INSTITUT CARDIOVASCULAIRE PARIS SUD

# Recent guidelines in LM & bifurcation PCI

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- In the last five years , I received  research grants or speaker fees or I am/was consultant for: Abbott Vascular, Asahi, Astra Zeneca, AVI, Boston Scientific, Biotronik, Colibri, Cook, Cordis, Daichi-Sankyo, Eli-Lilly, Iroko, Medtronic, Terumo. I am currently minor shareholder & general mamager of CERC

# Guidelines on myocardial revascularization

## The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)‡

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# 2011 ACCF/AHA/SCAI Guideline for Percutaneous Coronary Intervention

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Society for Cardiovascular Angiography and Interventions

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# Left main

# ‘Heart Team’

**Table 4** Multidisciplinary decision pathways, patient informed consent, and timing of intervention

| | | ACS | | | Stable MVD | Stable with indication for *ad hoc* PCI[a] |
|---|---|---|---|---|---|---|
| | Shock | STEMI | NSTE-ACS[b] | Other ACS[c] | | |
| **Multidisciplinary decision making** | Not mandatory. | Not mandatory. | Not required for culprit lesion but required for non-culprit vessel(s). | Required. | Required. | According to predefined protocols. |

**CLASS I**

1. A Heart Team approach to revascularization is recommended in patients with unprotected left main or complex CAD (14–16). *(Level of Evidence: C)*

**CLASS IIa**

1. Calculation of the Society of Thoracic Surgeons (STS) and SYNTAX scores is reasonable in patients with unprotected left main and complex CAD (13,14,17–22). *(Level of Evidence: B)*

# EU : Left main

**Table 9** Indications for coronary artery bypass grafting vs. percutaneous coronary intervention in stable patients with lesions suitable for both procedures and low predicted surgical mortality

| Subset of CAD by anatomy | Favours CABG | Favours PCI | Ref. |
|---|---|---|---|
| 1VD or 2VD - non-proximal LAD | IIb C | I C | — |
| 1VD or 2VD - proximal LAD | I A | IIa B | 30, 31, 50, 51 |
| 3VD simple lesions, full functional revascularization achievable with PCI, SYNTAX score ≤22 | I A | IIa B | 4, 30–37, 53 |
| 3VD complex lesions, incomplete revascularization achievable with PCI, SYNTAX score >22 | I A | III A | 4, 30–37, 53 |
| Left main (isolated or 1VD, ostium/shaft) | I A | IIa B | 4, 54 |
| Left main (isolated or 1VD, distal bifurcation) | I A | IIb B | 4, 54 |
| Left main + 2VD or 3VD, SYNTAX score ≤32 | I A | IIb B | 4, 54 |
| Left main + 2VD or 3VD, SYNTAX score ≥33 | I A | III B | 4, 54 |

By SYNTAX score terciles, MACCE rates were 13.0% vs. 7.7% ($P = 0.19$), 15.5% vs. 12.6% ($P = 0.54$), and 12.9% vs. 25.3% ($P = 0.08$) for CABG vs. PCI in the lower (0–22), intermediate (23–32), and high (≥33) terciles, respectively. Unpublished data at 2 years show respective mortalities of 7.9% and 2.7% ($P = 0.02$) and repeat revascularization rates of 11.4% and 14.3% ($P = 0.44$) in the two lower terciles, implying that PCI may be superior to

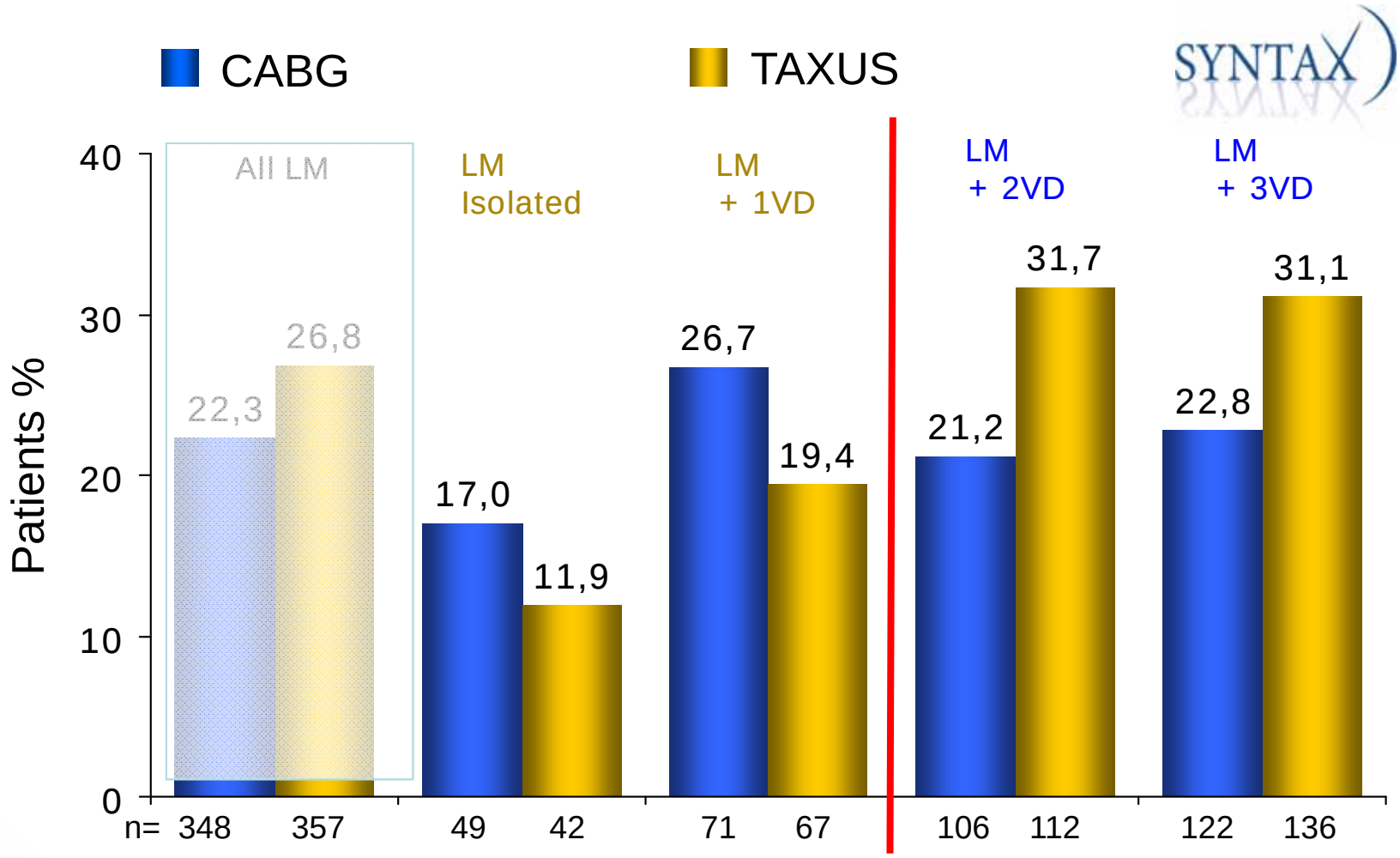
PCI may be superior to CABG @ 2 y. in the two lower terciles

