

# **Optimal Stent Deployment in the DES Era**

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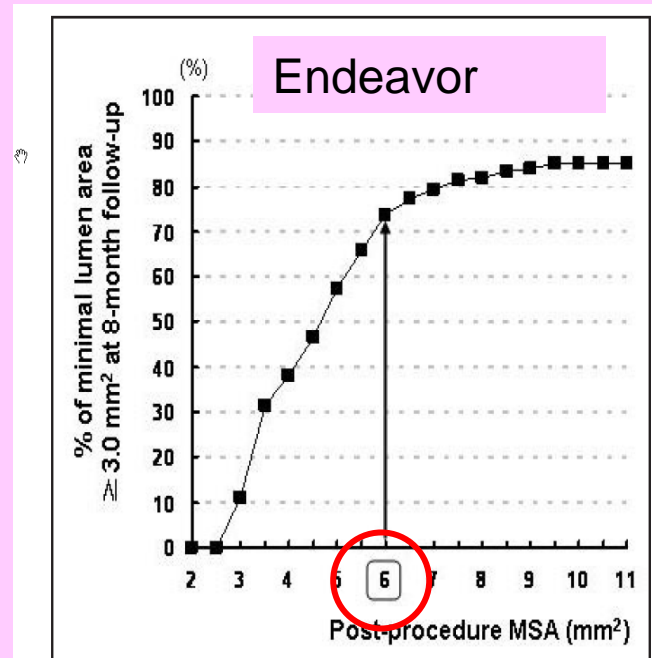
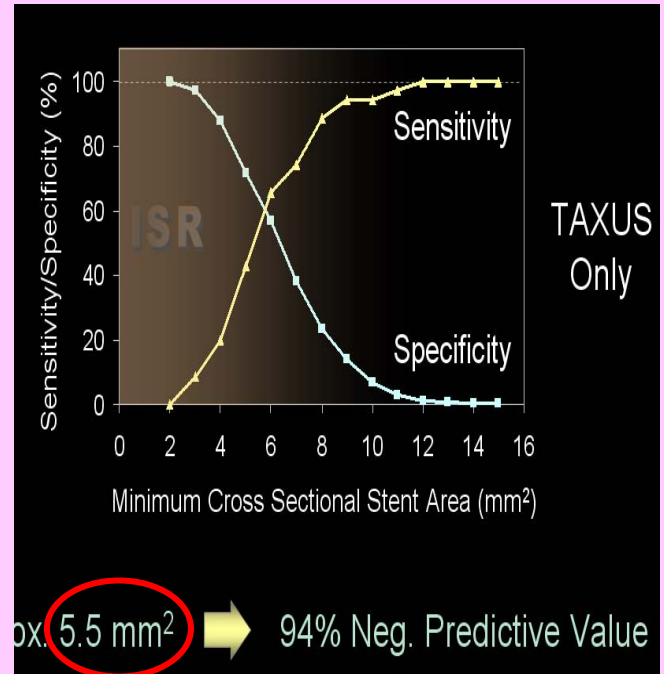
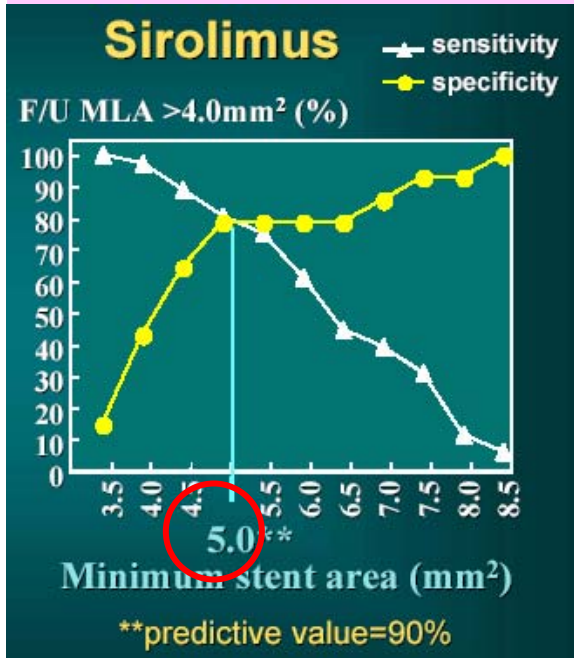
**Washington Hospital Center  
Washington, D.C.**

**Is there a role for**

**“bigger is better”**

**in drug eluting stents?**

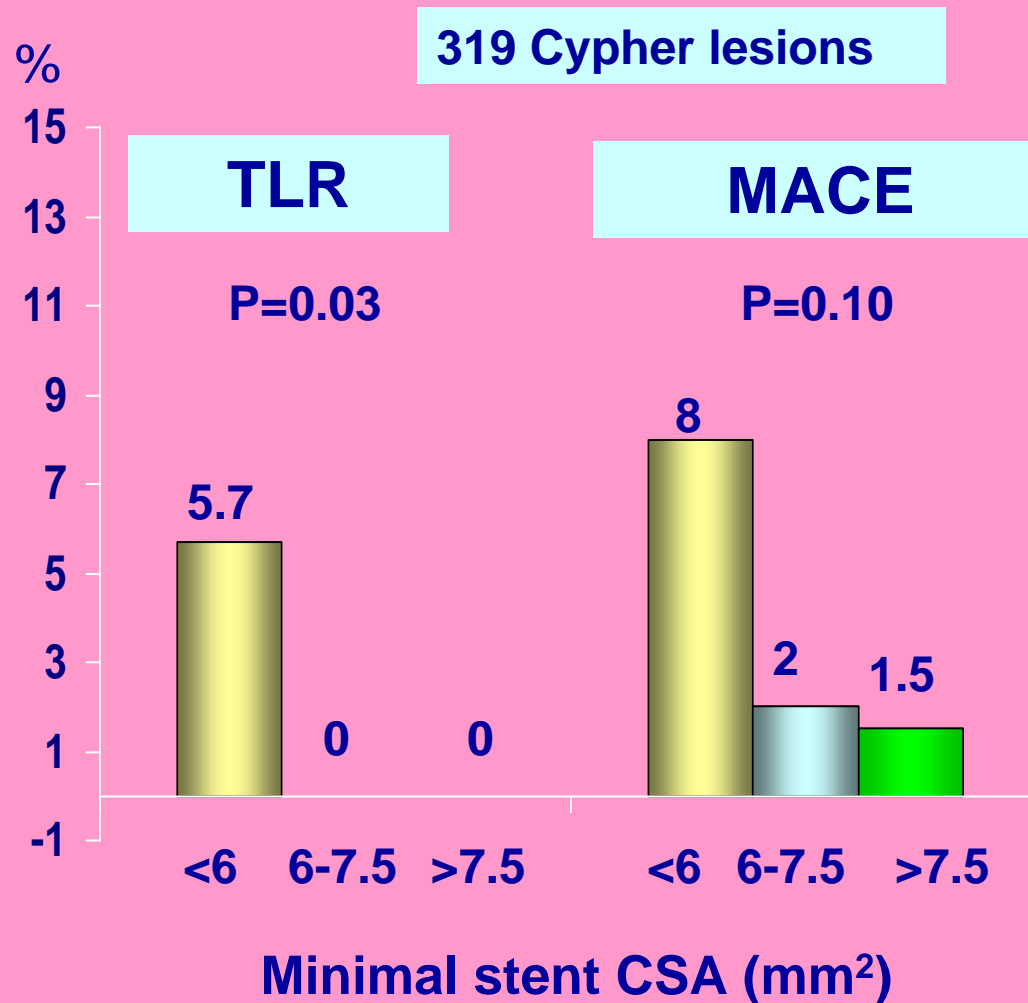
# Optimal Stent Area (IVUS) and Restenosis in DES.



Sonoda, et al. JACC 2004;43: 1959-63, Hu, Fitzgerald, Honda et al. JACC 2006;47:2B

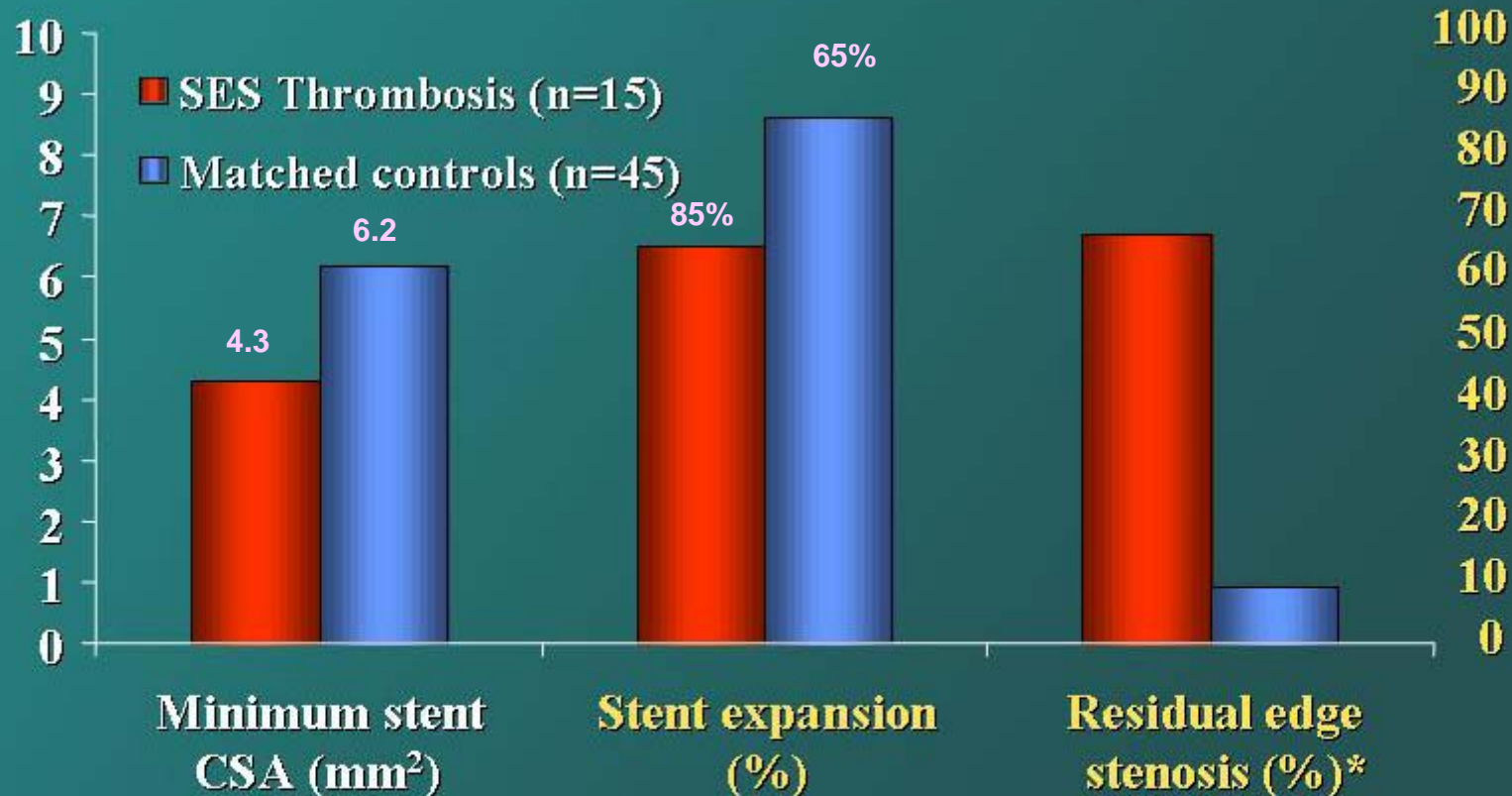
# IVUS Stent area and Outcome at 6 months.

WHC: Cheneau et al. AJC 2005;95:1240-2.



