

Acute Myocardial Infarction
and underlying stenosis severity

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**The majority of ACS occur
at the site of mild lesions**



The myth of the “dangerous” plaque

(Vulnerable) Plaque: Facts and Fiction

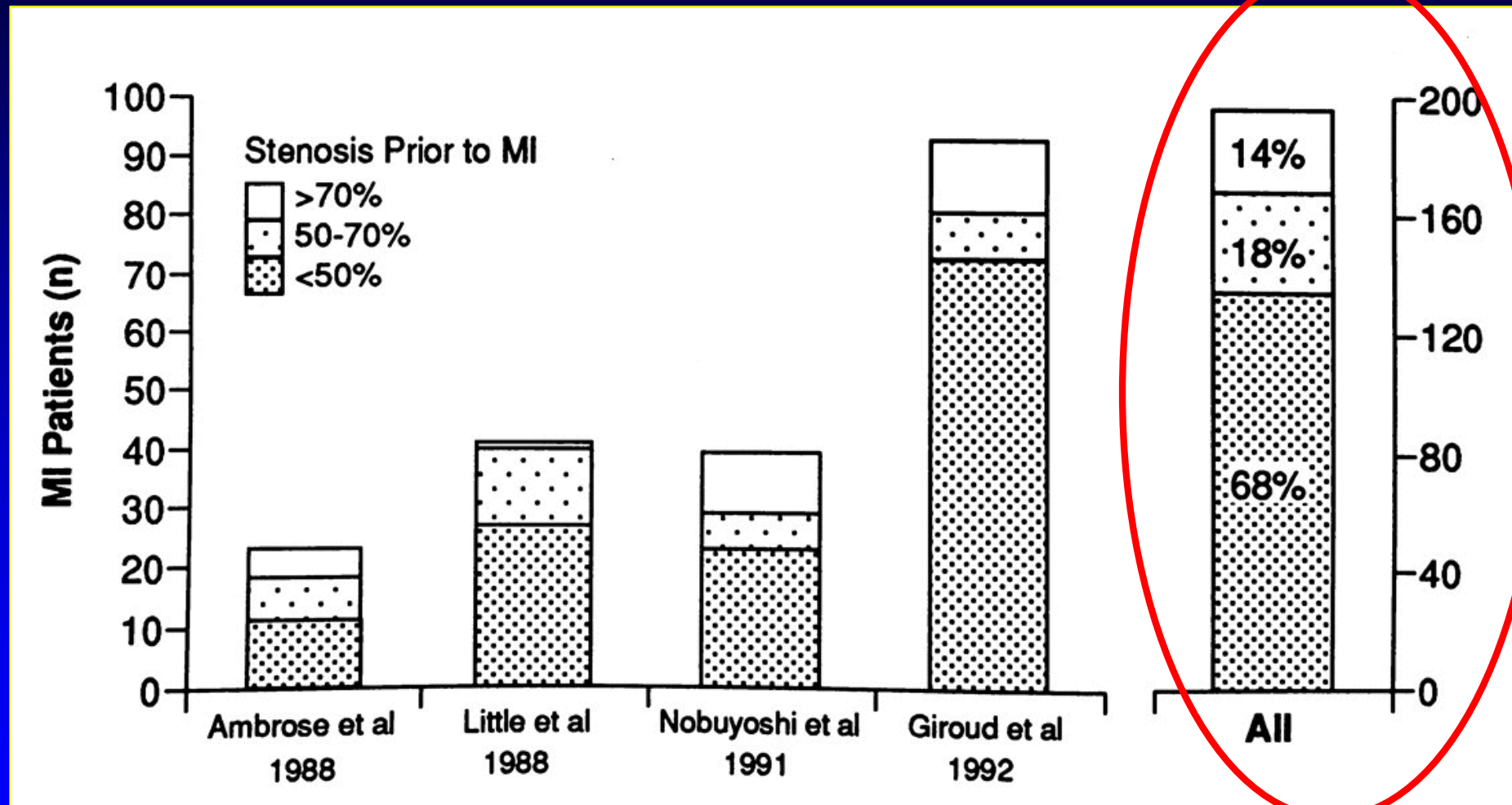
FACTS:

- plaques are very common
- majority of plaques has an excellent prognosis with medical treatment
- only few plaques are vulnerable
- strongest indicator with respect to prognosis is associated **ischemia**

FICTION:

- every plaque is vulnerable
- every vulnerable plaque leads to ACS
- most ACS occurs in mild plaques
- screening of vulnerability can be done by imaging

