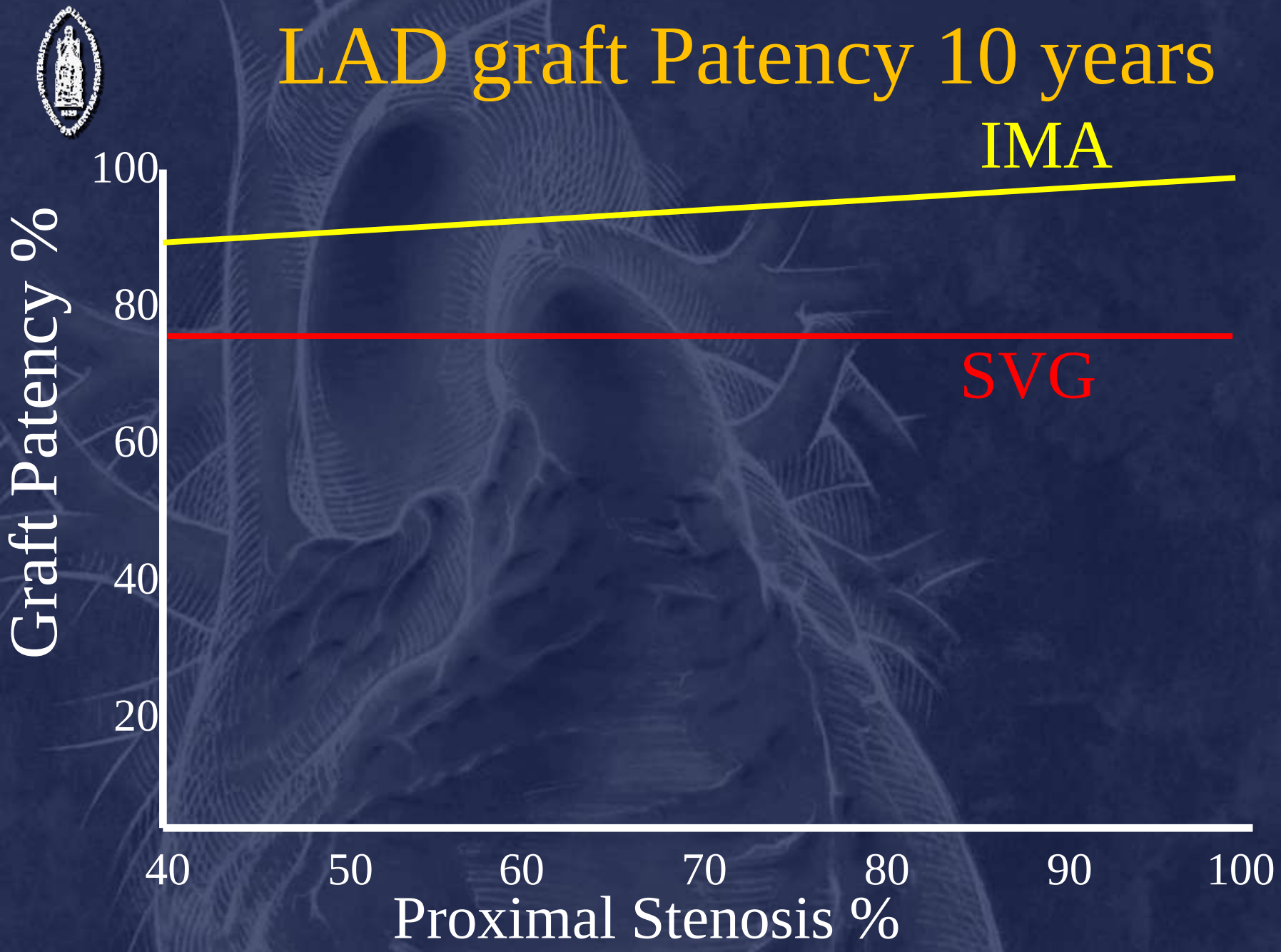
- *Equilibrium between the residual flow in the native artery and the flow given by the by pass*
- *Conductance in graft = conductance in native vessel*