nosis included in the registry or in the RCTs, 65% had SYNTAX scores >33.

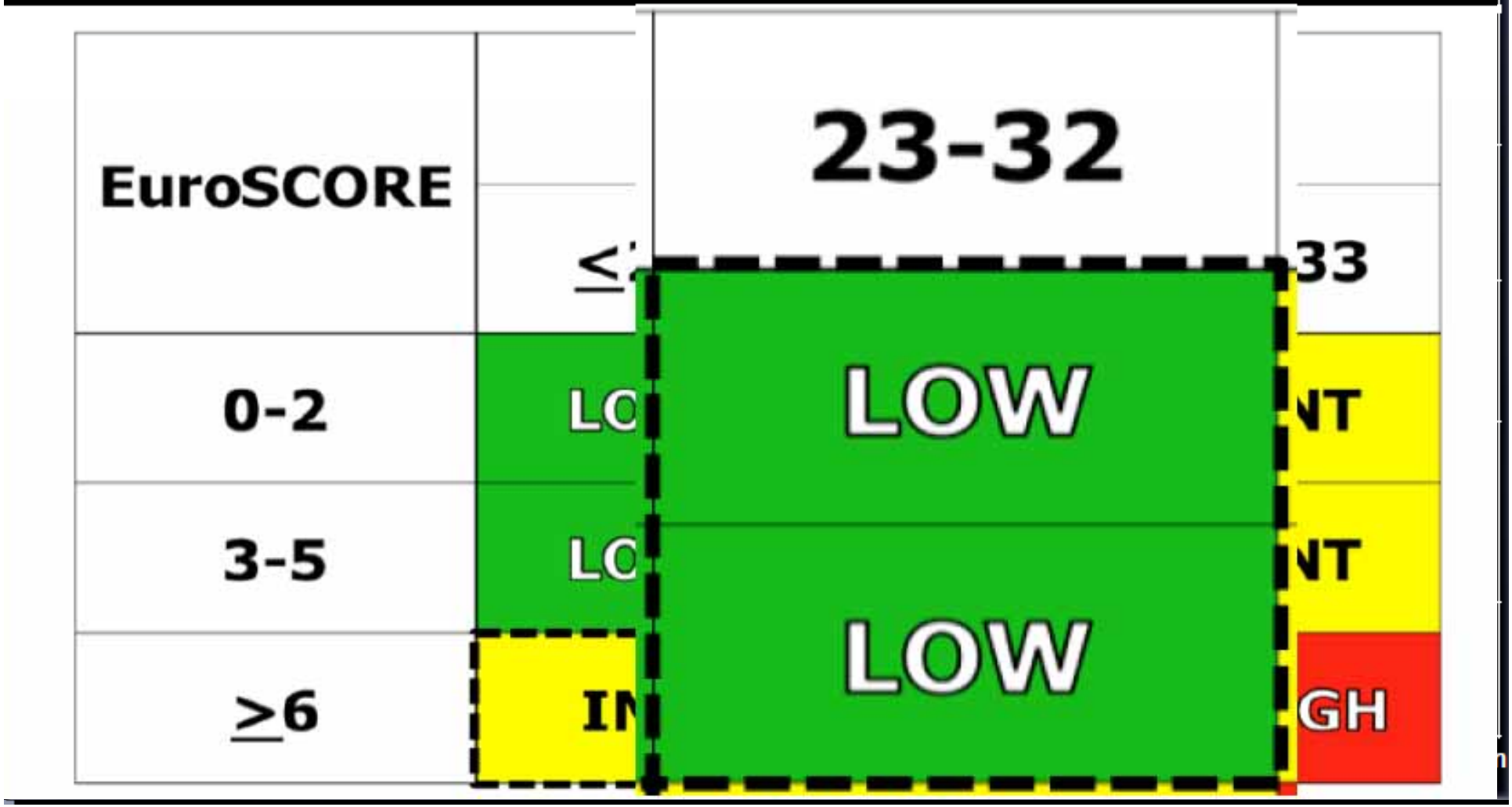
While LM stenosis is a potentially attractive target for PCI because of its large diameter and proximal position in the coronary circulation, two important pathophysiological features may mitigate against the success of PCI: (i) up to 80% of LM disease involves the bifurcation known to be at particularly high risk of restenosis; and