Underlying Stenosis Severity of Abrupt Total Occlusions



Falk, Shah and Fuster, Circulation 1995

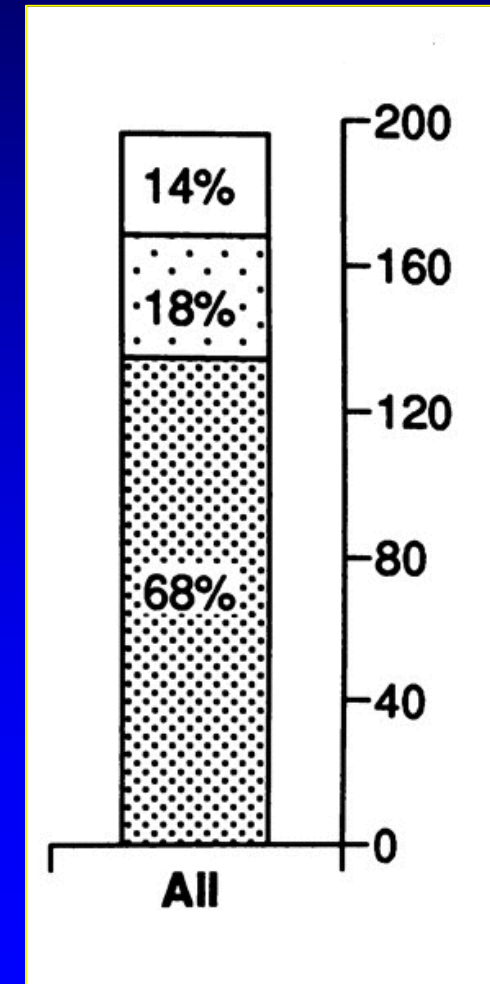
“Acute Coronary Syndromes most often occur at the site of mild stenoses”

Do Myocardial Infarctions Evolve from Mild Stenoses ?

Serial Angiographic (Retrospective) Studies in Patients with MI and a Prior Coronary Angiogram

No QCA, No IVUS but unblinded “eyebolling”

| | Number of Patients | DelayAngio-MI |
|---------------------------------------|--------------------|--|
| Ambrose et al <i>ACC</i> 1988 | 23 | 1 month to 7 years |
| Little et al. <i>Circulation</i> 1988 | 42 | 4 days to 6.3 years |
| Giroud et al. <i>AJC</i> 1992 | 92 | 1 month to 11 years |
| Moise et al. <i>AJC</i> 1984 | 116 | 39 months |
| Webster et al <i>JACC</i> 1990 | 30 | 55 months |
| Hackett et al <i>AJC</i> 1989 | 10 | 21 months |
| Total | 313 | A few days to 11 years (average <u>3.9 years</u> !!!) |



THE MYTHE OF THE “DANGEROUS” PLAQUE

The hypothesis of the occurrence of acute MI on such previously non-significant plaque is based upon

- **6 small retrospective studies**
- **with a total of 313 patients**
- in whom the “index” catheterization was performed an average of **3.9 years** before the acute event

All other literature (21 “meta-analyses” and hundreds of references), refer to these 6 studies !!!

To investigate the ***risk of an individual plaque or stenosis*** to rupture, not a retrospective analysis of selected patients experiencing an acute coronary syndrome should be studied, but ***prospective follow-up over years*** is mandatory in unselected patients !

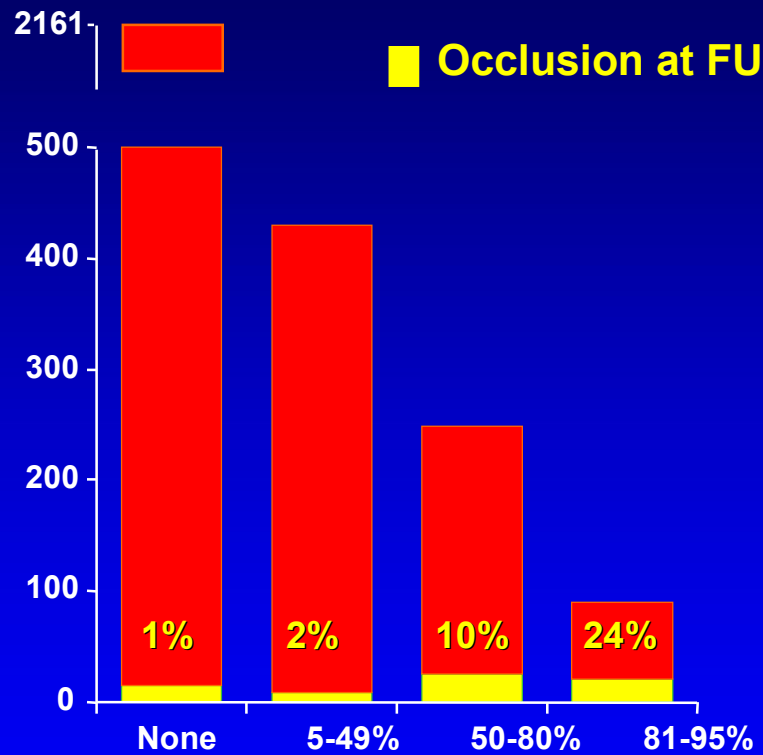
In such study in >2500 stenoses, performed by Aldermann, Stenosis severity was strongly correlated to the risk of occlusion and events:

The risk of a severe stenosis was 20 x higher than for a non-significant plaque.

Similar data have been obtained by IVUS and at pathologic Studies.