# IVUS Predictors of SAT

Fuji, Mintz et al. JACC 2005;45:995-8



- 2,575 patients were treated with 4,722 Cypher stents.
- 21 (0.8%) had stent thrombosis of whom 15 had IVUS
- 12/15 SES thrombosis lesions has stent CSA <5.0mm<sup>2</sup> (vs 13/45 controls)

# First Conclusion

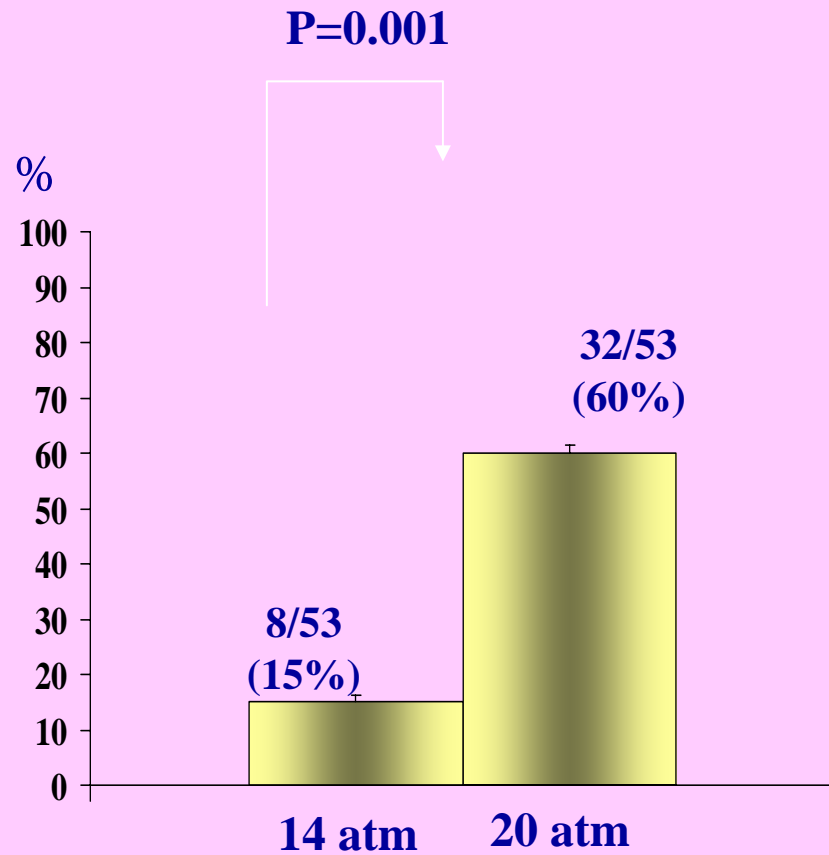
**“Bigger is better”  
is valid in drug eluting stents**

**A minimum area  $> 5.5 \text{ mm}^2$   
is associated with less restenosis and  
less thrombosis**

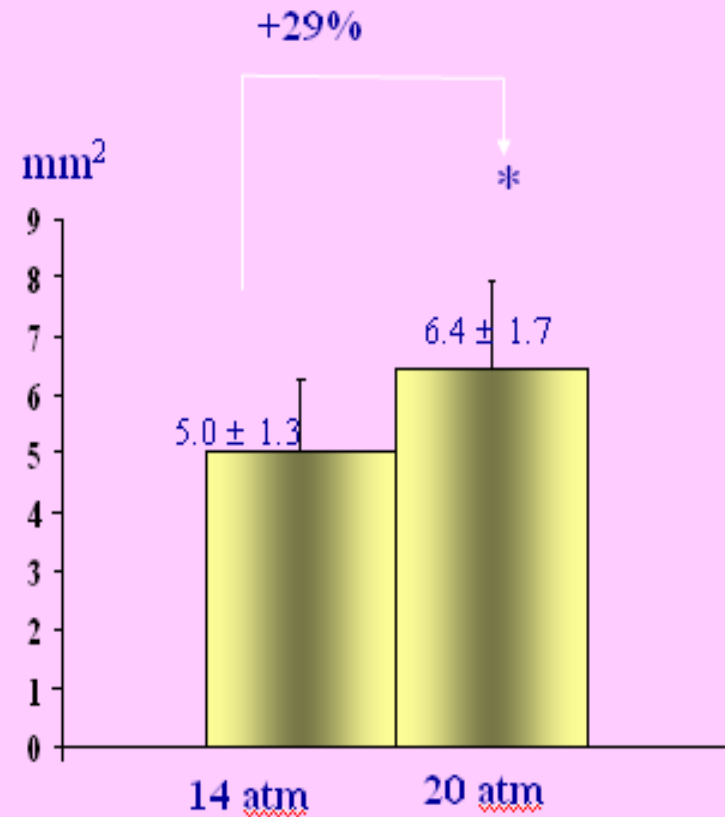
**What Pressure  
is necessary for  
optimal stent expansion?**