# MACCE to 3 Years in LM Subgroups

## Complexity of Disease (no p values as not powered for subanalysis)



# Reduced Mortality PCI vs CABG (LMS - CABG: 10.8%, PCI 1.3%) n=145 - RECLASSIFED as low risk.



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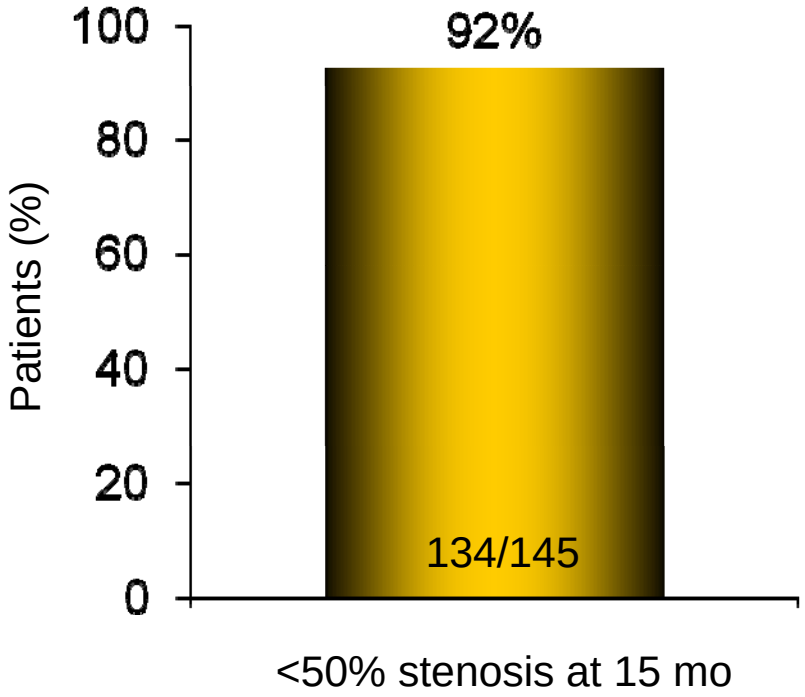
While LM stenosis is a potentially attractive target for PCI because of its large diameter and proximal position in the coronary circulation, two important pathophysiological features may mitigate

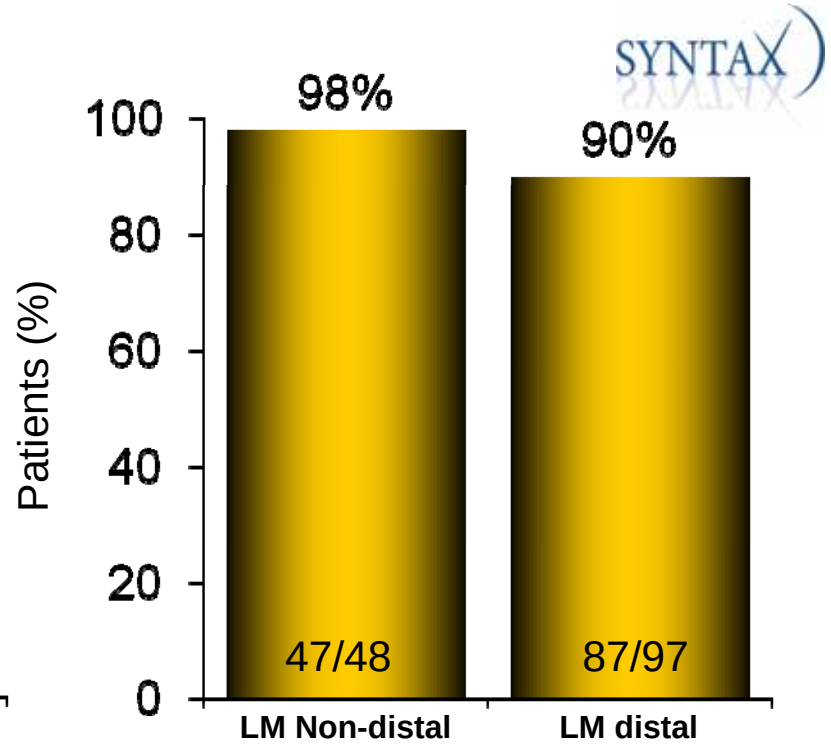
LM bifurcation known to be at particularly high risk of restenosis

bifurcation known to be at particularly high risk of restenosis; and

# SYNTAX LE MANS TAXUS Cohort

Primary Endpoint:



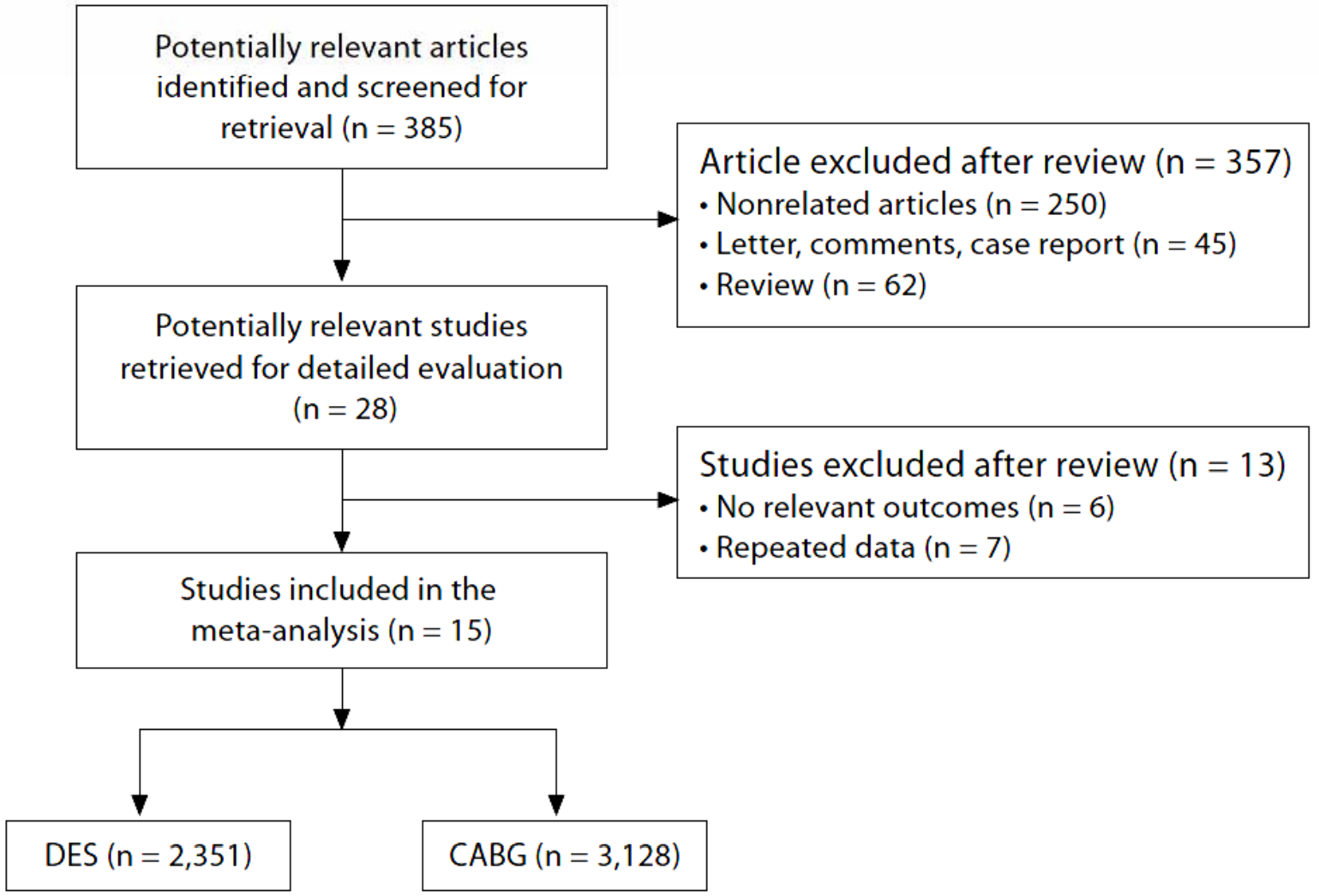

Definitions:
Diameter stenosis was assessed by QCA

# On site cardiac surgery?

and whether surgery is offered on site or not. Non-emergent high-risk PCI procedures, including those performed for distal left main (LM) disease, complex bifurcation stenosis involving large side branches, single remaining coronary artery, and complex chronic total occlusion (CTO) recanalization, should be performed by adequately experienced operators at centres that have access to circulatory support and intensive care treatment, and have cardiovascular surgery on site.

Distal LM PCI = cardiovascular surgery on site !