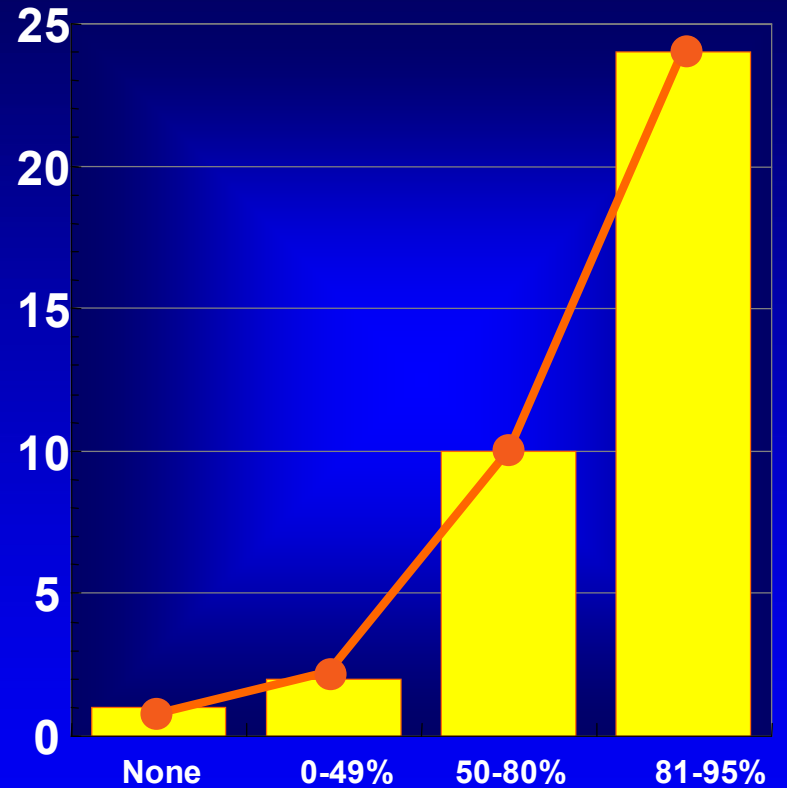
Coronary Occlusion at 5 Years as a Function of Stenosis Severity

Coronary Segments (n)