# Cypher Stents: Deployment Pressure and Optimal Stent expansion.

WHC: Cheneau et al. CCI 2005;65:222-6



**Full Expansion (Music Criteria)**

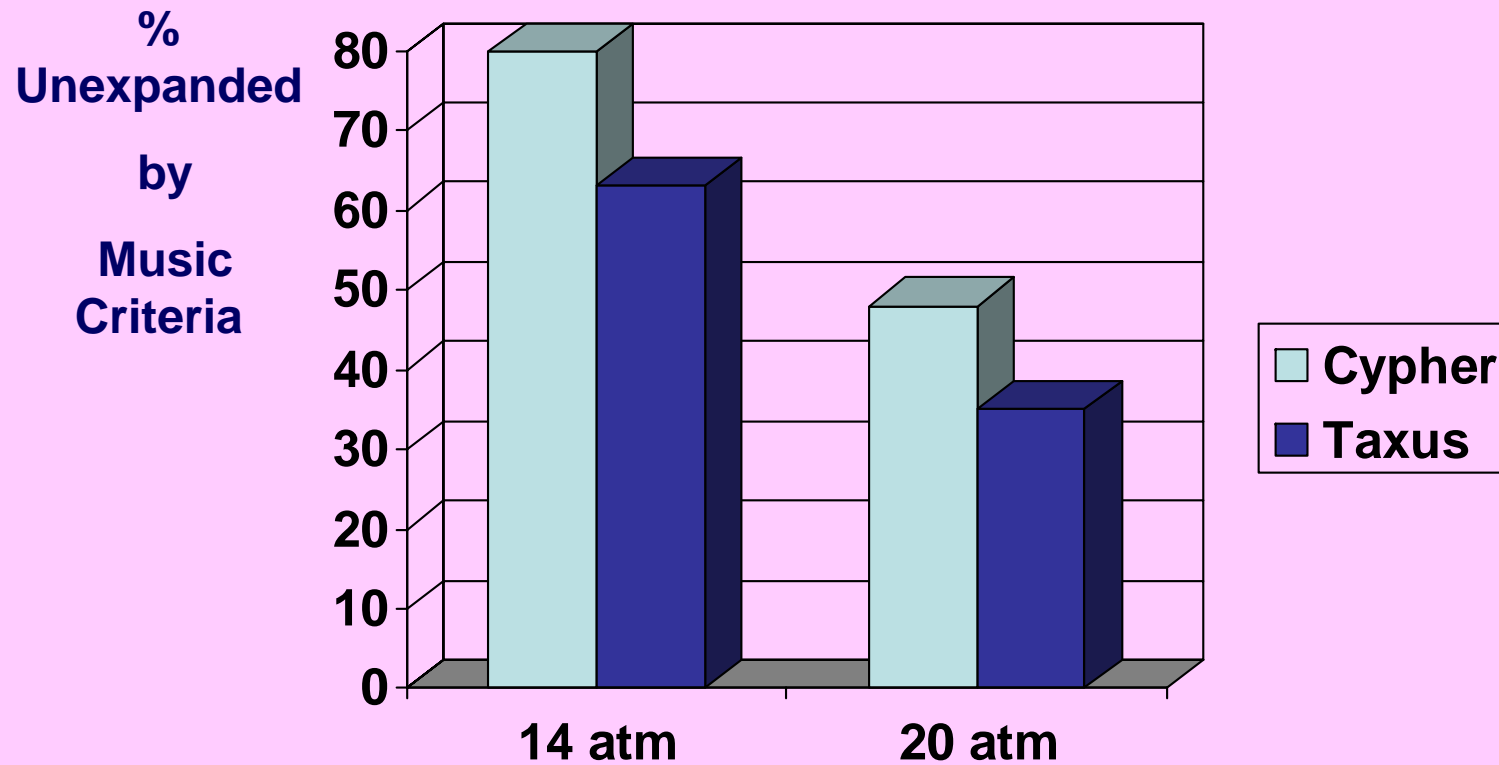


**Minimal Stent CSA**



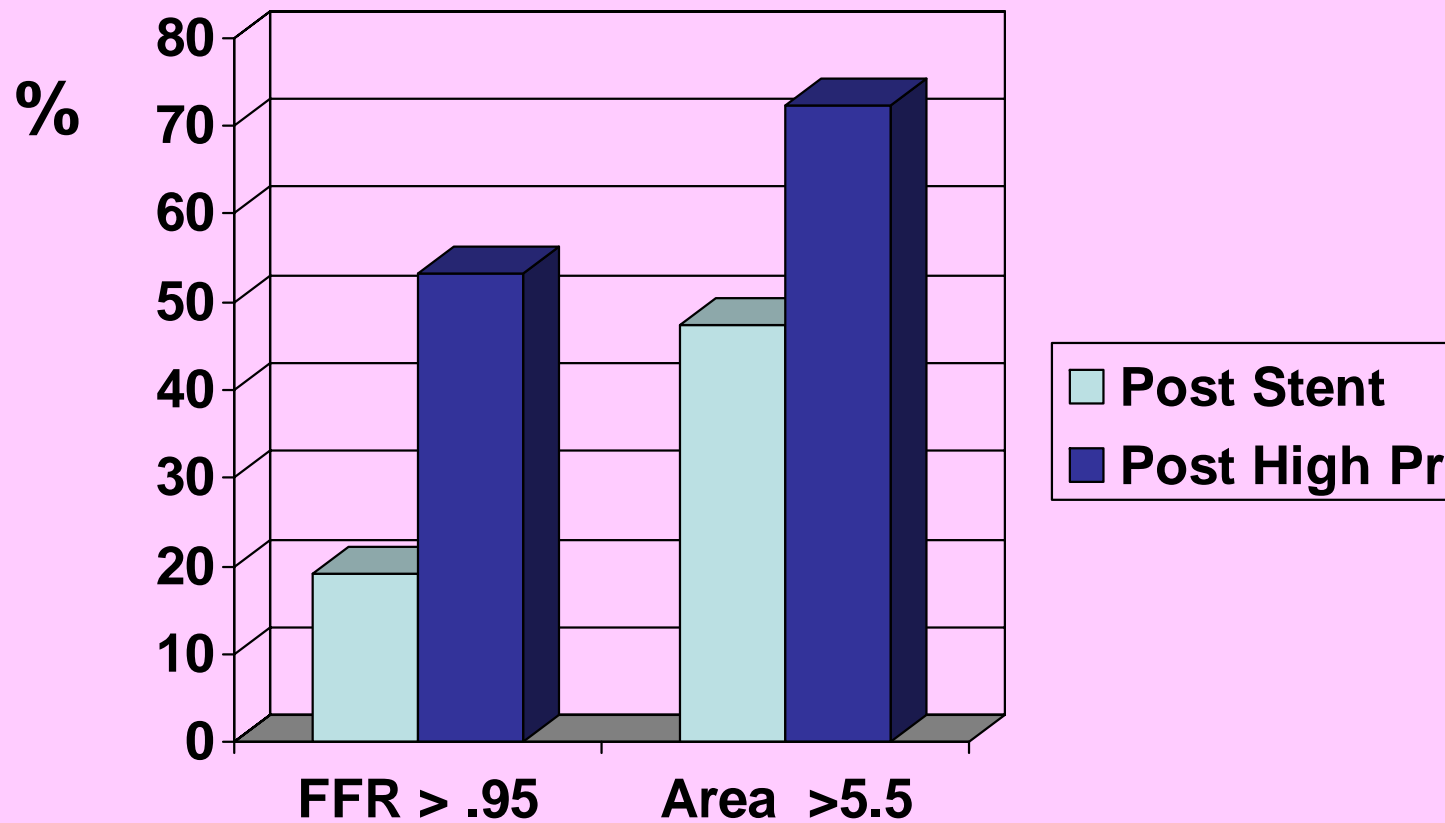
# Stent Expansion

WHC: Javid et al. CV Revasc Medic 2006; 7:208-211

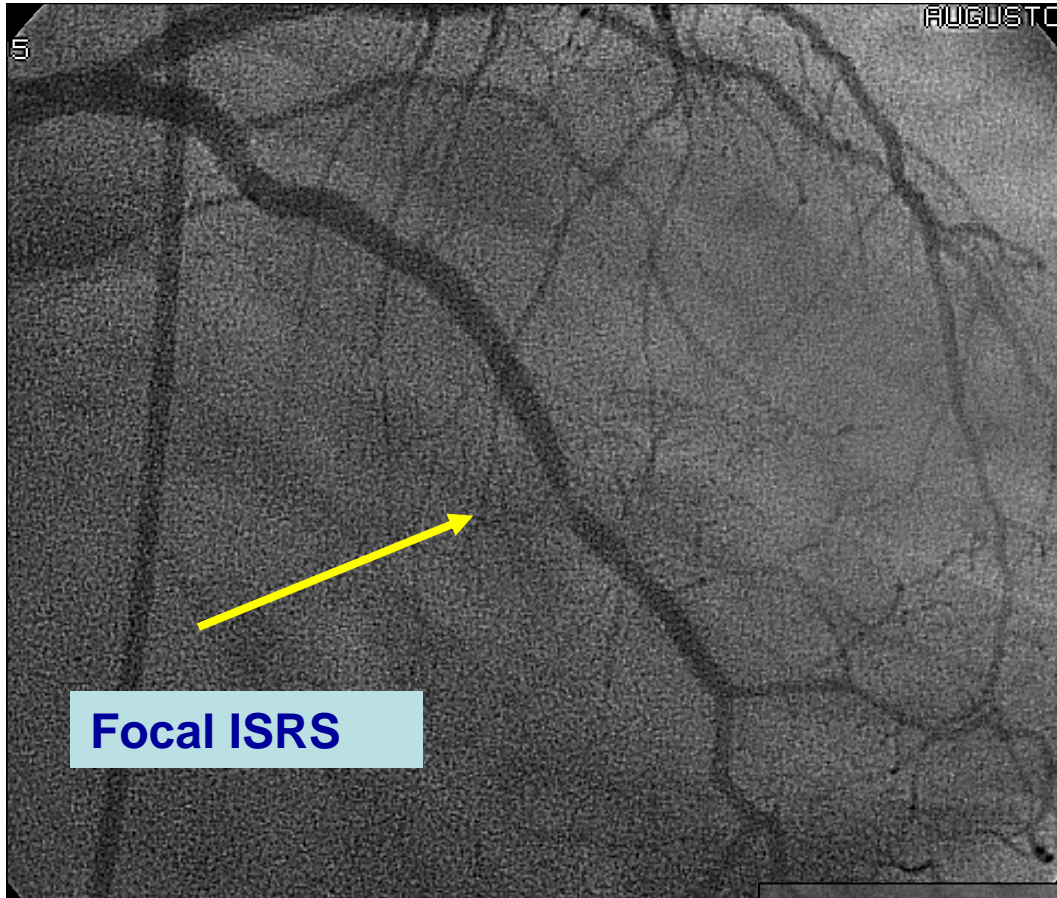


# FFR and IVUS Criteria Reached

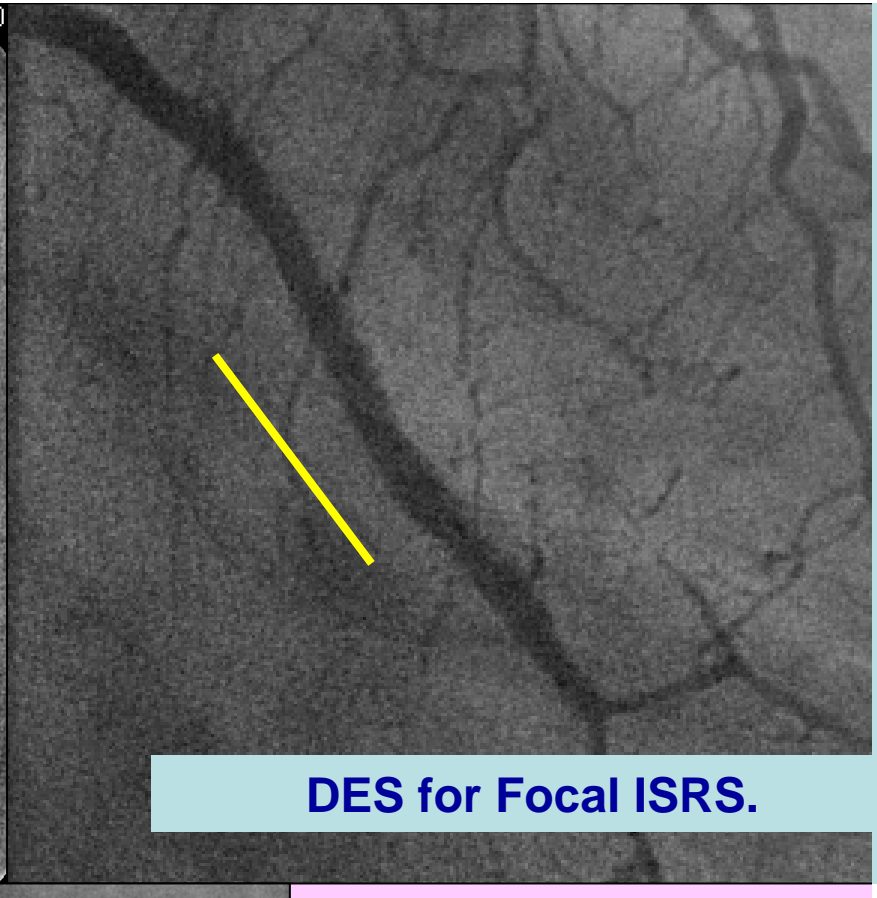
Tahk and Yoon. Aspen 2007



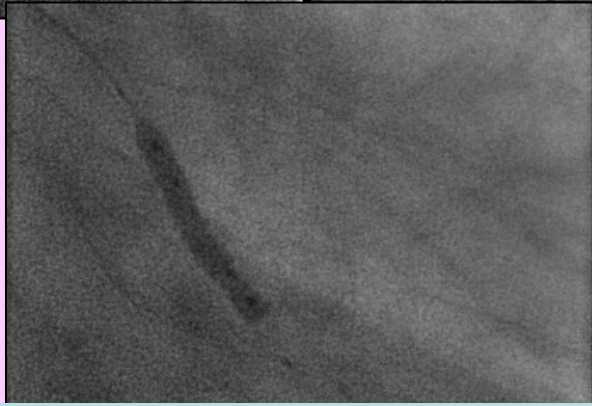
**A fully expanded balloon  
does not insure  
that the stent is fully expanded**



**Focal ISRS**

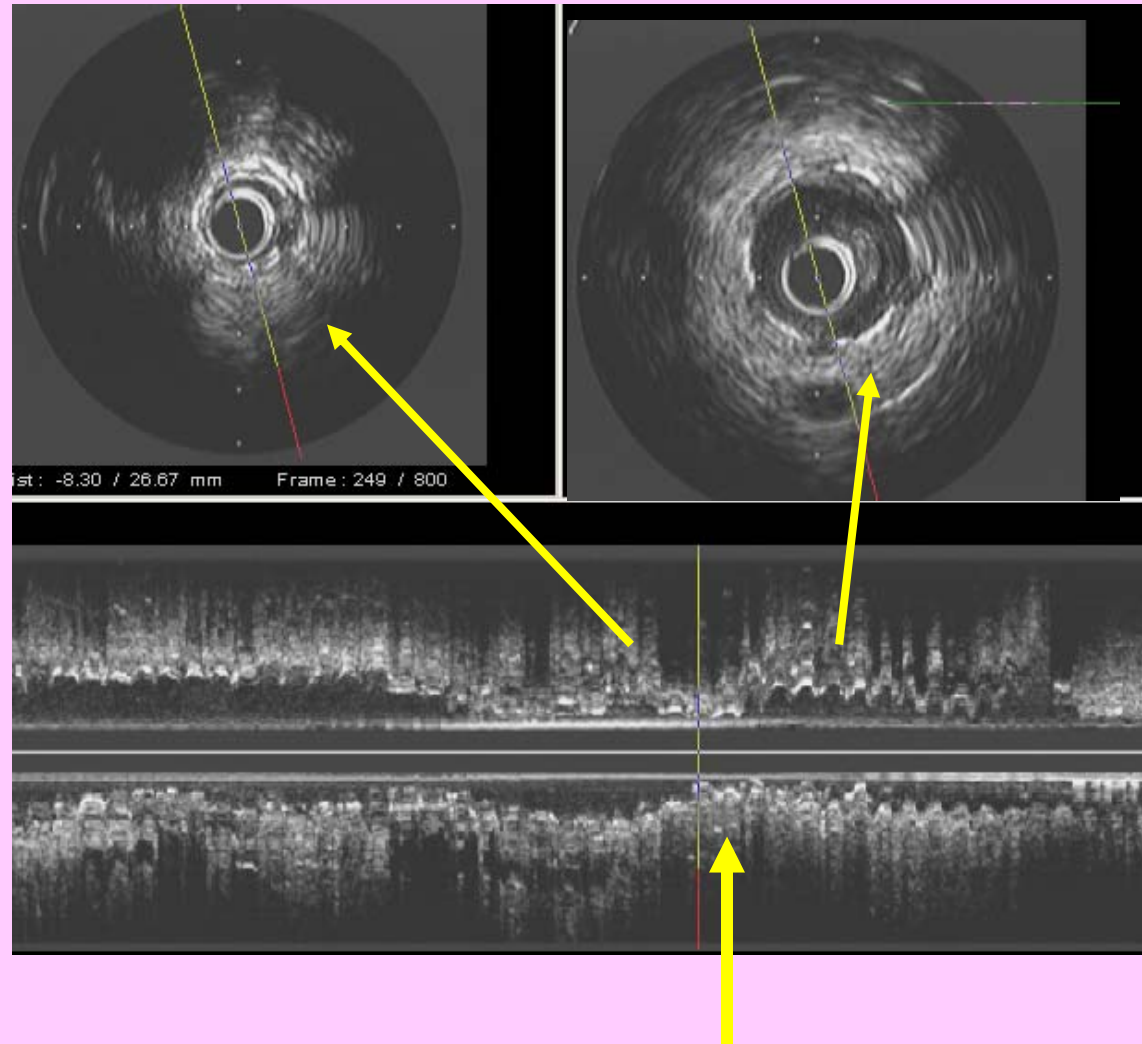


**DES for Focal ISRS.**



**Balloon fully expanded.  
(20 atmospheres)**

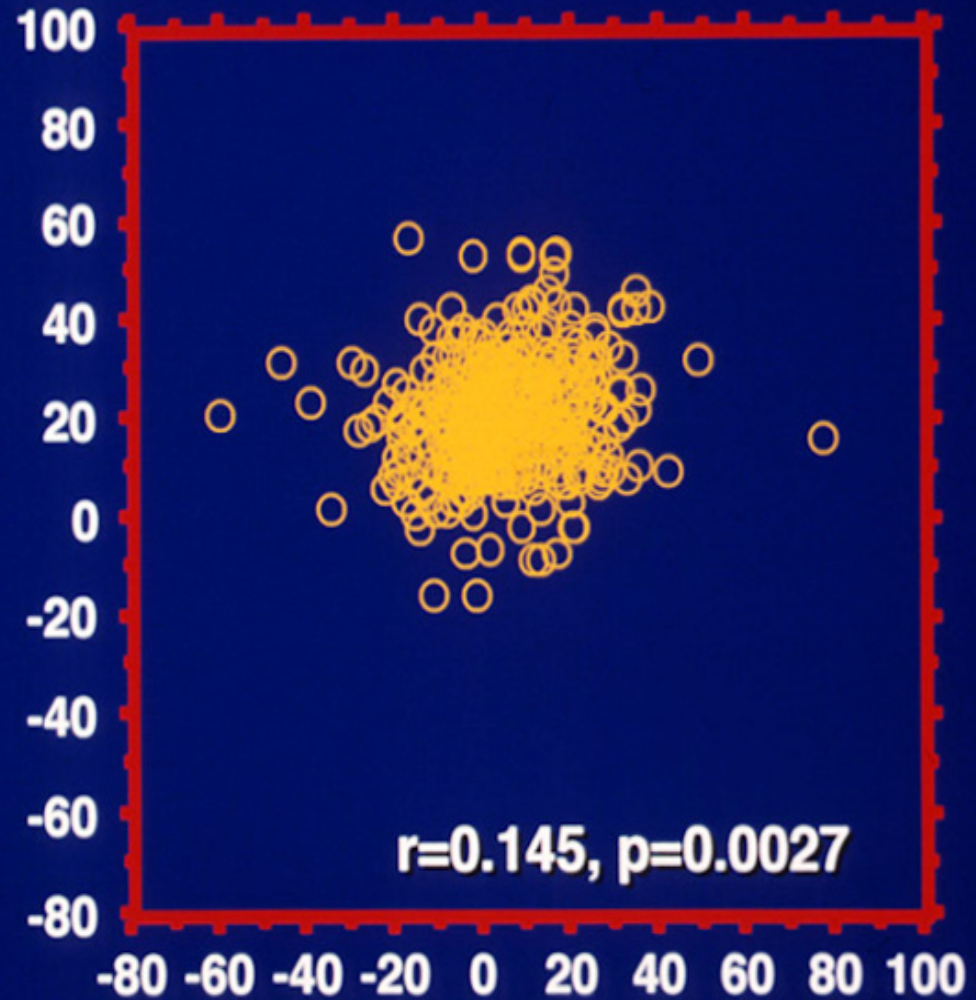
# Unexpanded Stent after 20 atm.