- *Functional capacity of bypass grafts depends on:*

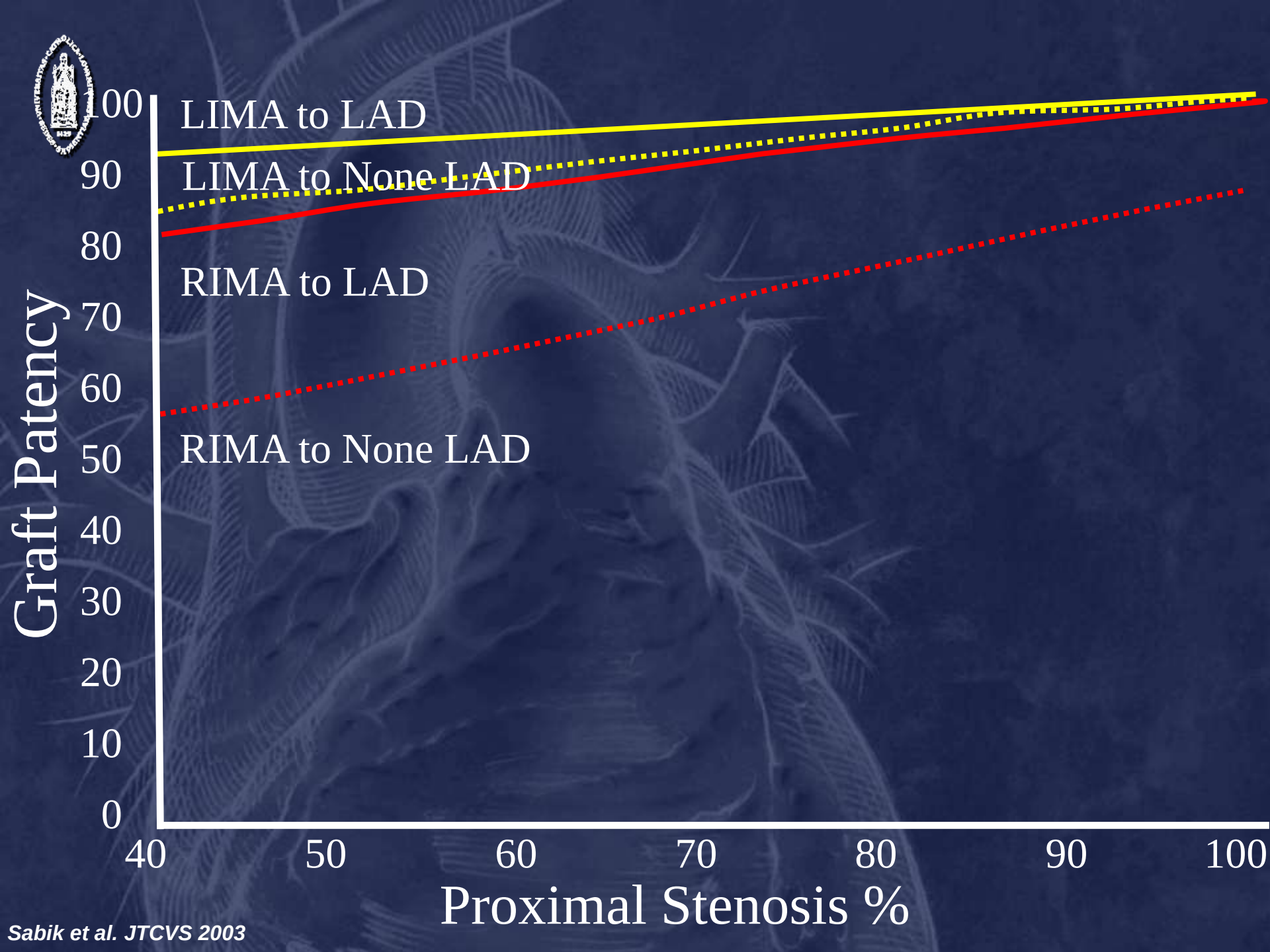
- graft properties, length and diameter

- severity of native vessel stenosis

LAD graft Patency 10 years



Sabik et al. JTCVS 2003



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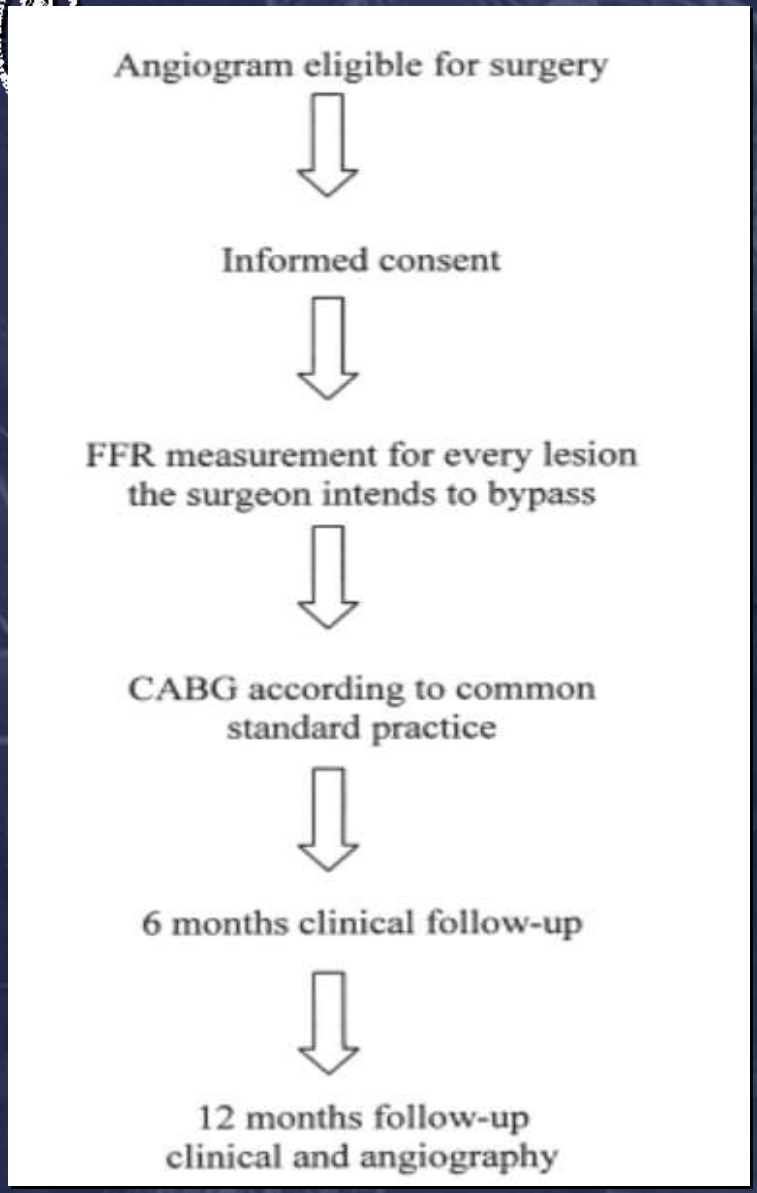


% stenosis, MLD, *how about FFR:*

Does Stenosis Severity of Native Vessels Influence Bypass Graft Patency? A Prospective Fractional Flow Reserve–Guided Study

164 patients

CJ Botman et al. Ann Thorac Surg 2007;83:2093–7

Vessels (total)	FFR<0,75 Significant	FFR>0,75 Not Significant	p-Value
Patent	325 (90%)	132 (79%)	
Occluded	32 (9%)	36 (21%)	<0.0001
Total	357	168	