Stenosis Severity at Baseline

% Occlusion at 5 Year



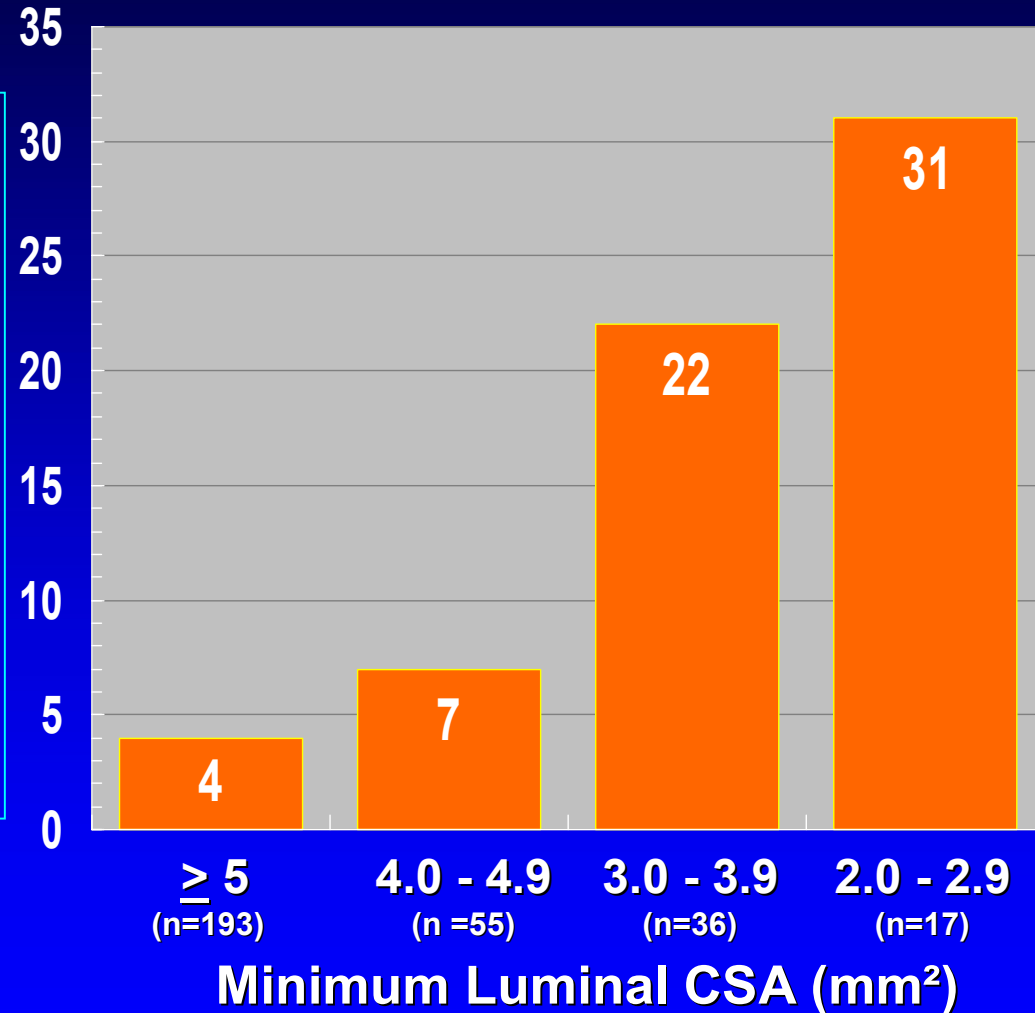
Stenosis Severity at Baseline

Adapted from Alderman et al. J Am Coll Cardiol 1993

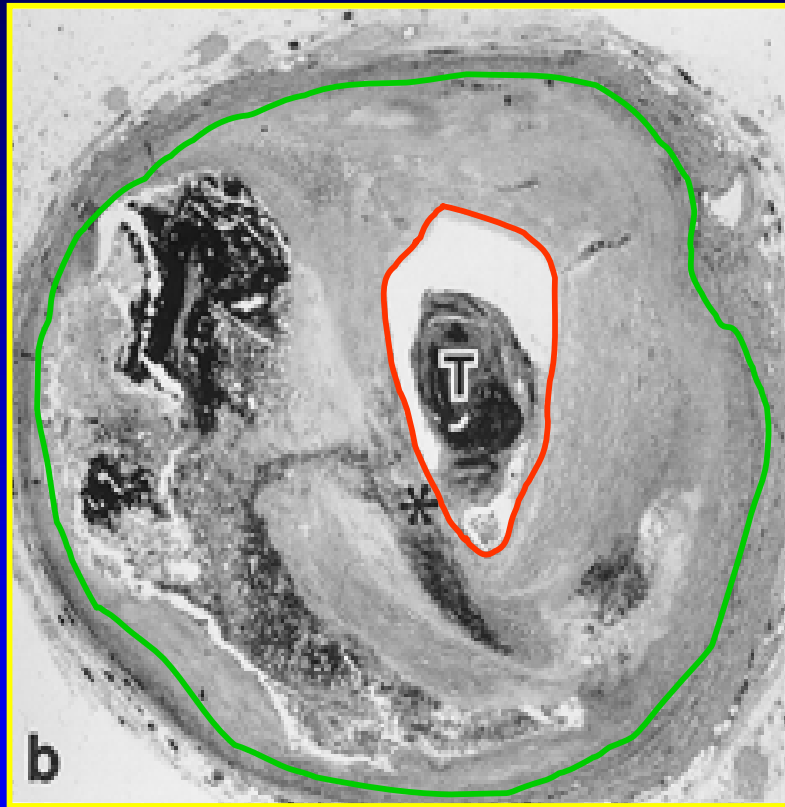
IVUS Examination: Clinical Outcome after Deferred Interventions

- 300 pts; 13 mos F-U
- CSA = only independent predictor of events
- Independent predictors of TLR: diabetes, min CSA, AS
- When CSA > 4 mm²:
 - event rate: 4%
 - TLR: 2.8%

Any Cardiac Event (%)