# Comparison between DES and CABG for ULM CAD: Meta-Analysis of 2 RCT and 13 Observational Studies



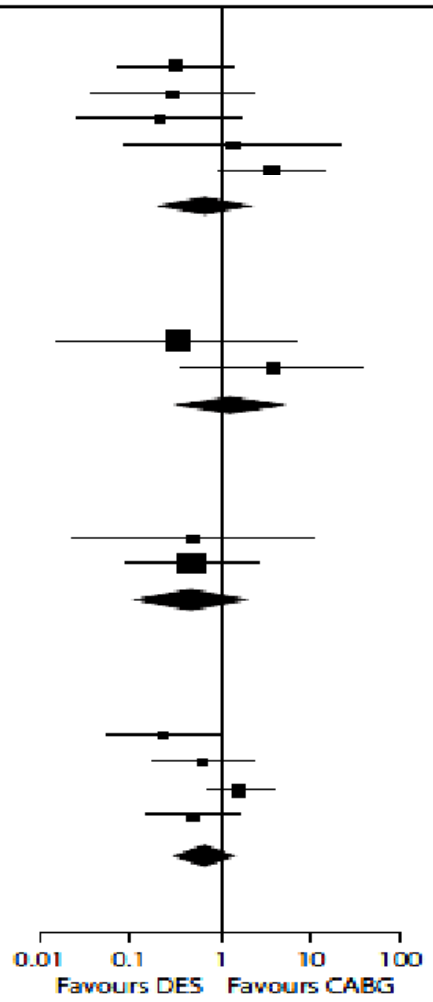



Zheng, Cardiology 2011;118:22–32

# Comparison between DES and CABG for ULM CAD: Meta-Analysis of 2 RCT and 13 Observational Studies

## Comparison of DES versus CABG for the early outcomes (<30d)

| Study | Year | Weight | OR (95% CI) |
|---|---|---|---|
| **Death** | | | |
| Sanmartin [9] | 2007 | 24.1% | 0.33 (0.07, 1.45) |
| Makikallio [10] | 2008 | 18.6% | 0.31 (0.04, 2.40) |
| Wu [22] | 2010 | 18.2% | 0.23 (0.03, 1.84) |
| Shimizu [21] | 2010 | 13.1% | 1.40 (0.09, 22.76) |
| Kang [19] | 2010 | 26.0% | 3.89 (1.04, 14.55) |
| Total (95% CI) | | 100.0% | 0.70 (0.20, 2.47) |
| Heterogeneity: $Tau^2 = 1.14$; $\chi^2 = 9.32$, d.f. = 4 ($p = 0.05$); $I^2 = 57\%$ | | | |
| Test for overall effect: $Z = 0.56$ ($p = 0.58$) | | | |
| **MI** | | | |
| Sanmartin [9] | 2007 | 69.3% | 0.36 (0.02, 7.02) |
| Kang [19] | 2010 | 30.7% | 3.80 (0.39, 36.83) |
| Total (95% CI) | | 100.0% | 1.42 (0.32, 6.26) |
| Heterogeneity: $\chi^2 = 1.55$, d.f. = 1 ($p = 0.21$); $I^2 = 35\%$ | | | |
| Test for overall effect: $Z = 0.46$ ($p = 0.64$) | | | |
| **Cerebrovascular events** | | | |
| Sanmartin [9] | 2007 | 24.3% | 0.50 (0.02, 10.61) |
| Kang [19] | 2010 | 75.7% | 0.50 (0.10, 2.59) |
| Total (95% CI) | | 100.0% | 0.50 (0.12, 2.13) |
| Heterogeneity: $\chi^2 = 0.00$, d.f. = 1 ($p = 0.99$); $I^2 = 0\%$ | | | |
| Test for overall effect: $Z = 0.94$ ($p = 0.35$) | | | |
| **Composite endpoint** | | | |
| Sanmartin [9] | 2007 | 19.4% | 0.24 (0.05, 1.04) |
| Ghenim [17] | 2009 | 22.4% | 0.66 (0.18, 2.41) |
| Kang [19] | 2010 | 32.5% | 1.67 (0.72, 3.90) |
| Wu [22] | 2010 | 25.7% | 0.52 (0.17, 1.61) |
| Total (95% CI) | | 100.0% | 0.69 (0.30, 1.59) |
| Heterogeneity: $Tau^2 = 0.37$; $\chi^2 = 6.26$, d.f. = 3 ($p = 0.10$); $I^2 = 52\%$ | | | |
| Test for overall effect: $Z = 0.87$ ($p = 0.38$) | | | |






Zheng, Cardiology 2011;118:22–32

# US : Role of surgical risk

CABG (46). Physicians can estimate operative risk for all CABG candidates using a standard instrument, such as the risk calculator from the STS database. The above considerations are important factors when choosing among revascularization strategies for unprotected left main CAD and have been factored into revascularization recommendations.

PCI indication is driven by surgical risk evaluation

# US : Left main

| | | |
|---|---|---|
| **UPLM*** | | |
| **CABG** | **I** | **B** |
| **PCI** | **IIa—For SIHD when *both* of the following are present:**<br>• **Anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (e.g., a low SYNTAX score of ≤22, ostial or trunk left main CAD)**<br>• **Clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (e.g., STS-predicted risk of operative mortality ≥5%)** | **B** |
| | **IIa—For UA/NSTEMI if not a CABG candidate** | **B** |
| | **IIa—For STEMI when distal coronary flow is TIMI flow grade <3 and PCI can be performed more rapidly and safely than CABG** | **C** |
| | **IIb—For SIHD when *both* of the following are present:**<br>• **Anatomic conditions associated with a low to intermediate risk of PCI procedural complications and an intermediate to high likelihood of good long-term outcome (e.g., low-intermediate SYNTAX score of <33, bifurcation left main CAD)**<br>• **Clinical characteristics that predict an increased risk of adverse surgical outcomes (e.g., moderate-severe COPD, disability from prior stroke, or prior cardiac surgery; STS-predicted risk of operative mortality >2%)** | **B** |
| | **III: Harm—For SIHD in patients (versus performing CABG) with unfavorable anatomy for PCI and who are good candidates for CABG** | **B** |

## Guideline for PCI/CABG indication: March, 2012: Japanese Circulation Society

| PCI/CABG indication | | | |
|---|---|---|---|
| anatomical condition | | Favors PCI | Favors CABG |
| 1VD or 2 VD | non LAD proximal lesion | 1A | IIb C |
| | LAD proximal lesion (except for ostium) | 1C | I A |
| | LAD ostium lesion | IIb C | |
| 3 VD | non LAD proximal lesion | IIb B | |
| | LAD proximal lesion | III B | |
| unprotected LM | Isolated or 1VD ostium/shaft | IIb C | |
| | Isolated or 1VD, distal bifurcation | IIIC / IIb C* | |
| | Multi-vessel disease | III C | |

*Class IIb: non LCX lesion, and need to be approved by the heart team (cardiac surgery must be included)

# Left main

- Similarities
  - Role of Heart Team
  - Role of Syntax score (>32 = CABG)
  - Distal vs Mid/Ostial
  - FFR in equivocal LM stenosis

- Discrepancies
  - Role of surgical score (STS)
  - No PCI if STS < 2%
  - ACS presentation
  - Need for ‘onsite’ cardiac surgery

# EU : Bifurcation

has not yet been established. Variables to be considered are plaque distribution, size and downstream territory of each vessel (main and side branch), and the bifurcation angle. Stent implan-

Main vessel stenting with provisional SB angioplasty > routine double stenting

with or without stenting of the side branch, seems preferable compared with routine stenting of both vessels. FFR data from side

when indicated (Section 6). For bifurcation and LM lesions, DES are preferred with special attention to adequate sizing and deployment. For tr

DES better, Instent LL < 0.2 MM

DES with strong antiproliferative properties (late lumen loss ≤0.2 mm) are preferred to reduce restenosis rates.[210]