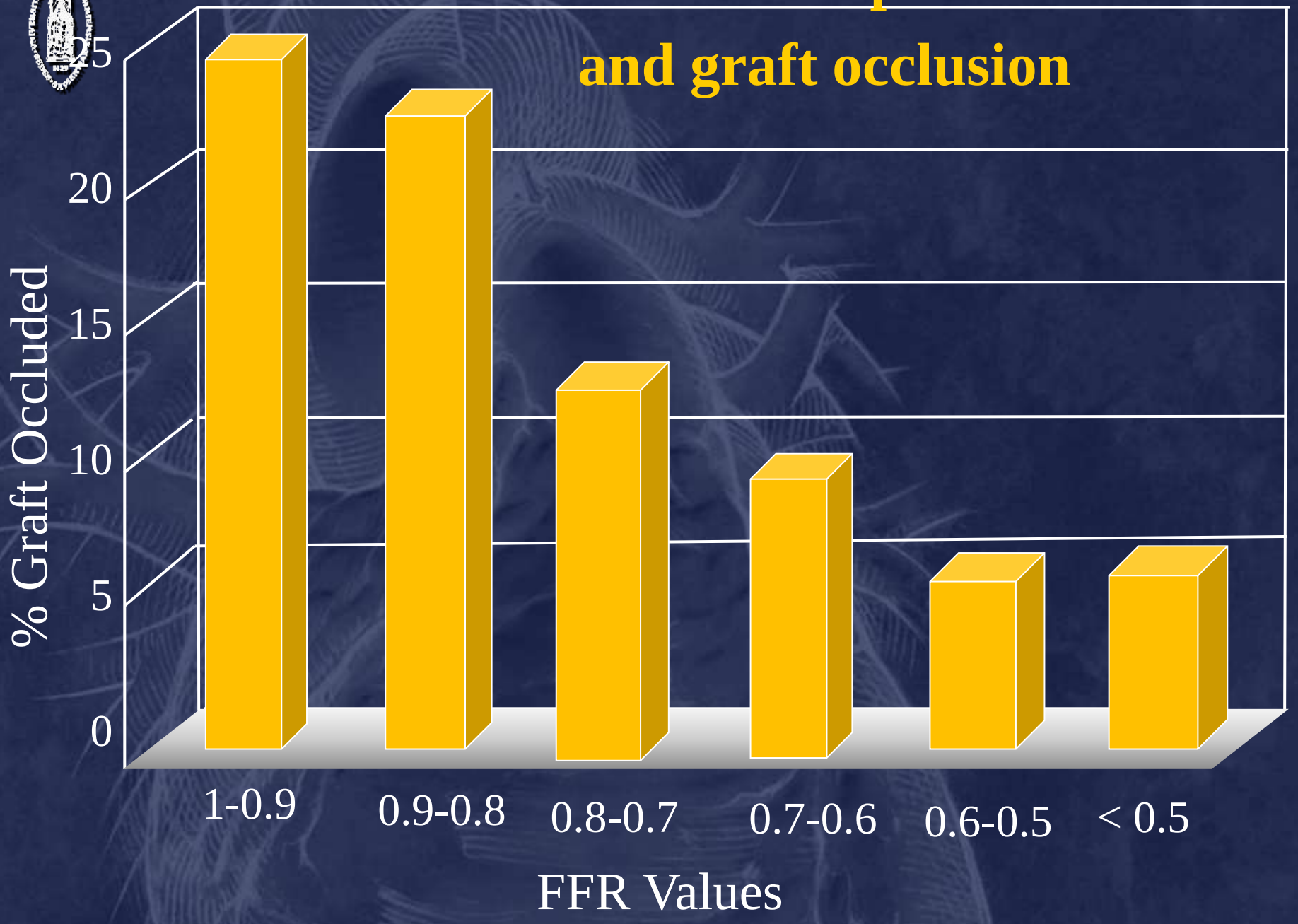
At 1 year, *the patency of bypass grafts of functionally significant lesions is significantly higher than that of functionally non-significant lesions.* (p< 0.001)

In the group of visually intermediate lesions

Intermediate Lesion at Visual Inspection	FFR<0,75	FFR>0,75	p-Value
Patent	120	95	
Occluded	13 (10%)	24 (20%)	<0.02

At 1 year, 10% of the bypasses on functionally significant lesions and 20% of the bypasses on non-functionally significant lesions were occluded (p< 0.02)

Relationship between FFR and graft occlusion



Conclusions

- FFR tool to assess the functional significance of a coronary artery lesion

- FFR tool to assess resistance of a graft

Collaboration between surgeons and cardiologists to improve outcome of CABG: choice of conduit in relation to anatomy and stenosis significance.