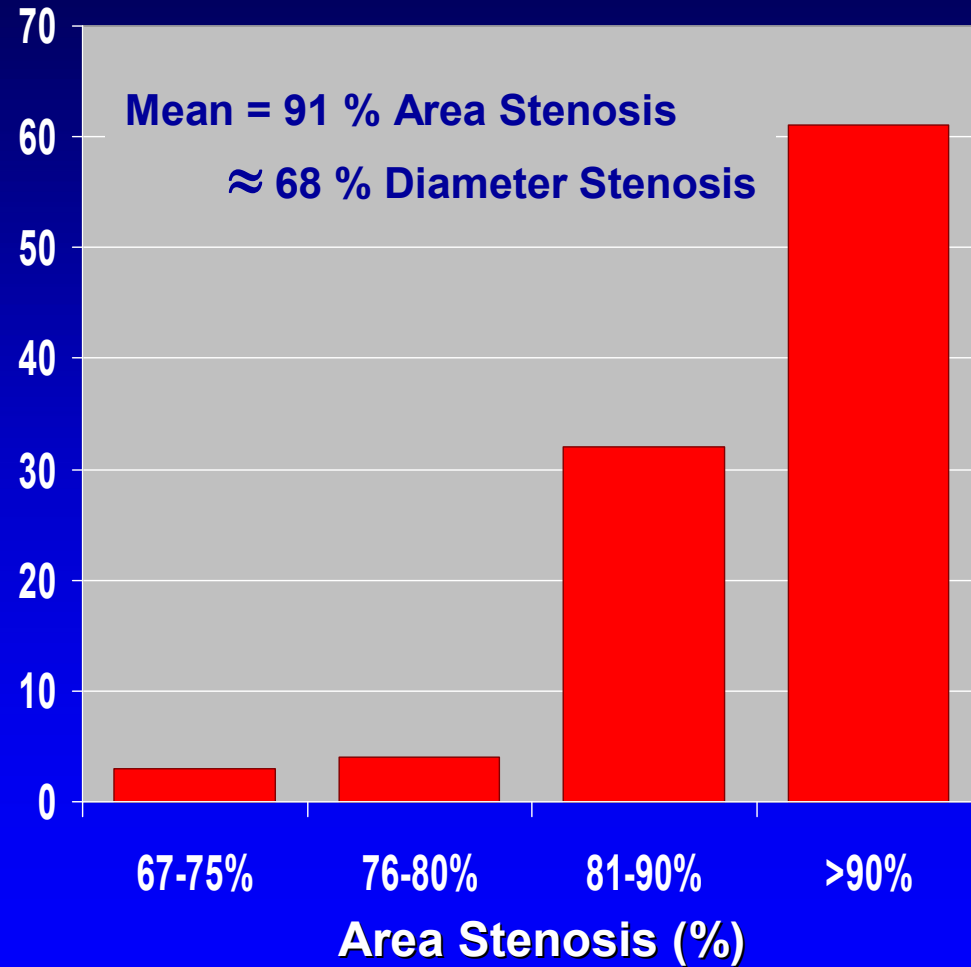


Severity of Coronary Atherosclerosis at Sites of Plaque Rupture with Occlusive Thrombosis



$$\text{Area Stenosis} = \frac{\text{Vessel area} - \text{lumen area}}{\text{Vessel area}}$$