# US : bifurcation

**CLASS I**

1. Provisional side-branch stenting should be the initial approach in

Provisional SB stenting if small & moderately diseased

*(Level of Evidence: A)*

**CLASS IIa**

1. It is reasonable to use elective double stenting in patients with

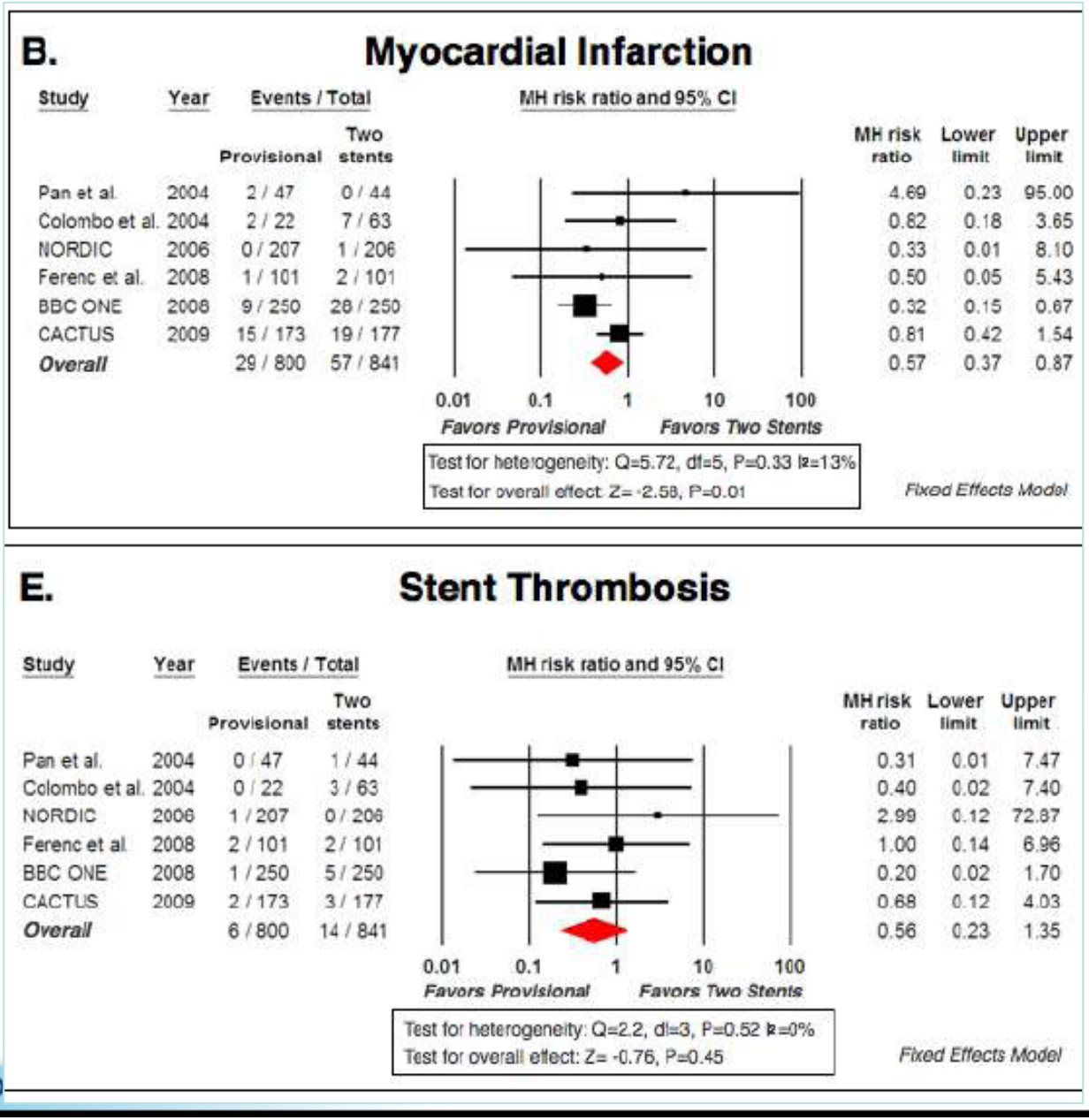
Elective double stenting in large SB & high risk of occlusion

successful side-branch reaccess is low (730–733). *(Level of Evidence: B)*

In patients with low-risk bifurcation lesions (minimal or moderate ostial side-branch disease [<50% diameter stenosis] of focal length [5 to 6 mm]), provisional stenting yields similar clinical outcome to elective double stenting, with lower incidence of periprocedural biomarker elevation (726–729). Conversely, in patients with high-risk bifurcations, elective double stenting is associated with a trend toward higher angiographic success rates, lower in-hospital MACE, and better long-term patency of the side branch compared with provisional stenting (193). Culotte, Crush, and T-stent techniques have been studied in RCTs (726–729,737). Use of DES yields better outcomes than BMS (738), and sirolimus-eluting stents yield better outcomes than paclitaxel-eluting stents (739–742). Clinical evidence supports the use of final kissing balloon inflation after elective double stenting (743).

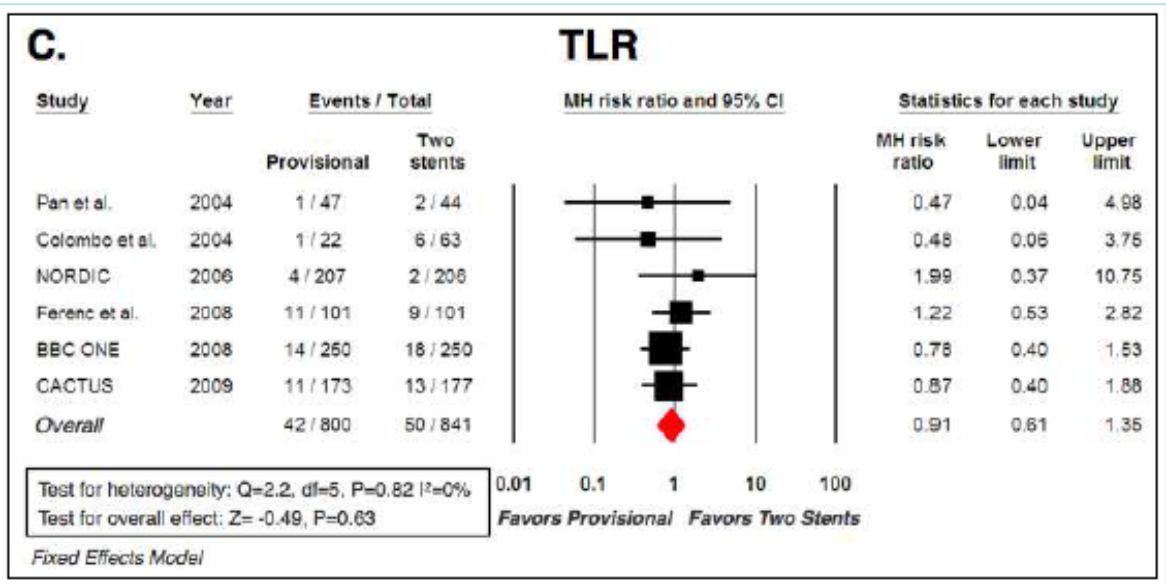
Better longterm patency & lower MACE with elective double stenting in high risk bifurcations ??