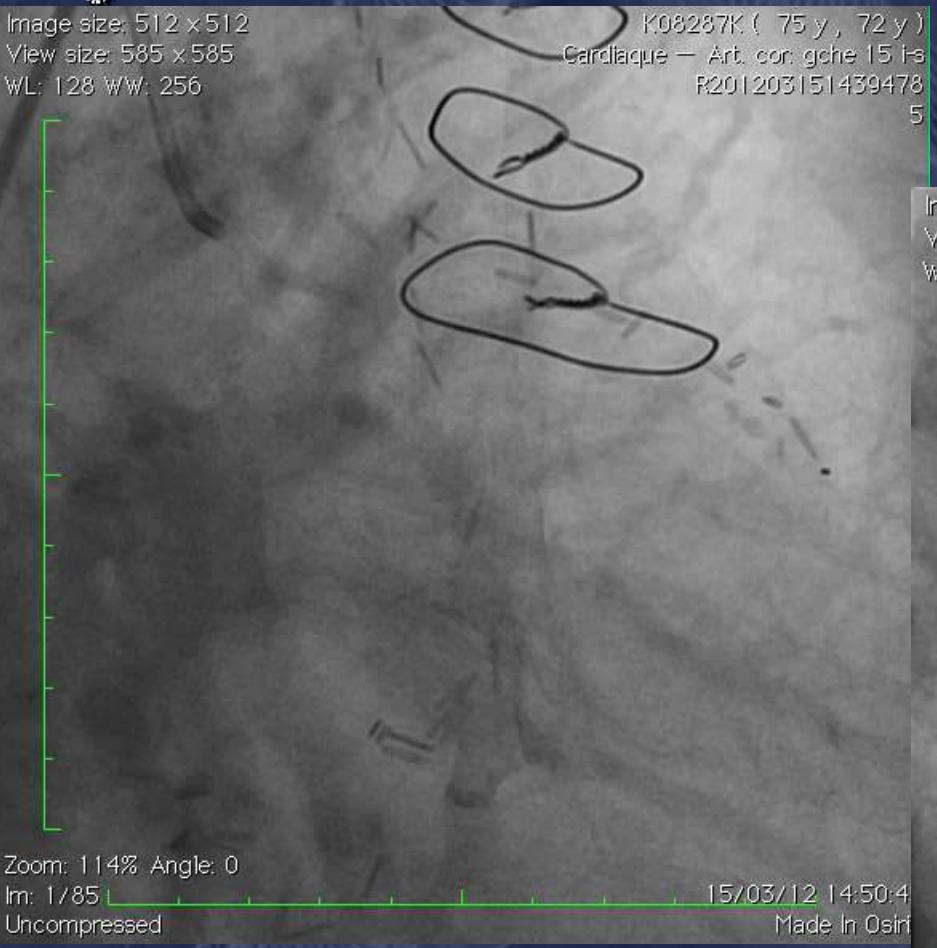

Thank you

48 yrs old male patient with CABG in need of Aortic valve replacement

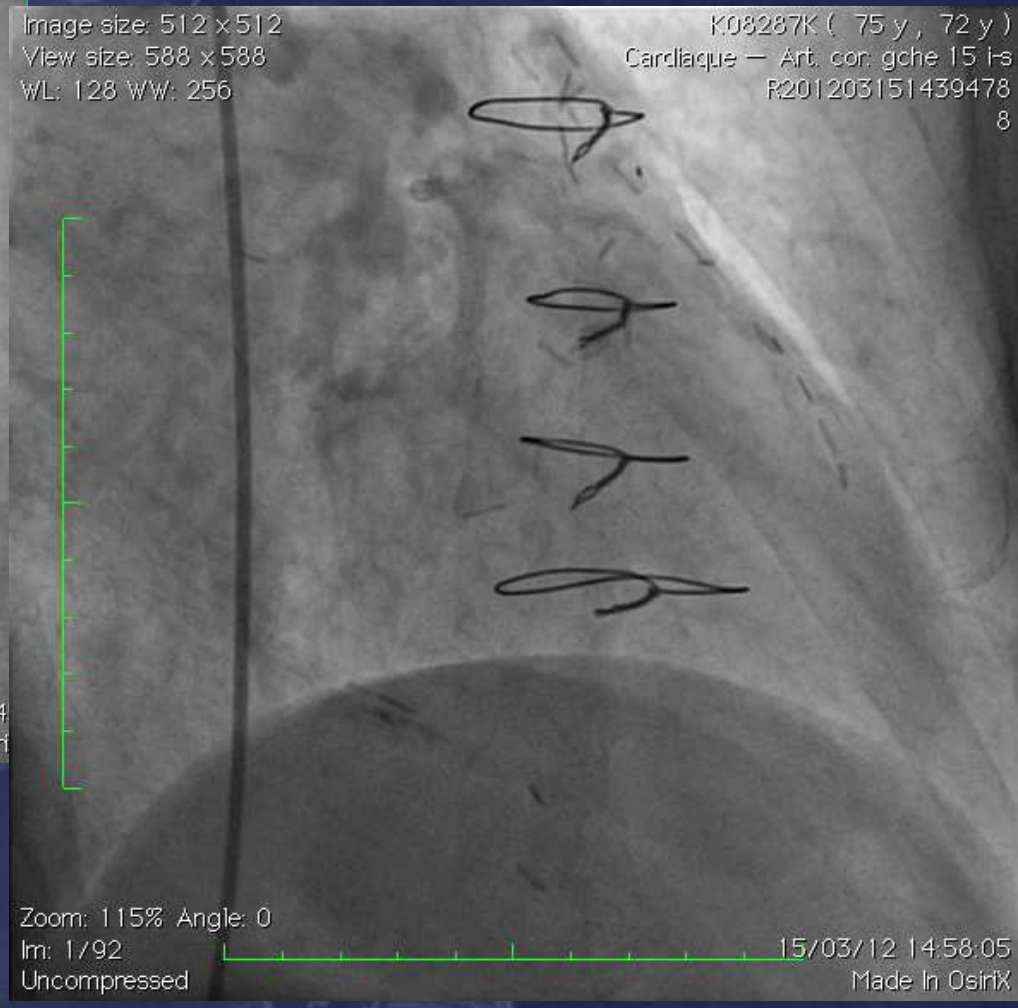
Severe stenosis of mid RCA

GEA graft: impossible to inject anterogradely