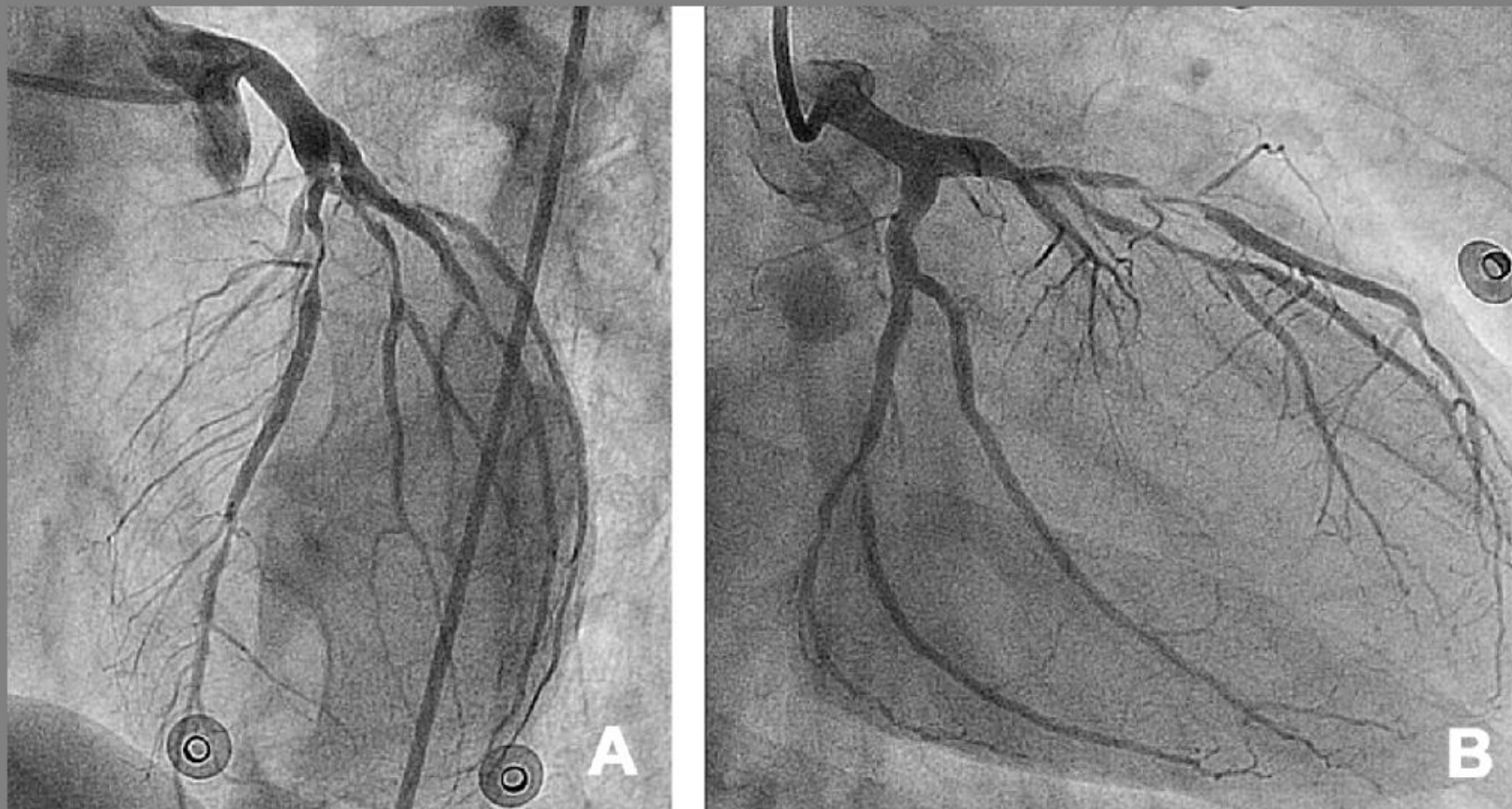
% of Total Number (n=182) of Stenoses



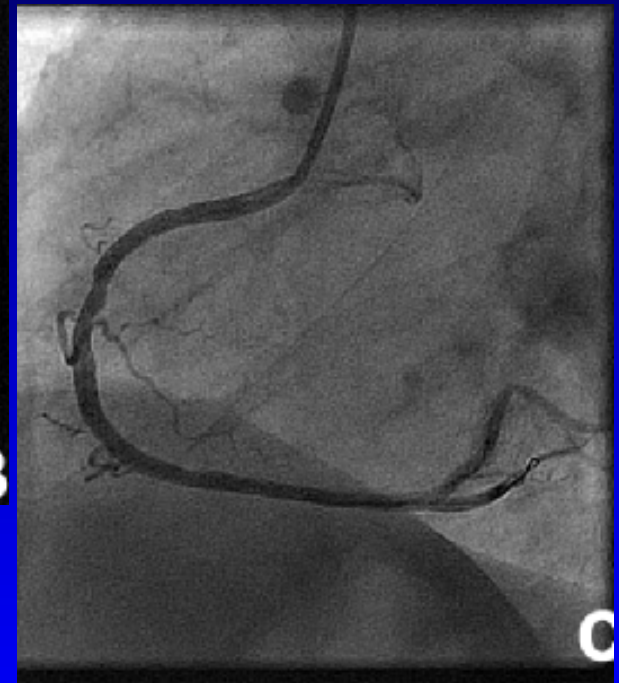
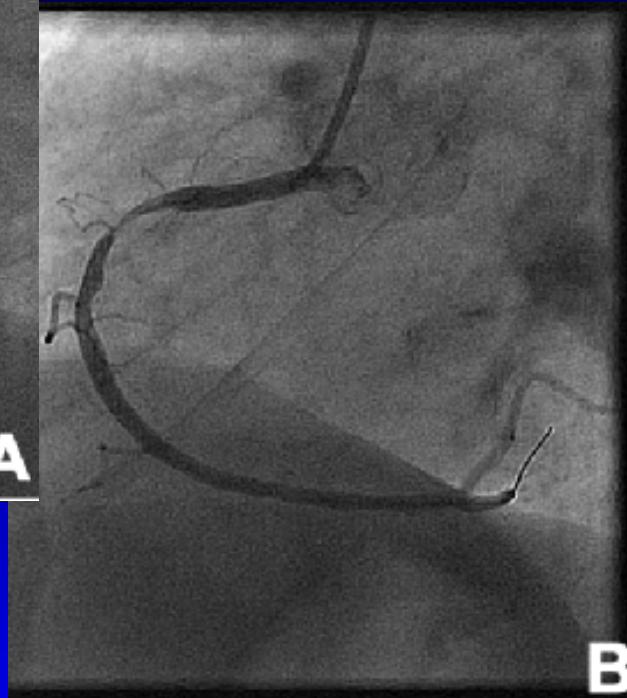
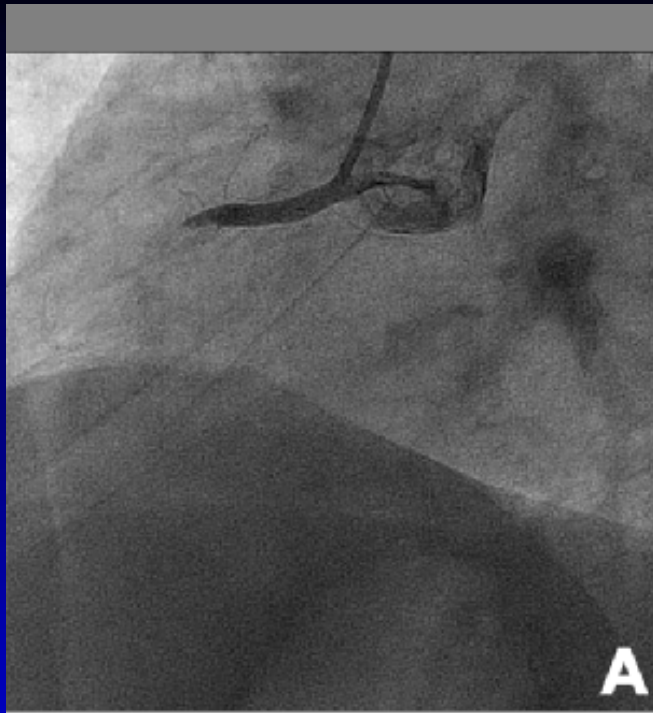
250 consecutive patients with ST-elevation MI in the Catharina Hospital:

- reasonable estimation of pre-infarct stenosis severity possible in 156 patients
- angio's divided in 4 groups:
 - group 1: spontaneous reperfusion at first angio view
 - group 2: reperfusion after easy and uncomplicated wiring
 - group 3: reperfusion after non-trivial wiring
 - group 4: no reperfusion.