IVUS-Guided  
Stenting

←  
Comparison  
of IVUS and  
QCA post-  
stent+adjunct  
PTCA  
(N=616)

IVUS DS (%)



QCA DS (%)

# Second Conclusion

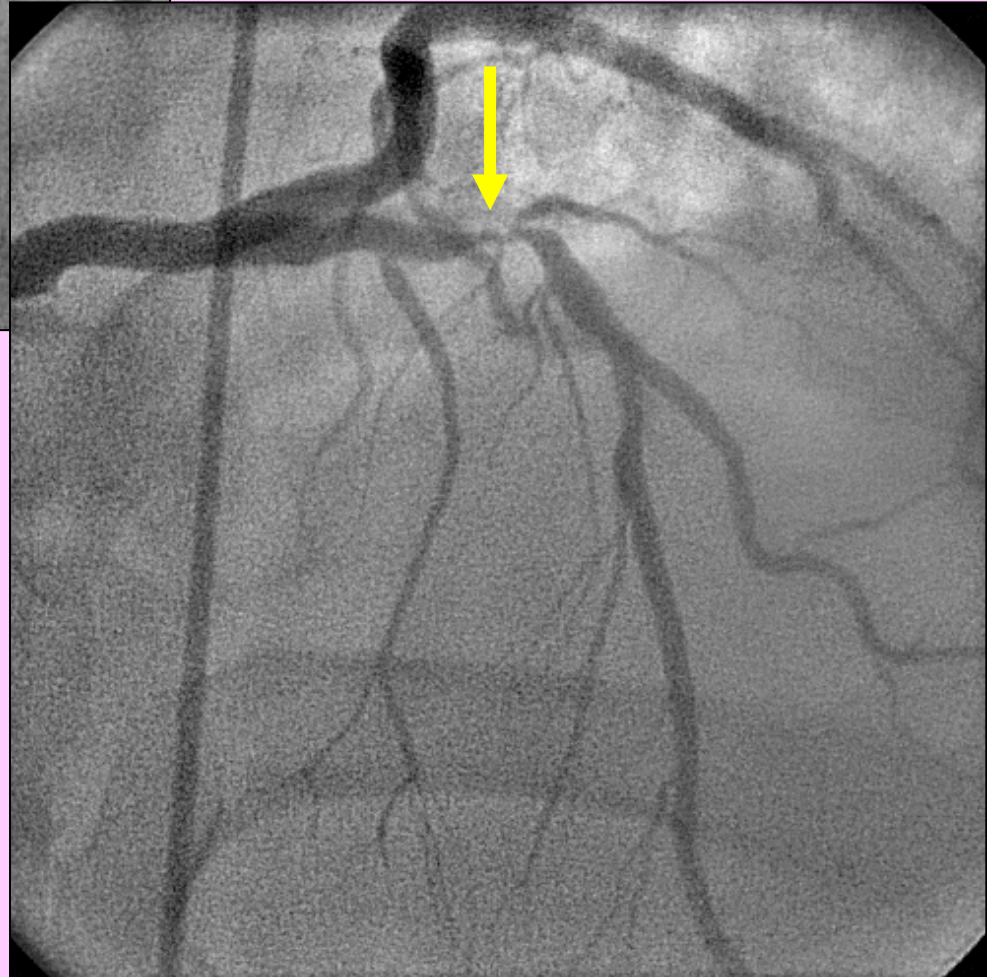
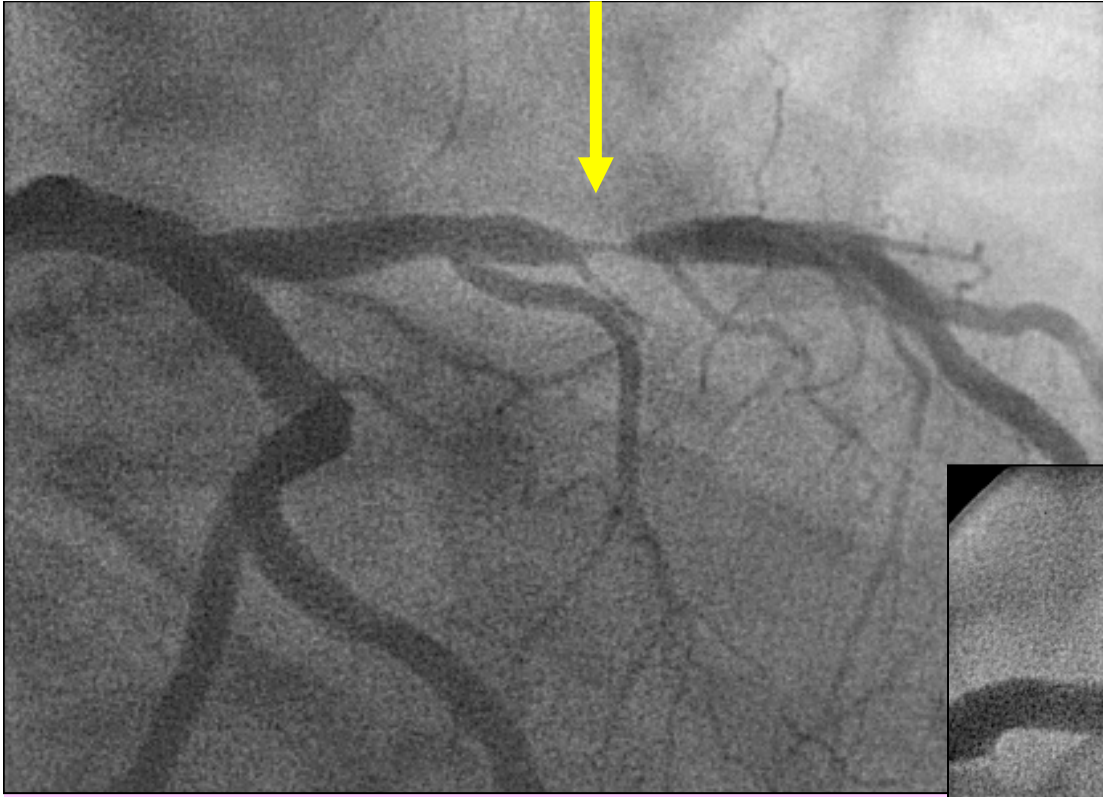
**High pressure is required for full stent expansion.**

**Optimal stent expansion can only be proven with IVUS.**

**Non compliant balloon required for rigid plaques.**

**Stent Length  
is best defined by IVUS**



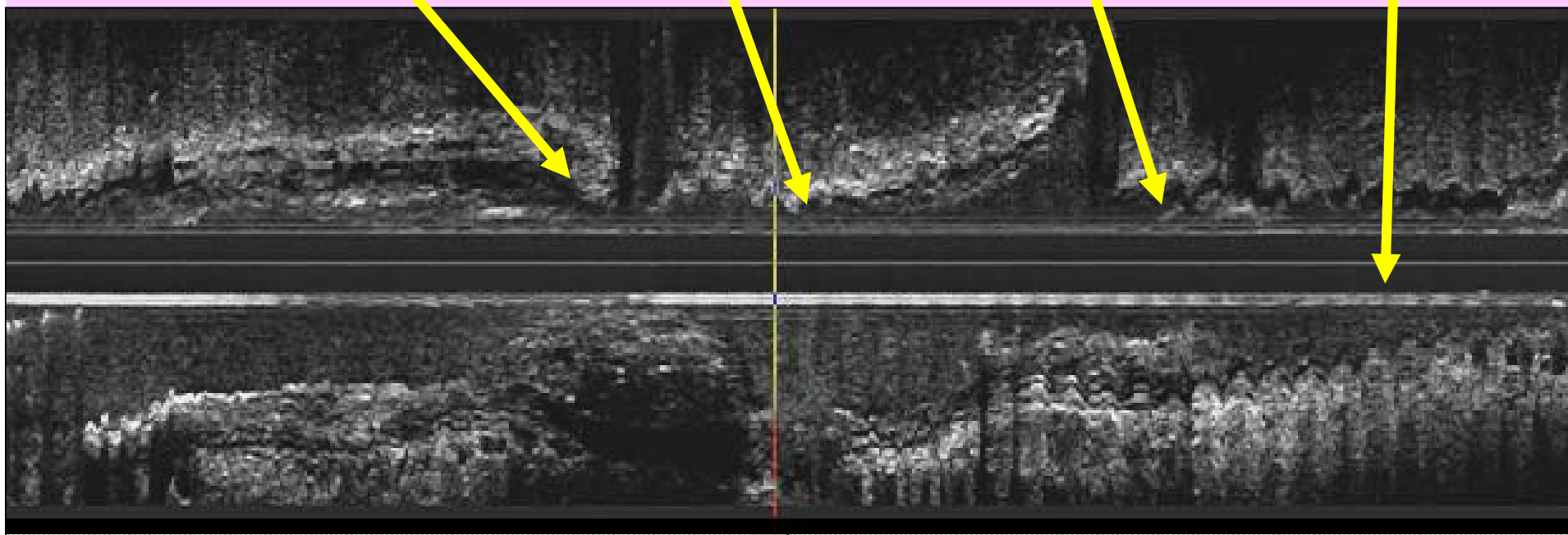
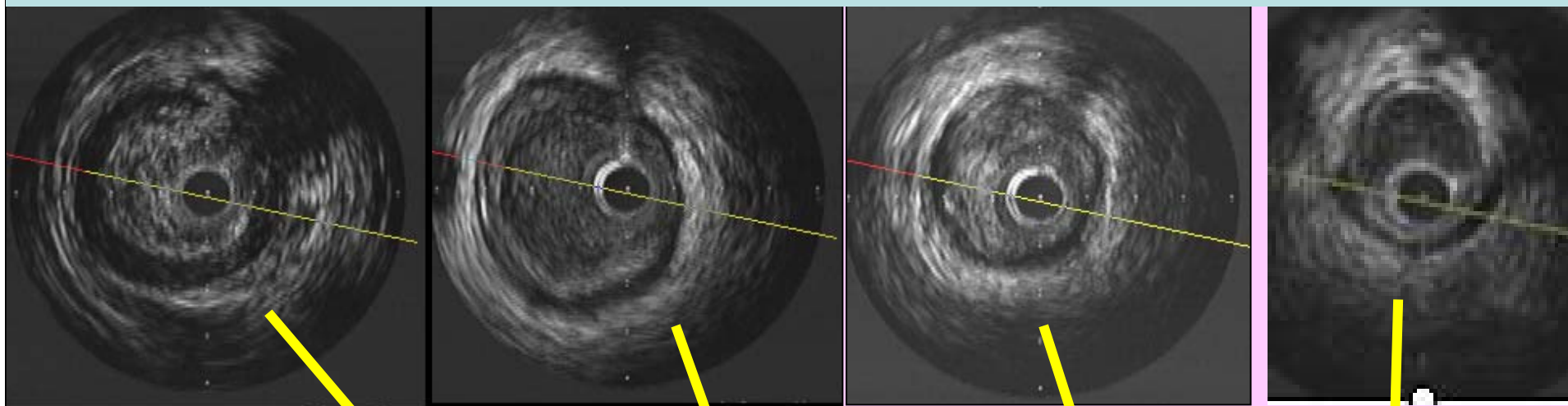