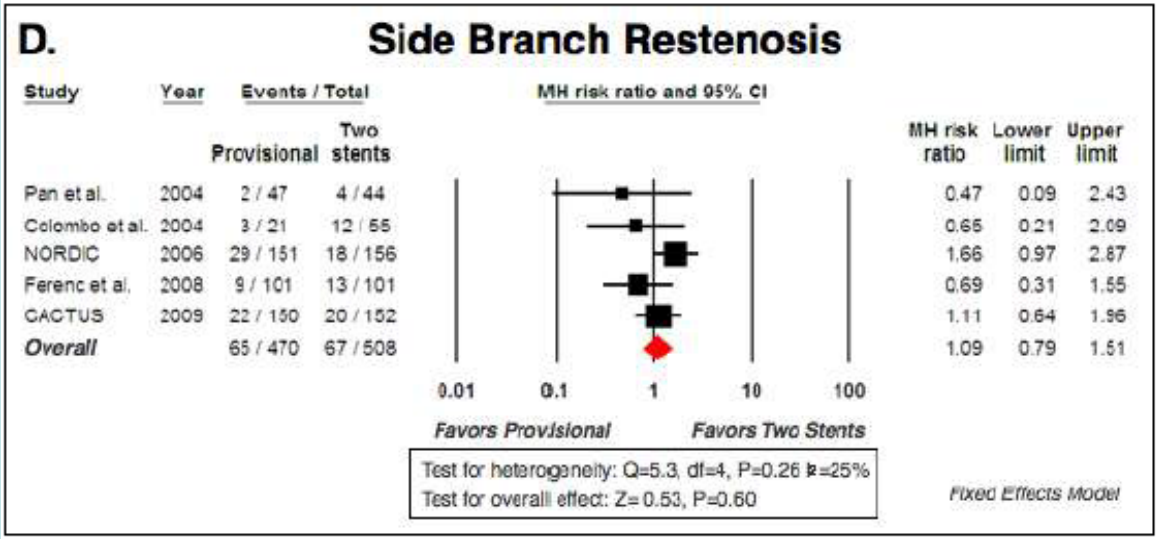
193. Herzog CA, Ma JZ, Collins AJ. Comparative survival of dialysis patients in the United States after coronary angioplasty, coronary artery stenting, and coronary artery bypass surgery and impact of diabetes. Circulation. 2002;106:2207–11.


B.
Myocardial Infarction
Study
Year
Events / Total
Provisional
Two stents
MH risk ratio and 95% CI
MH risk ratio
Lower limit
Upper limit
Pan et al. 2004 2 / 47 0 / 44 4.69 0.23 95.00
Colombo et al. 2004 2 / 22 7 / 63 0.62 0.18 3.65
NORDIC 2006 0 / 207 1 / 206 0.33 0.01 8.10
Ferenc et al. 2008 1 / 101 2 / 101 0.50 0.05 5.43
BBC ONE 2008 9 / 250 28 / 250 0.32 0.15 0.67
CACTUS 2009 15 / 173 19 / 177 0.81 0.42 1.54
Overall 29 / 800 57 / 841 0.57 0.37 0.87
0.01 0.1 1 10 100
Favors Provisional
Favors Two Stents
Test for heterogeneity: Q=5.72, df=5, P=0.33 I²=13%
Test for overall effect: Z= -2.58, P=0.01
Fixed Effects Model
E.
Stent Thrombosis
Study
Year
Events / Total
Provisional
Two stents
MH risk ratio and 95% CI
MH risk ratio
Lower limit
Upper limit
Pan et al. 2004 0 / 47 1 / 44 0.31 0.01 7.47
Colombo et al. 2004 0 / 22 3 / 63 0.40 0.02 7.40
NORDIC 2006 1 / 207 0 / 206 2.99 0.12 72.87
Ferenc et al. 2008 2 / 101 2 / 101 1.00 0.14 6.96
BBC ONE 2008 1 / 250 5 / 250 0.20 0.02 1.70
CACTUS 2009 2 / 173 3 / 177 0.68 0.12 4.03
Overall 6 / 800 14 / 841 0.56 0.23 1.35
0.01 0.1 1 10 100
Favors Provisional
Favors Two Stents
Test for heterogeneity: Q=2.2, df=3, P=0.52 I²=0%
Test for overall effect: Z= -0.76, P=0.45
Fixed Effects Model



Brar


C.
TLR
Study
Year
Events / Total
Provisional
Two stents
MH risk ratio and 95% CI
Statistics for each study
MH risk ratio
Lower limit
Upper limit
Pan et al. 2004 1 / 47 2 / 44 0.47 0.04 4.98
Colombo et al. 2004 1 / 22 6 / 63 0.48 0.06 3.75
NORDIC 2006 4 / 207 2 / 206 1.99 0.37 10.75
Ferenc et al. 2008 11 / 101 9 / 101 1.22 0.53 2.82
BBC ONE 2008 14 / 250 18 / 250 0.76 0.40 1.53
CACTUS 2009 11 / 173 13 / 177 0.87 0.40 1.88
Overall 42 / 800 50 / 841 0.91 0.61 1.35
0.01 0.1 1 10 100
Favors Provisional
Favors Two Stents
Test for heterogeneity: Q=2.2, df=5, P=0.82 I²=0%
Test for overall effect: Z= -0.49, P=0.63
Fixed Effects Model