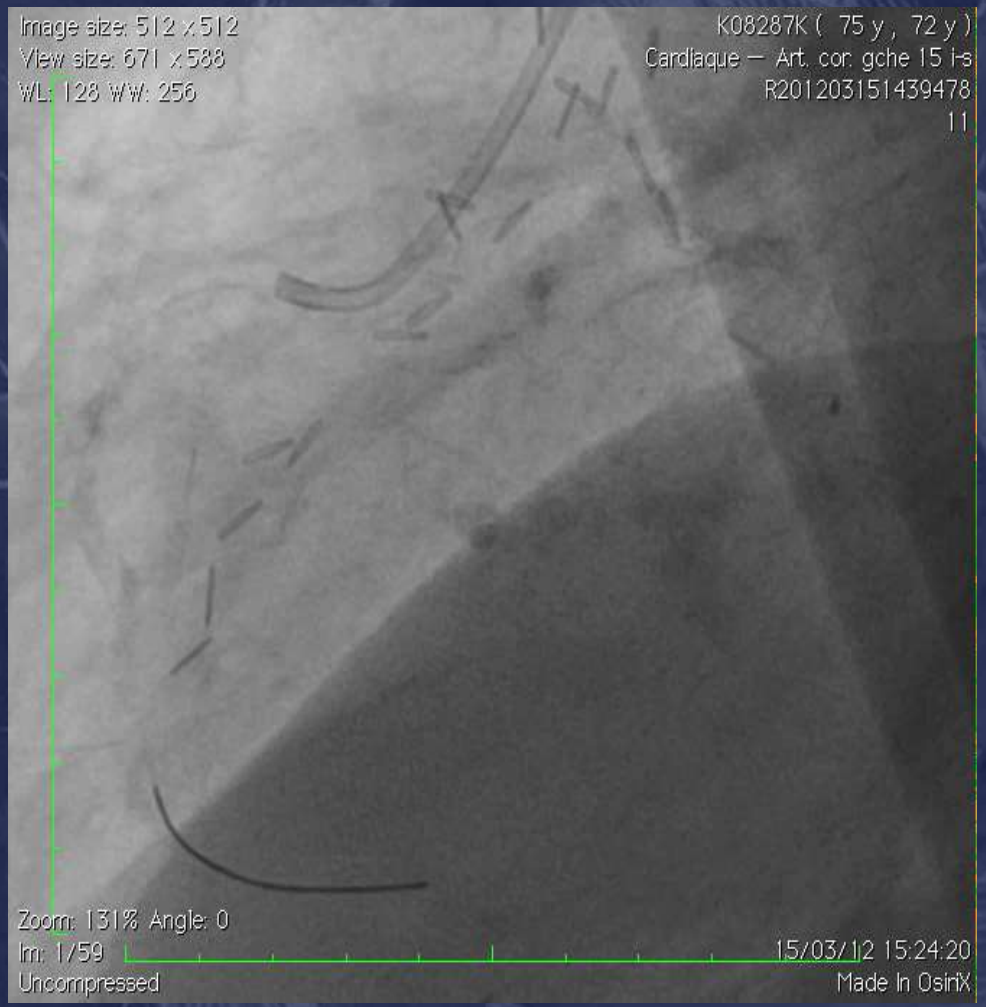
Left Coronary Artery: Left main



Grafterd with a magnificent and functional Y IMA Graft



FFR in distal RCA



Result:

FFR : 0.90

Surgery: Aortic valve replacement only