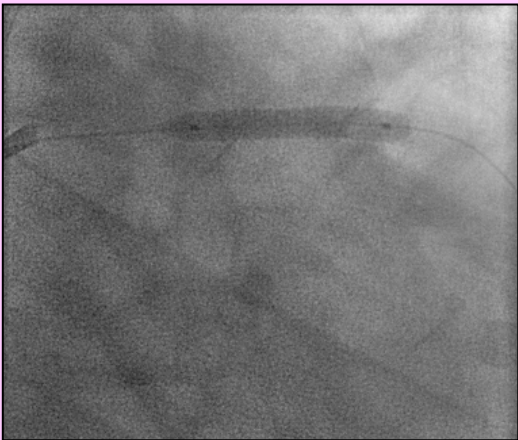
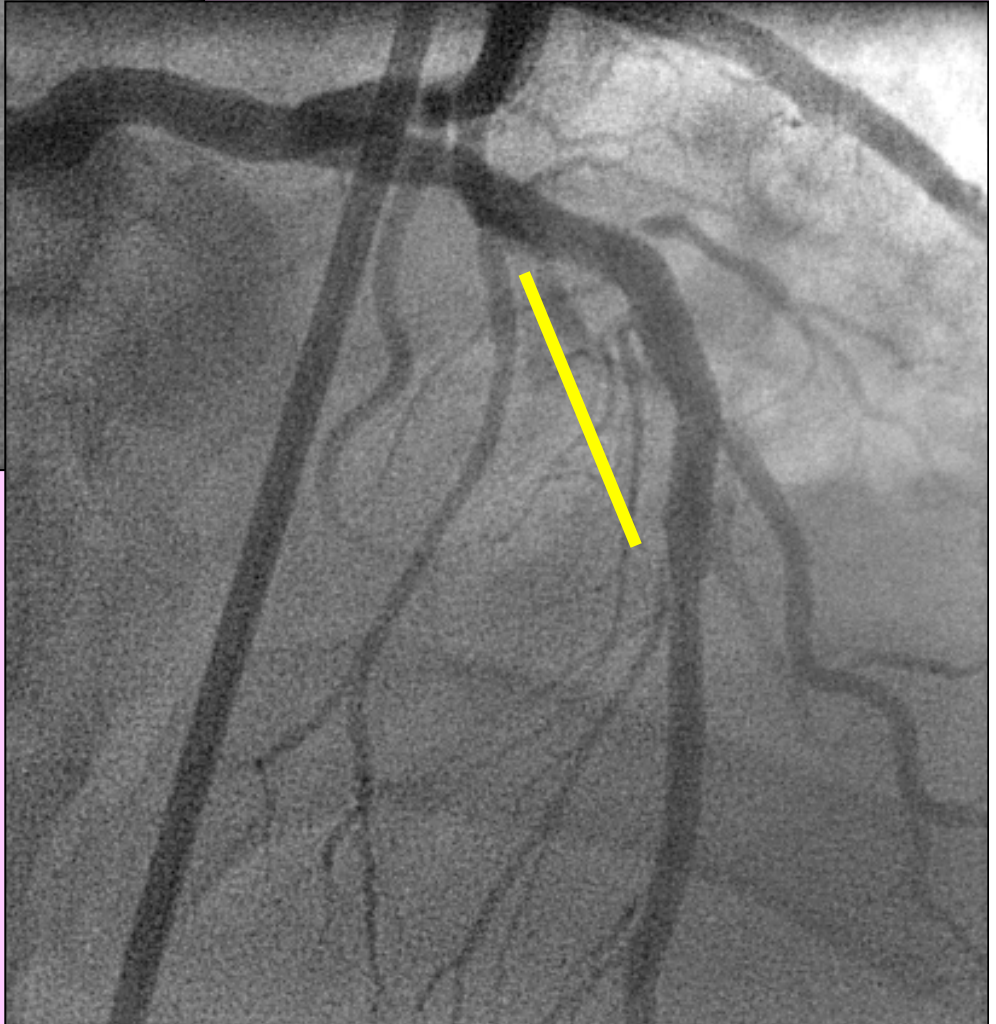
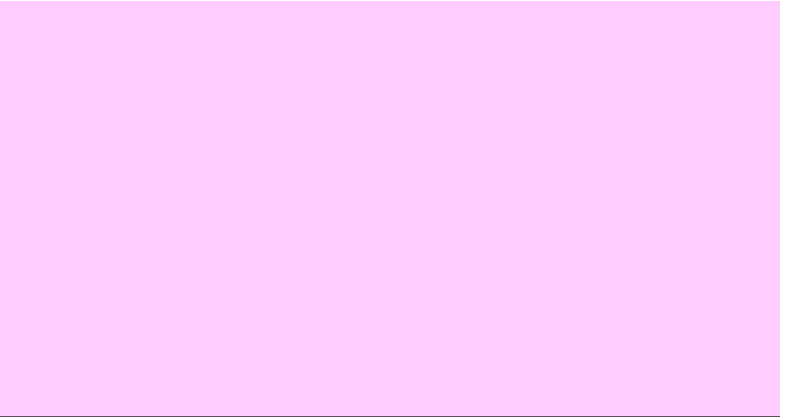
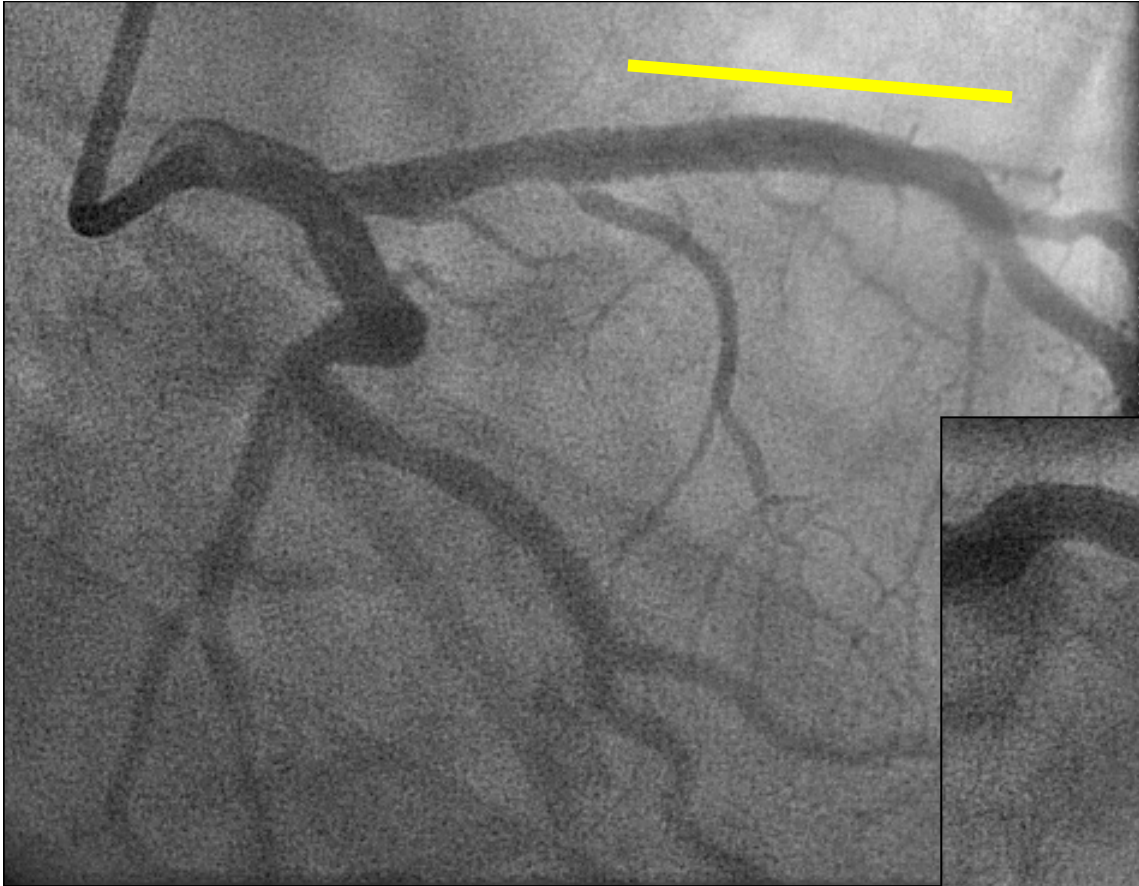
**First Lesion**

**Reference**

**Second Lesion**

**Distal Vessel**





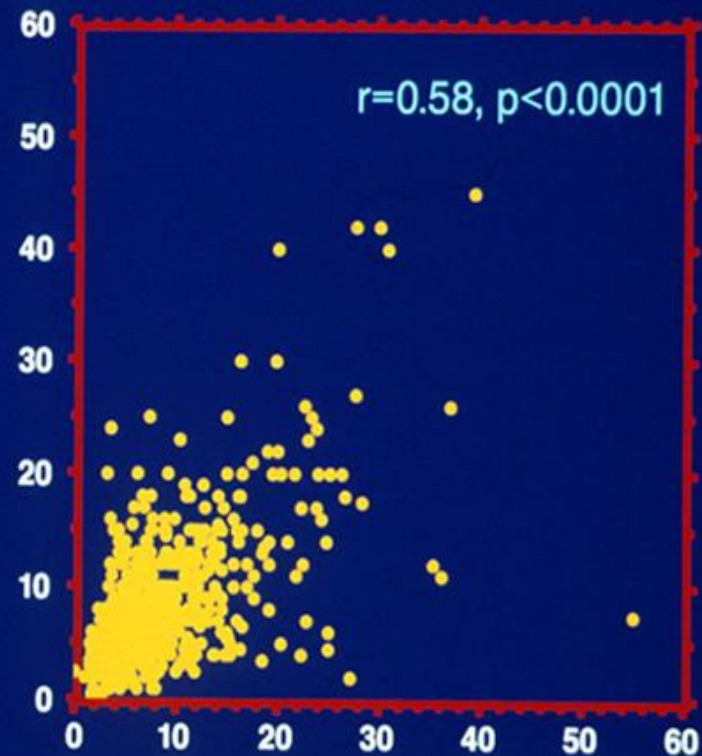
# Lesion Length: IVUS vs QCA

WHC: Mintz et al 1996

Lesion length  
by QCA has very  
poor correlation  
with the  
true lesion length  
by IVUS

WHC. Mintz et al

IVUS lesion length (mm)



QCA lesion length (mm)