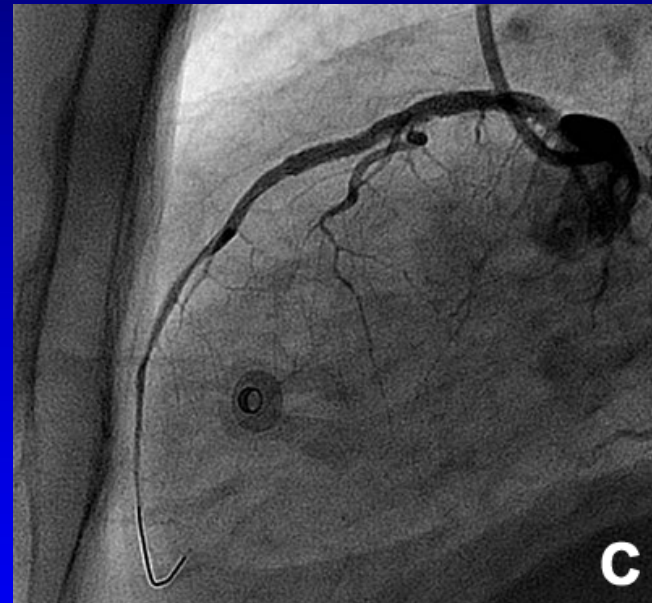
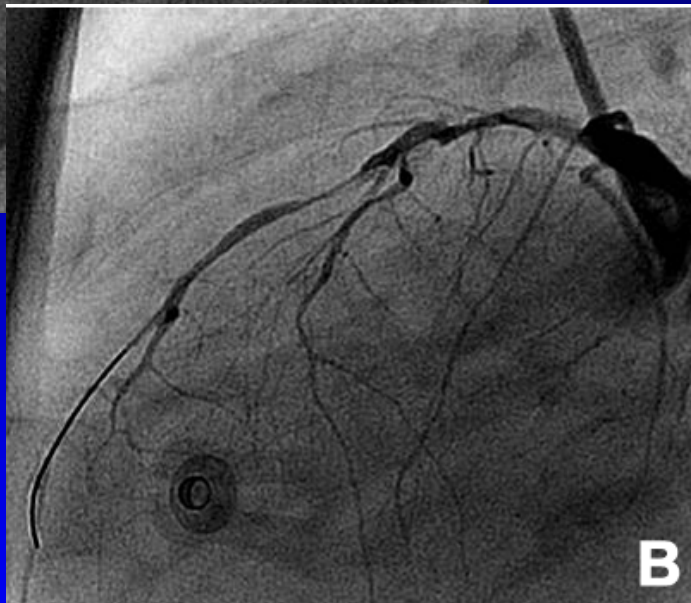
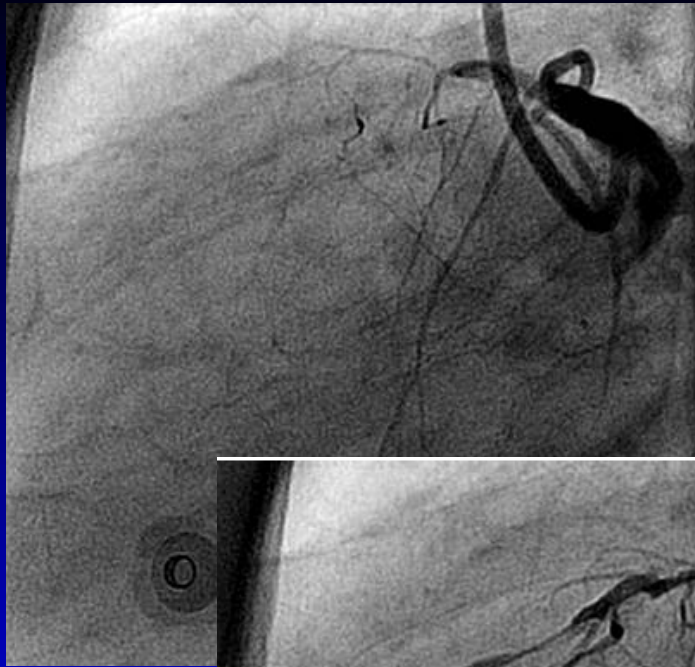
→ angiographic assessment possible in gr 1 & 2