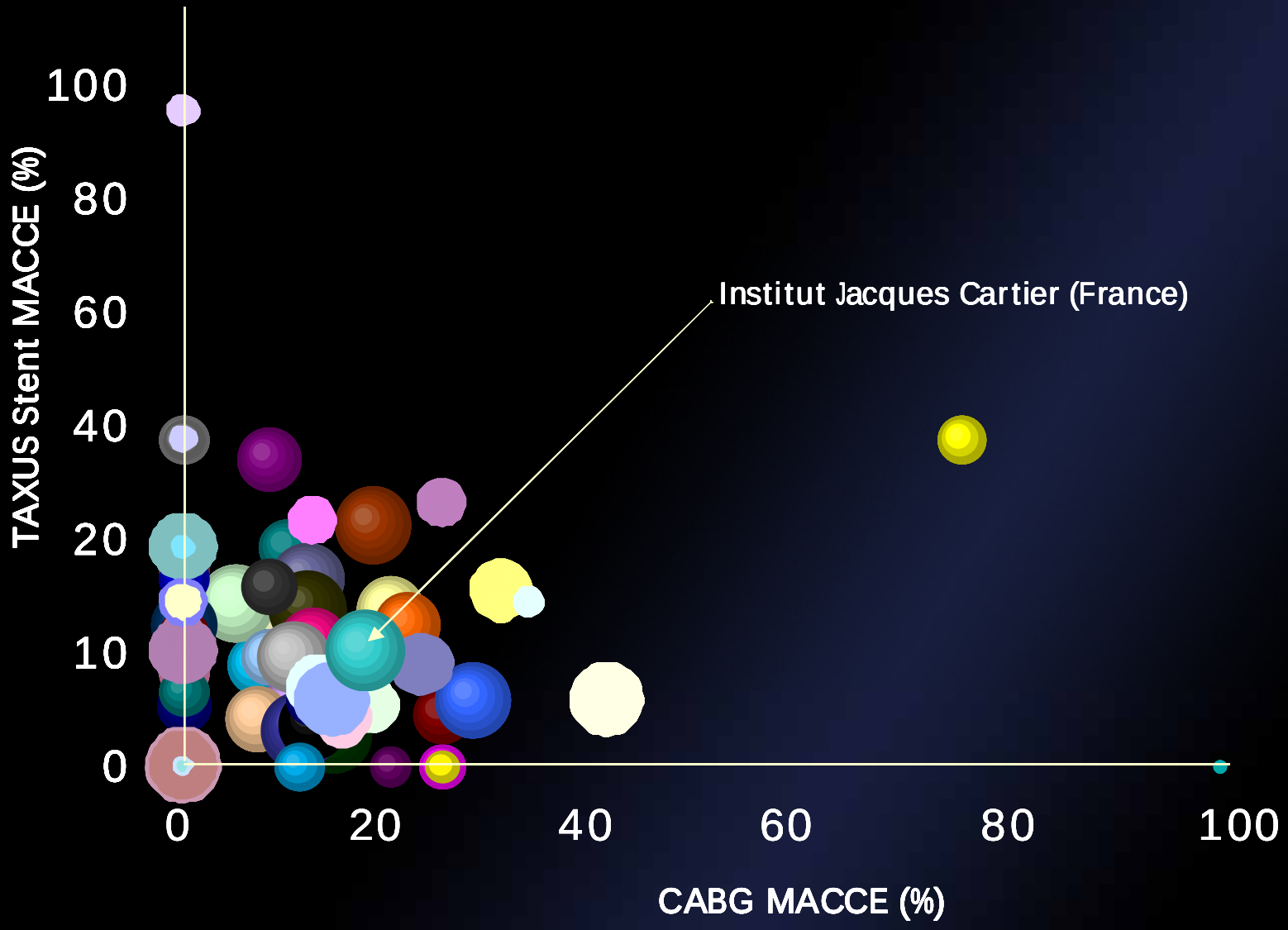

D.
Side Branch Restenosis
Study
Year
Events / Total
Provisional
Two stents
MH risk ratio and 95% CI
MH risk ratio
Lower limit
Upper limit
Pan et al. 2004 2 / 47 4 / 44 0.47 0.09 2.43
Colombo et al. 2004 3 / 21 12 / 55 0.65 0.21 2.09
NORDIC 2006 29 / 151 18 / 156 1.66 0.97 2.87
Ferenc et al. 2008 9 / 101 13 / 101 0.69 0.31 1.55
CACTUS 2009 22 / 150 20 / 152 1.11 0.64 1.96
Overall 65 / 470 67 / 508 1.09 0.79 1.51
0.01 0.1 1 10 100
Favors Provisional
Favors Two Stents
Test for heterogeneity: Q=5.3, df=4, P=0.26 I²=25%
Test for overall effect: Z= 0.53, P=0.60
Fixed Effects Model

# Bifurcation

- Similarities
  - Need for analysing plaque distribution
  - Role of DES
  - DES with low LL
  - Kissing if double stenting

- Discrepancies
  - No consideration about anatomic parameters (in US)
  - Role of elective double stenting technique

# CLINICAL JUDGEMENT IS CRUCIAL



# Take home message

- Recommendations are there to guide you
  - Many possible scenarios
  - Role of local heart team expertise
- Benefit of LM PCI in moderately complex disease is underestimated, particularly if both scores are low
- Discrepancies reflect the grey zones
  - LM : High STS & Syntax score
  - Role of elective double stenting in high-risk bifurcation