# **Third Conclusion**

**IVUS guidance  
allows for better definition of lesion  
length, and stent length.**

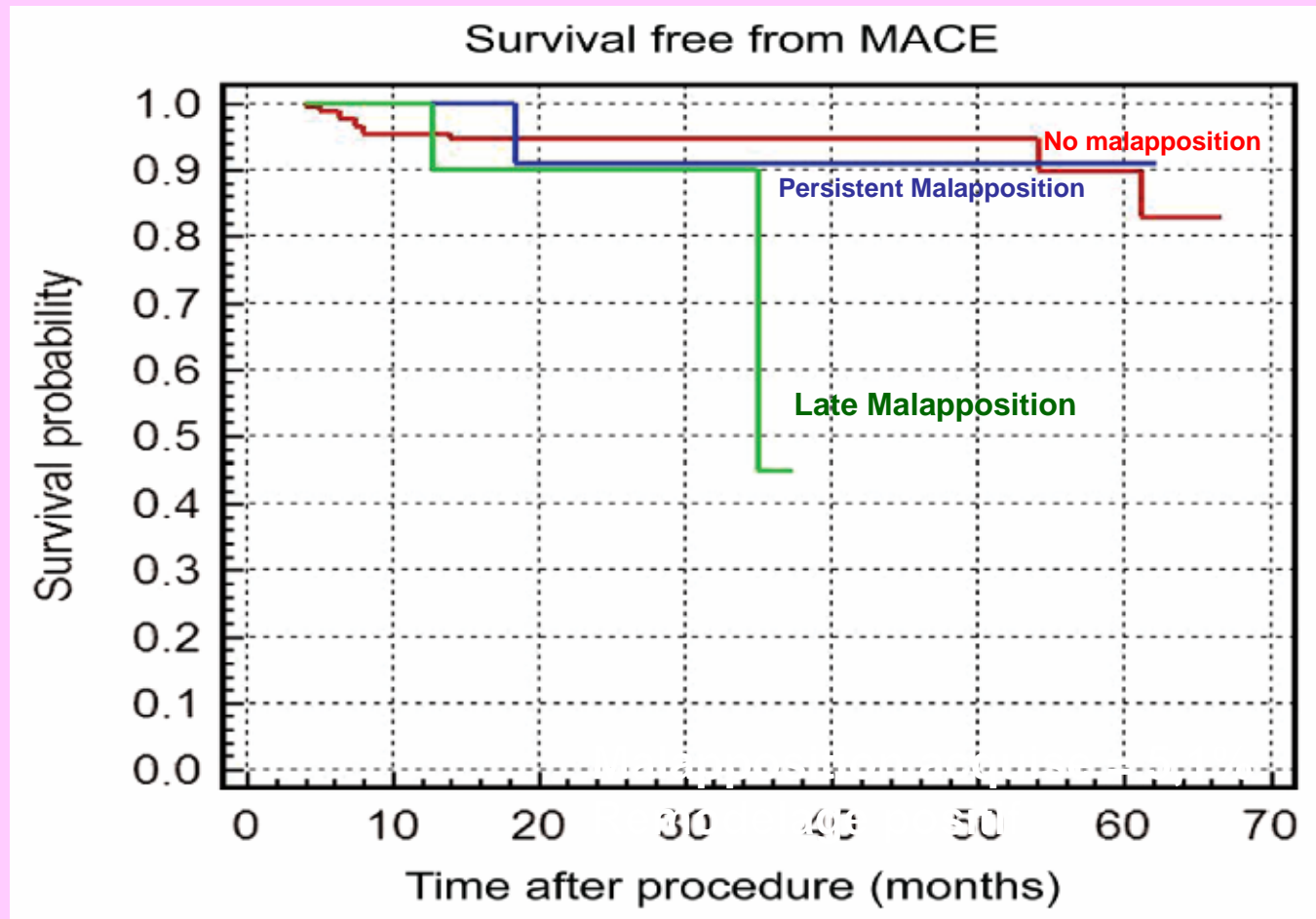
# **Implications of Stent Malapposition**

- **Stent Malapposition has no Clinical Consequences:**
  - MY Hong. Circulation
  - Sirius Trial
  - Taxus Metanalysis
  - WHC SES series
  - Hoffman, Heart 2007
  
- **Stent Malapposition can lead to Stent Thrombosis:**
  - Cook
  - Ge

# Early vs. Late Incomplete Apposition in DES

Siqueira, De Souza et al. Eur Heart J 2007; 28: 1304-9

29 months follow up in 195 DES (175 SES + 20 PES) with IVUS at 6-8 months



5.1% with acquired malapposition: due to positive remodeling



# Fourth Conclusion

**Malapposition of portions of the stent occurs in  $\pm 12\%$  of cases.**

**Malapposition (mild to moderate) has no clinical consequences in the first 12 months.**

**Long term outcome still undefined.**

**Late acquired malapposition has more events.**

**Full stent Expansion more important than Malapposition.**

# **Vessel Size Remodeling.**

## Positive Remodeling:

large plaque mass.

plaque is soft.

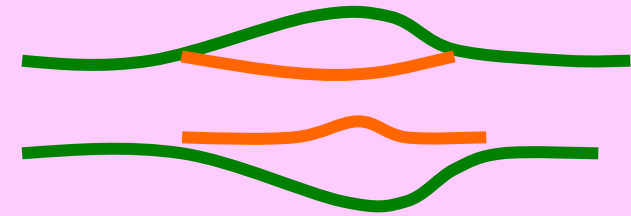
more likely to have thrombus.

associated with higher CRP.

More common in young people.

Very common in acute coronary syndrome.

More common no reflow during PCI.

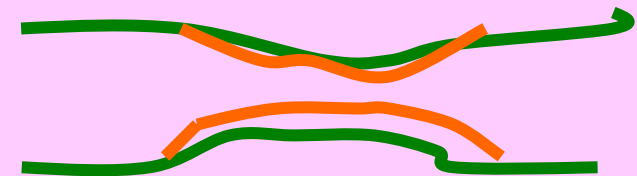


## Negative Remodeling:

less plaque mass

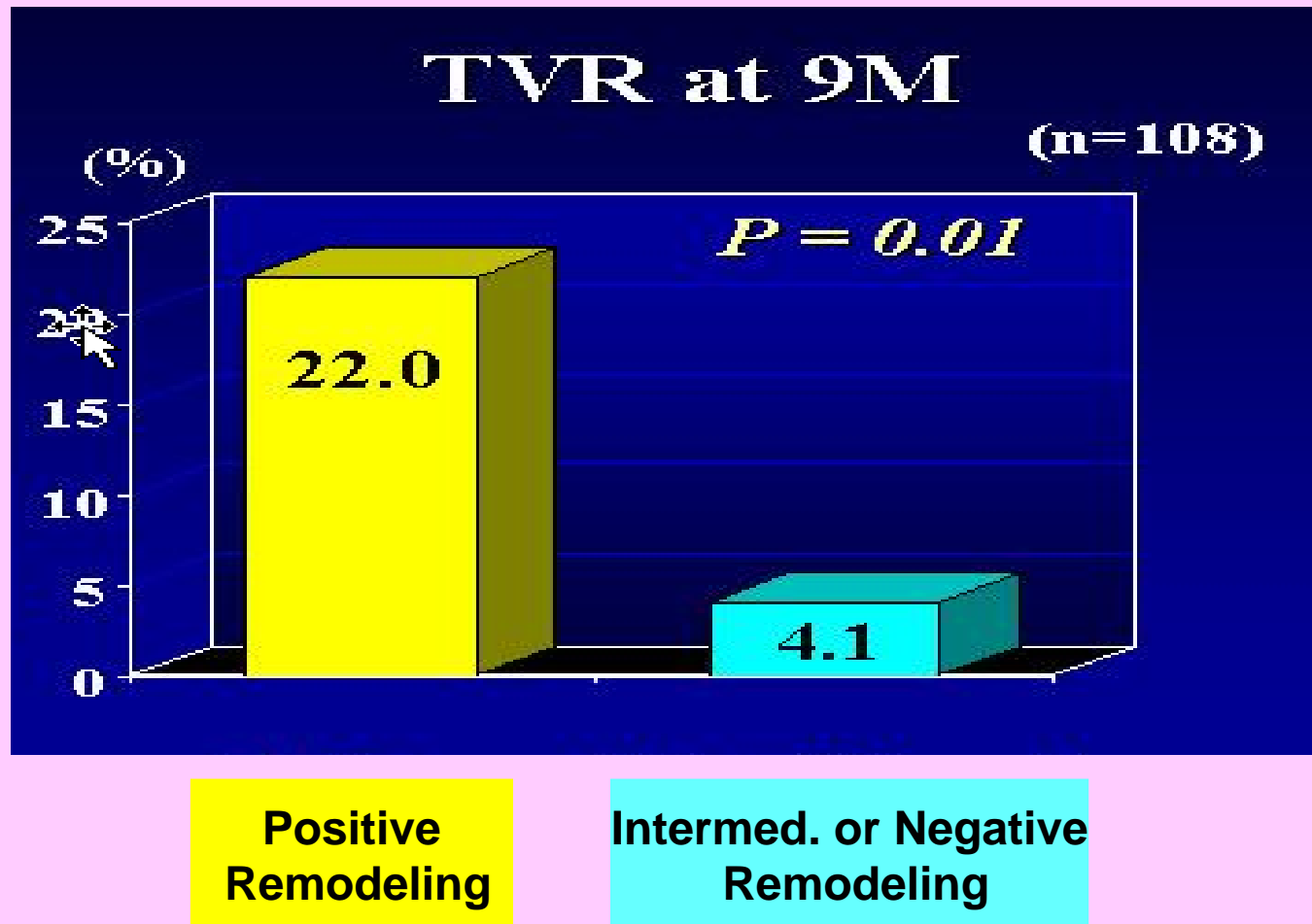
plaques are fibrotic.

less likely to have thrombus.