Group 1: spontaneous reperfusion at first angio



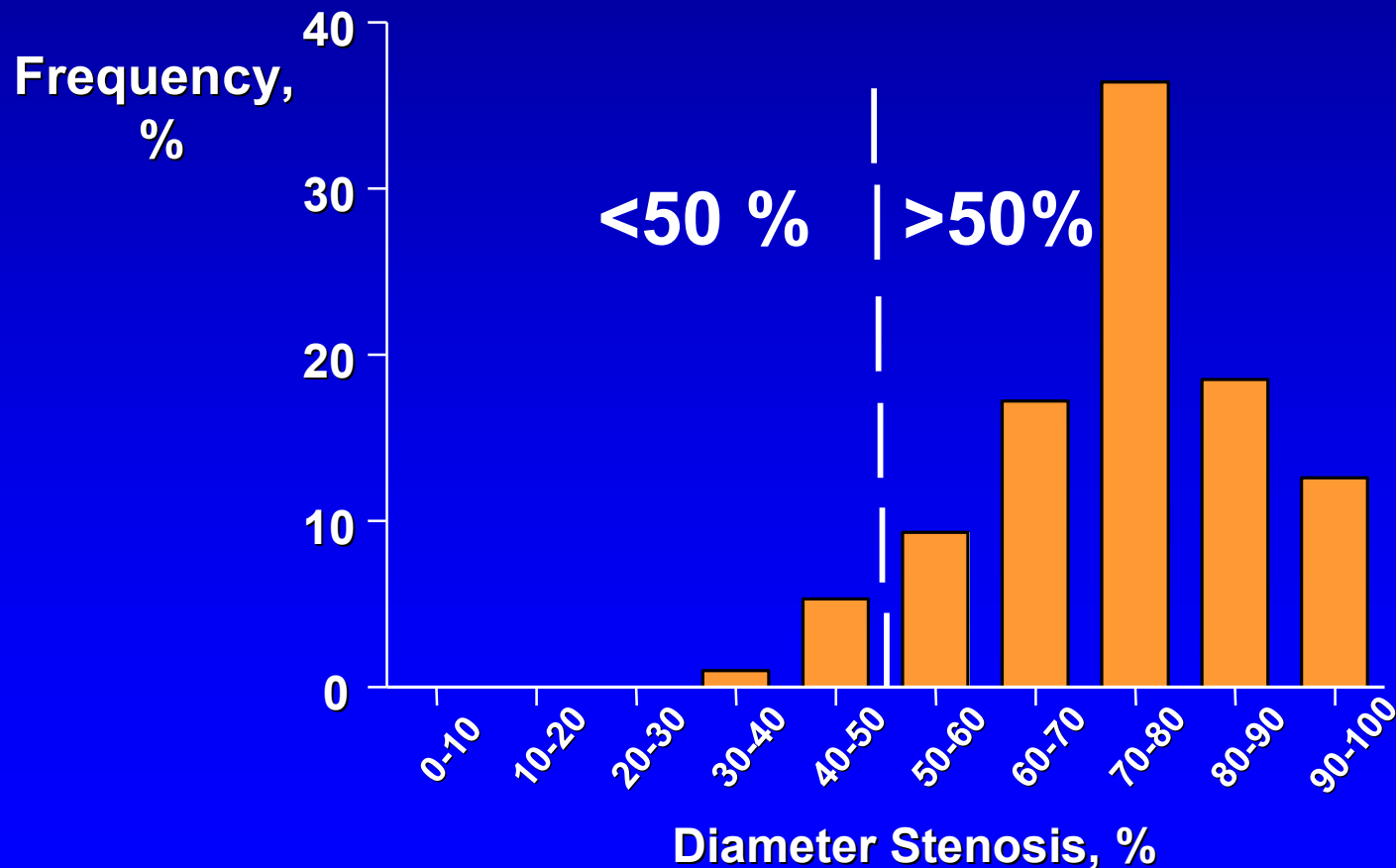
Group 2: reperfusion after easy and uncomplicated wiring



Group 3: reperfusion after complicated wiring
→ not suitable for analysis

Stenosis Severity at Primary PCI in AMI

- 156 stenoses with distal flow enabling accurate QCA out of 250 consecutive Acute MI's
- In 92 %, underlying stenosis was > 50%
- In 71 %, underlying stenosis was > 70%



250 consecutive patients with ST-elevation MI
in the Catharina Hospital:

- underlying stenosis angiographically significant in 92 % of the cases
- *At meticulous anamnesis, 80 % of patients had recurrent chest pain in the year before the acute myocardial infarction occurred !!*

The fact that acute coronary syndromes “sometimes” occur in relation to a previously insignificant plaque, does not mean that a plaque is more dangerous than a severe stenosis, *because*:

Non-significant “plaques” :

Are 20 x more frequent than severe lesions. So, even if 50% of ACS would be related to such plaque, its individual risk is 20 times lower than the risk of a severe stenosis

Non-significant “plaques” :

Are often not giving complaints and therefore not treated in a similar way as a physiologically significant stenosis (**aspirin, statines, stenting**).

Therefore, the “natural” outcome of severe lesions is positively influenced, whereas mild lesions remain silent and progress

CONCLUSIONS:

- In contrary to what is often believed, the majority of acute myocardial infarctions occur on previously significant stenosis, especially when also hemodynamically significant .
- The risk of an individual mild or moderate plaque to rupture is extremely small and definitely $< 1\%$ per year with good medical treatment. (*Defer study, Courage trial*)
- In 80% of cases, AMI is preceded by repetitive episodes of ischemia in the year before
- PCI of (hemodynamically) significant stenosis makes sense, relieves angina and often improves outcome (*FAME study !*)
- non-significant stenosis can better be treated medically

COURAGE TRIAL: SOME CRITICAL NOTES

- How representative is the Courage Trial?
 - *only 6% of eligible patients were truly included*
- **Two-way negative bias for PCI group:**
 1. *In PCI group, selection of lesions to be stented was on the basis of angiography → at least 30% unnecessary stents, which unfavourably affects prognosis*
 2. *In PCI group, also a number of ischemic lesions must have been missed, which also unfavourably affects prognosis (ACIP-trial, Circulation 1996)*

In terms of functional class the PCI group did better than the medical group, ***particularly in patients with proven ischemia !***