# Vessel Remodeling and ISRS

Okura et al. JACC 2001, 37: 1031-35

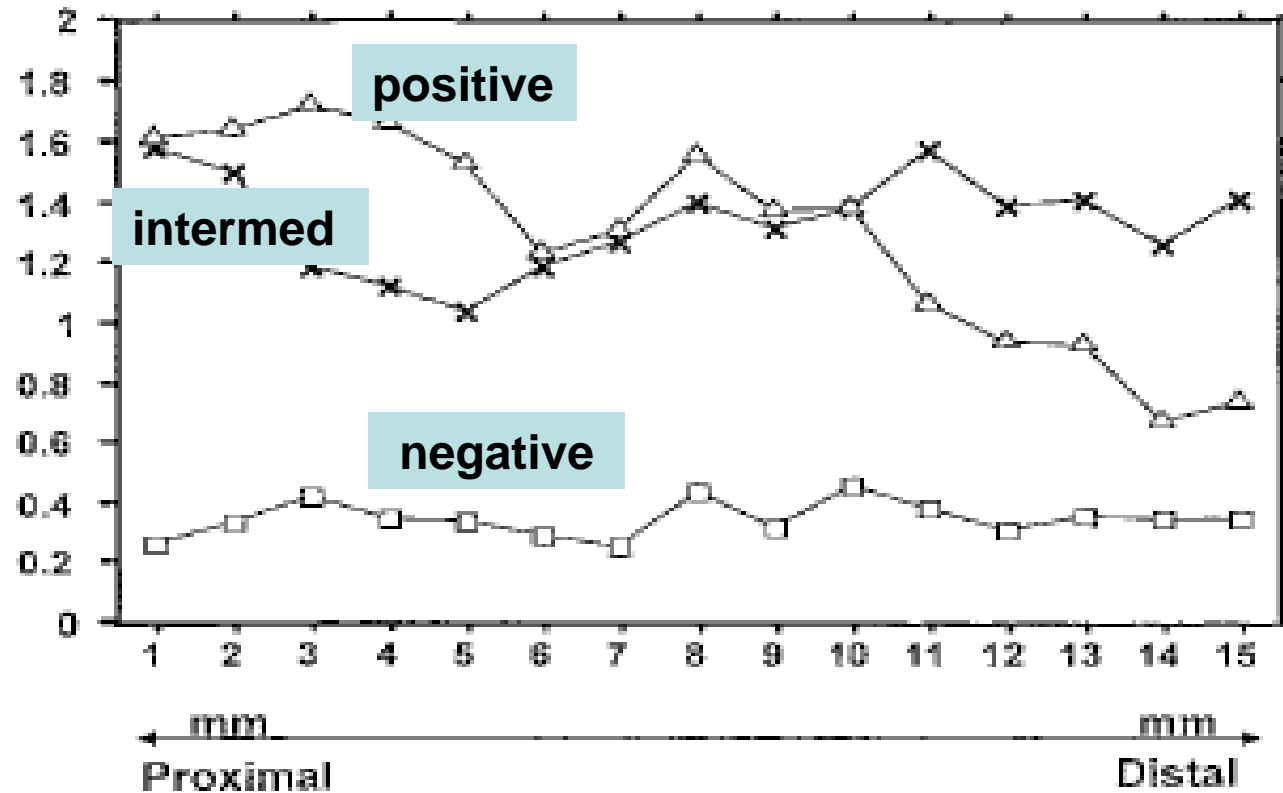


# Remodeling and RS in DES.

Mintz, Park et al. *Circulation*. 2003;108:1295-8

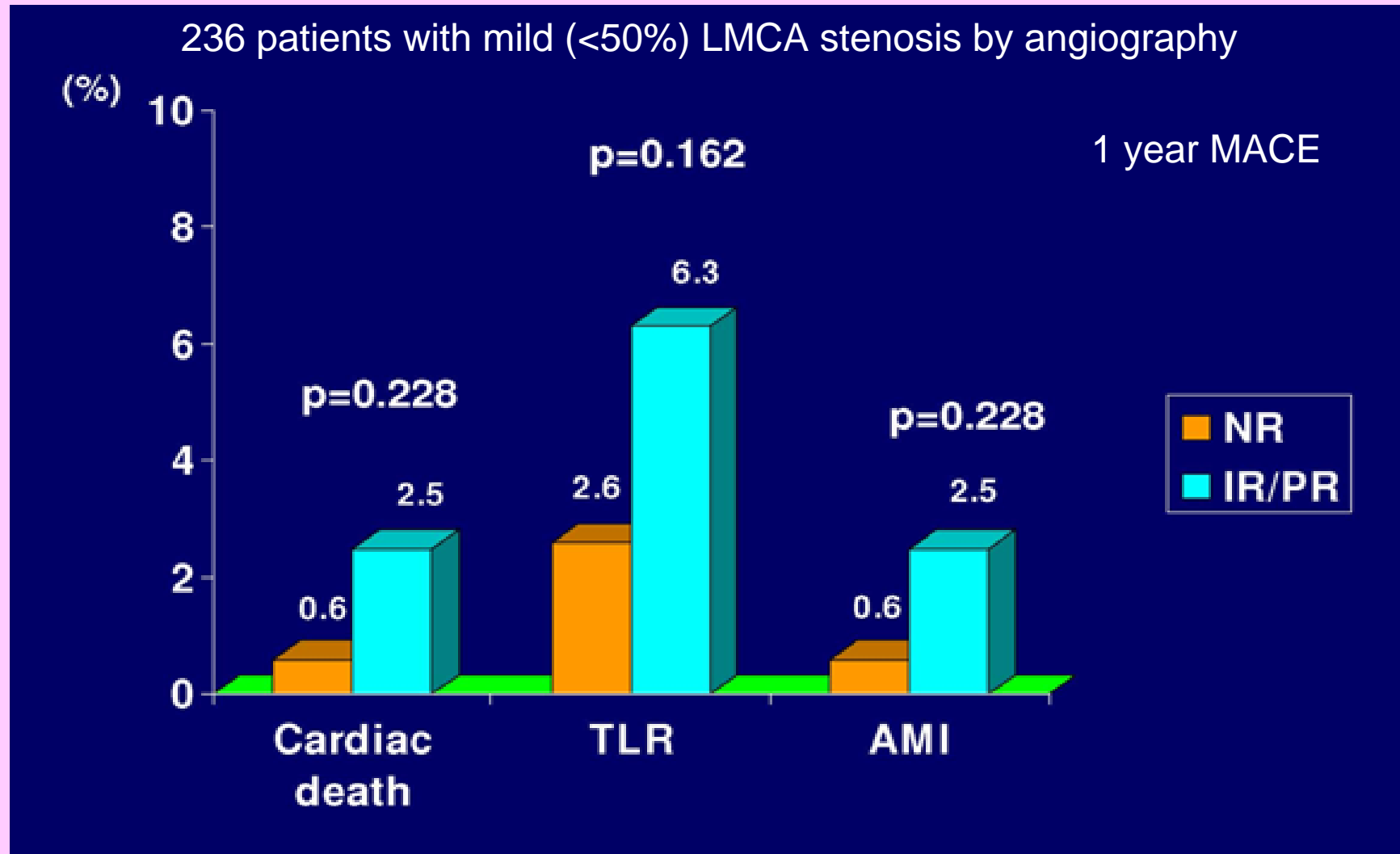
ASPECT (ASian Paclitaxel-Eluting Stent Clinical Trial)

IH CSA (mm<sup>2</sup>)



# Mild LMCA Disease and Remodeling.

WHC: YJ Hong et al. TCT 06



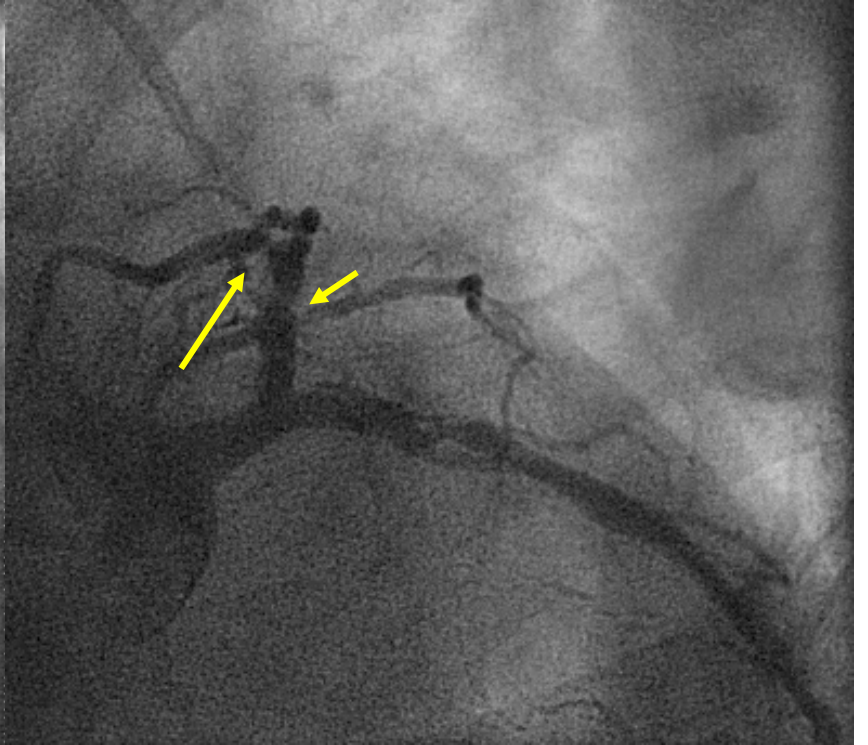
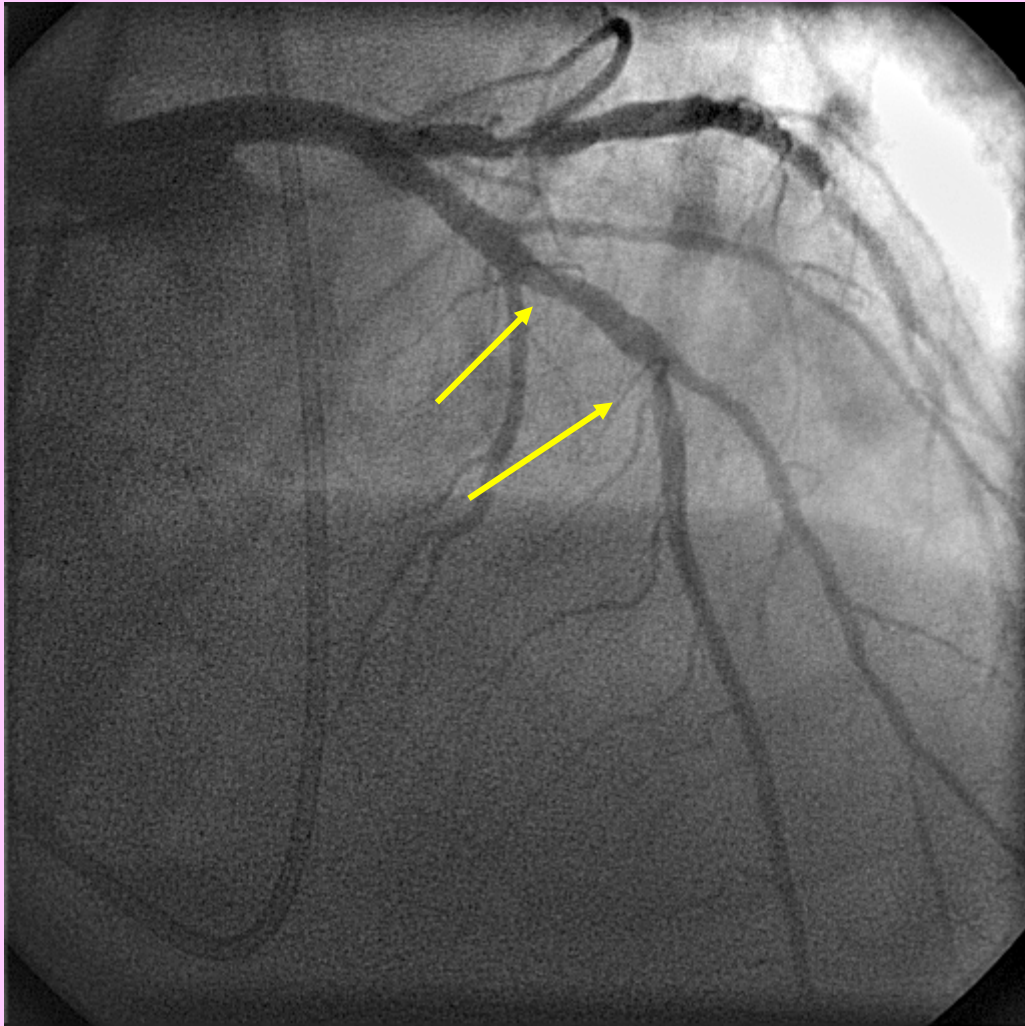
# **Fifth Conclusion**

**Lesions with positive remodeling have more restenosis.**

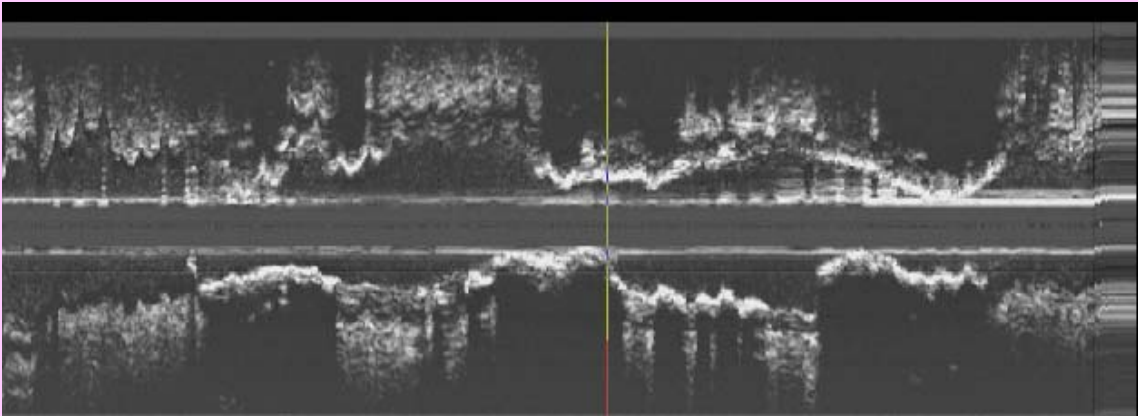
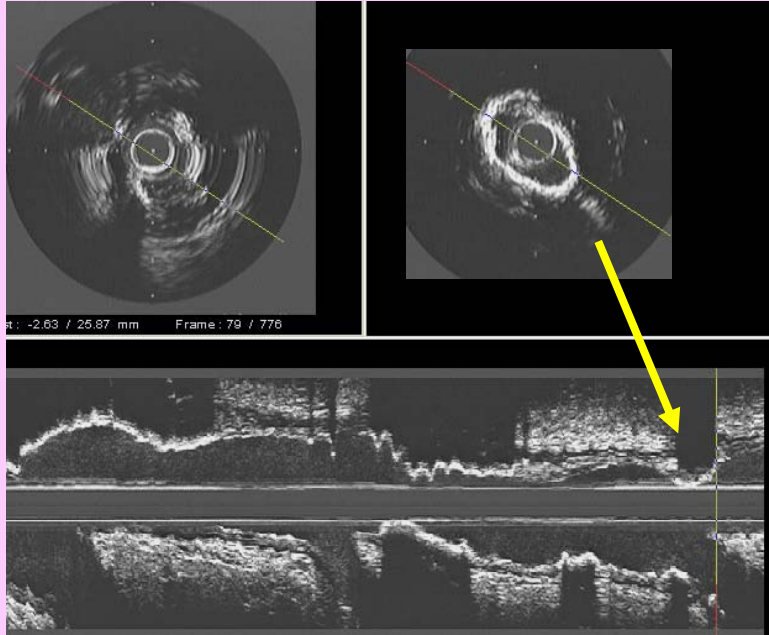
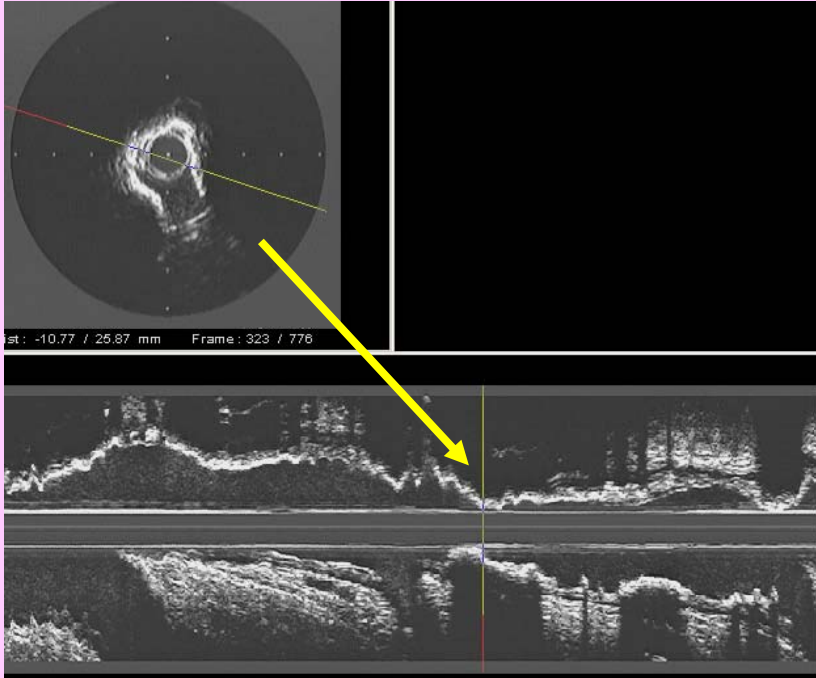
**Strategies to minimize restenosis are most important in this group**

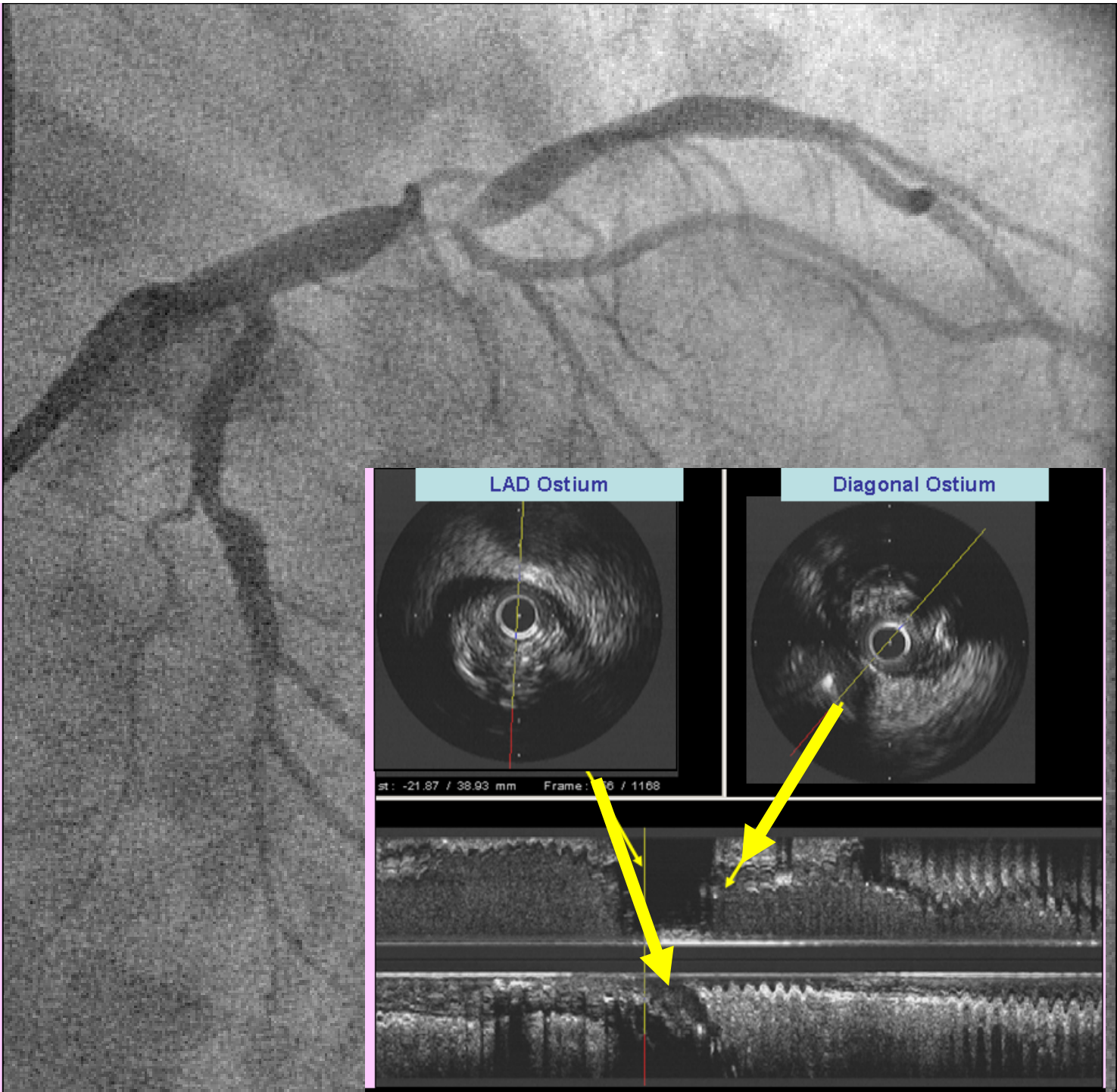
# **Calcified Lesions and Ostial Lesions**



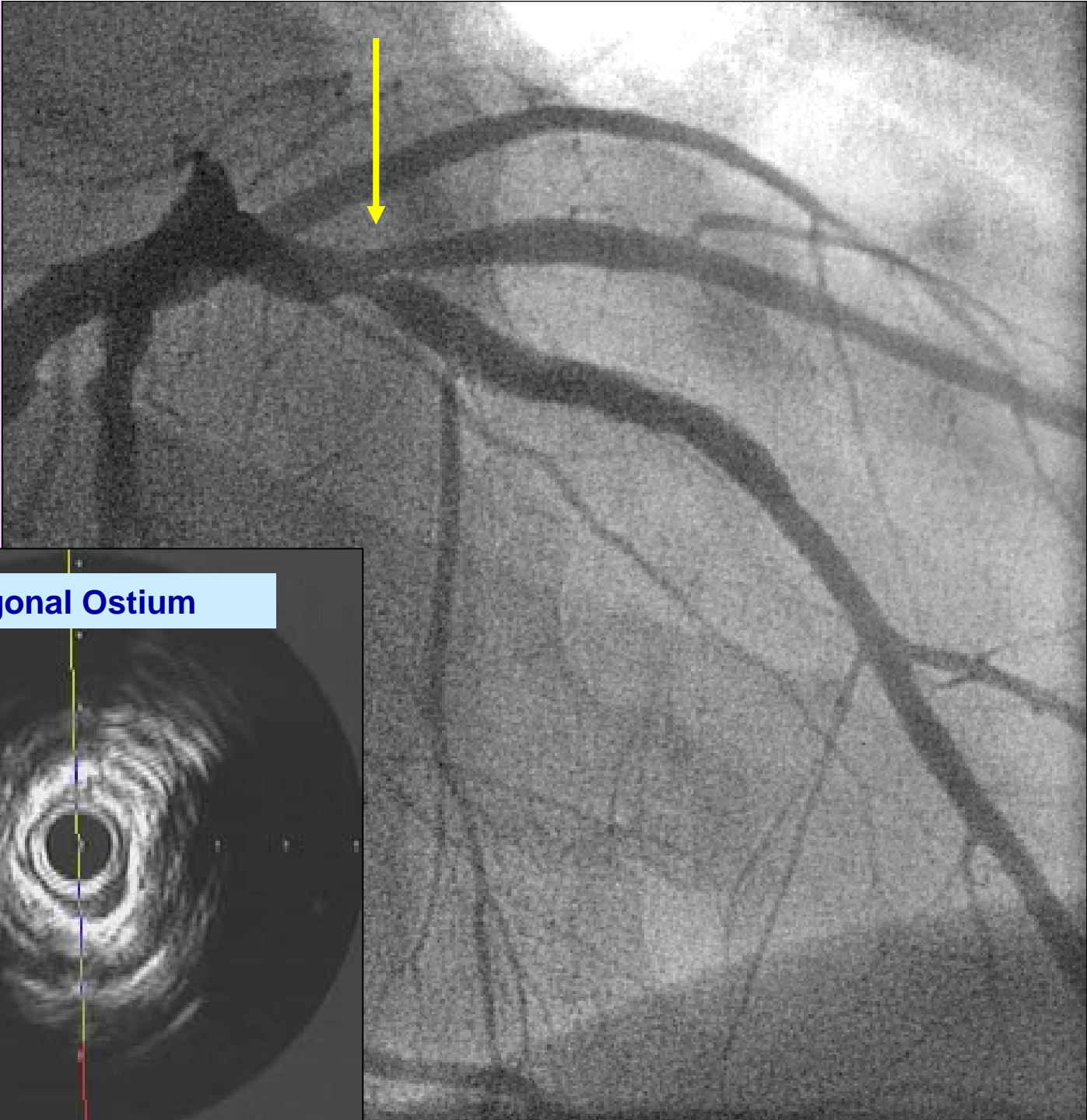


# IVUS of LAD

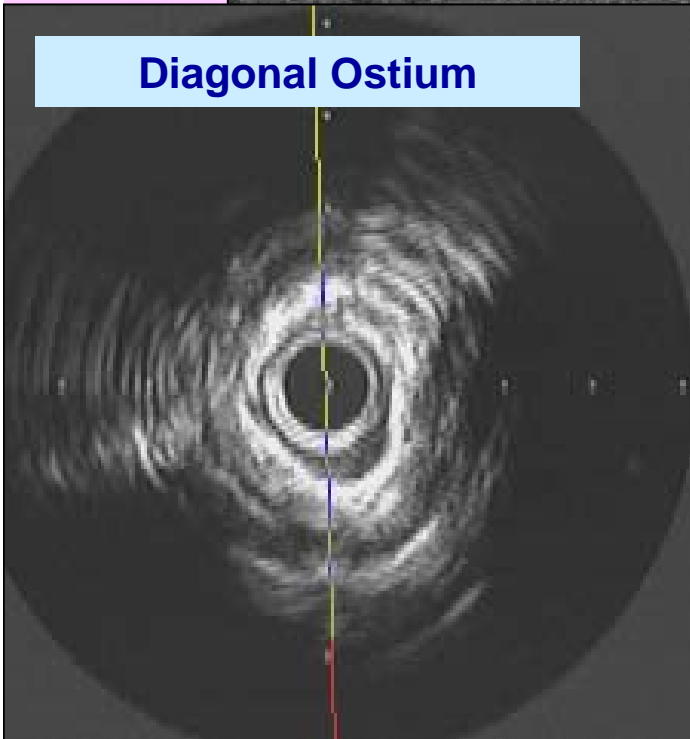








**Diagonal Ostium**



# **Sixth Conclusion**

## **IVUS:**

**Finds unsuspected severe calcification.**

**Permits optimal planning and outcome of stenting in ostial and bifurcation lesions.**

**Unfavorable lesions are not dilated and are sent for surgery.**

# Summary Conclusions

**Stent expansion to at least 5.5 m<sup>2</sup> has less restenosis and less thrombosis.**

**Need for high deployment pressure.**

**Adequate Expansion is different from Malapposition**

**Early Malapposition not proven to have clinical consequences. Late acquired malapposition has more events.**

**IVUS allows optimal stenting of calcified, ostial and bifurcation lesions.**