EVIDENCE FOR INTERVENTION IN CORONARY ARTERY DISEASE

Dr. Stephen Cox. FRACP

Interventional Cardiologist

Brisbane

June 2020

John Lubbock

Our duty is to believe that for which we have sufficient evidence, and to suspend our judgment when we have not.

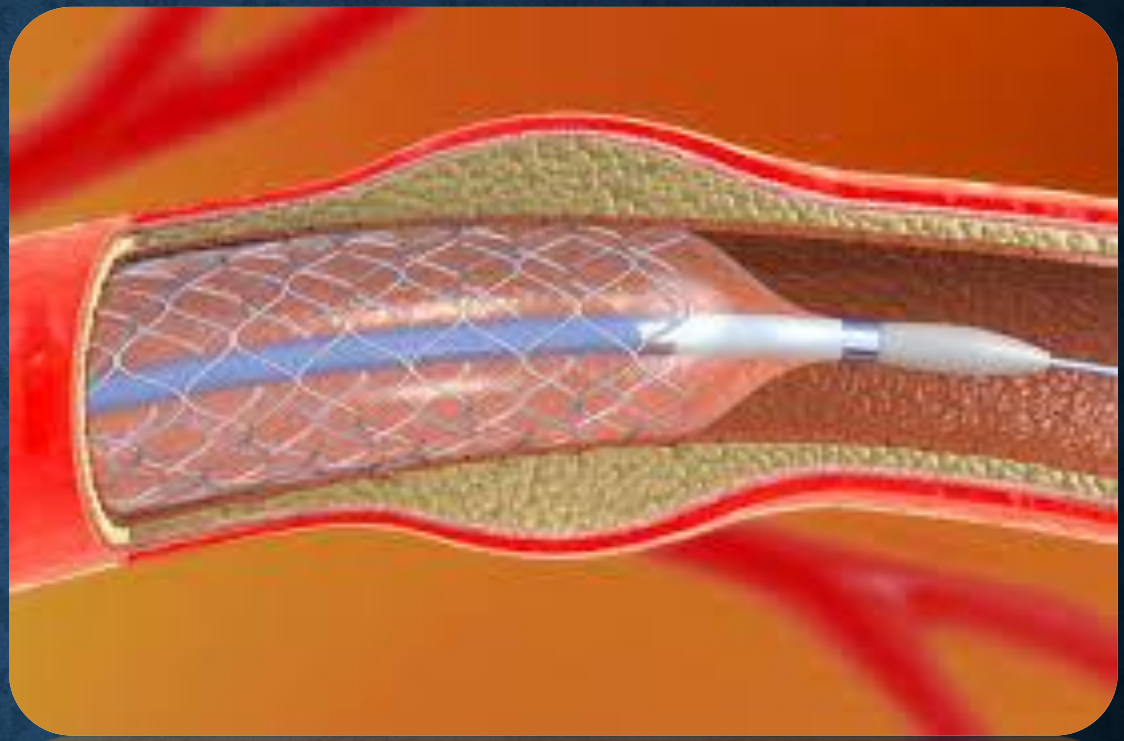
We assume that by doing ‘things’ to patients that we make them ‘better’, but what is the evidence???……

IS THERE GOOD EVIDENCE FOR INTERVENTION IN CORONARY DISEASE?

- With CABG?
- With PCI?
- Or should we focus on Optimal Medical Therapy (OMT)??

20 YEARS AGO……

- “Stents will cure everything”
- “CABG is dead”



……just not true

Its all about ‘best options’

WHAT DID THE GUIDELINES SAY?

Revascularisation in Stable CAD

Extent of CAD (anatomical and/or functional)		Class[b]	Level[c]
For prognosis	Left main disease with stenosis >50%[a]	I	A
	Any proximal LAD stenosis >50%[a]	I	A
	Two-vessel or three-vessel disease with stenosis > 50%[a] with impaired LV function (LVEF<40%)[a]	I	A
	Large area of ischaemia (>10% LV)	I	B
	Single remaining patent coronary artery with stenosis >50%[a]	I	C
For symptoms	Any coronary stenosis >50%[a] in the presence of limiting angina or angina equivalent, unresponsive to medical therapy	I	A

European Heart Journal (2014) **35**, 2541–2619

OUTLINE

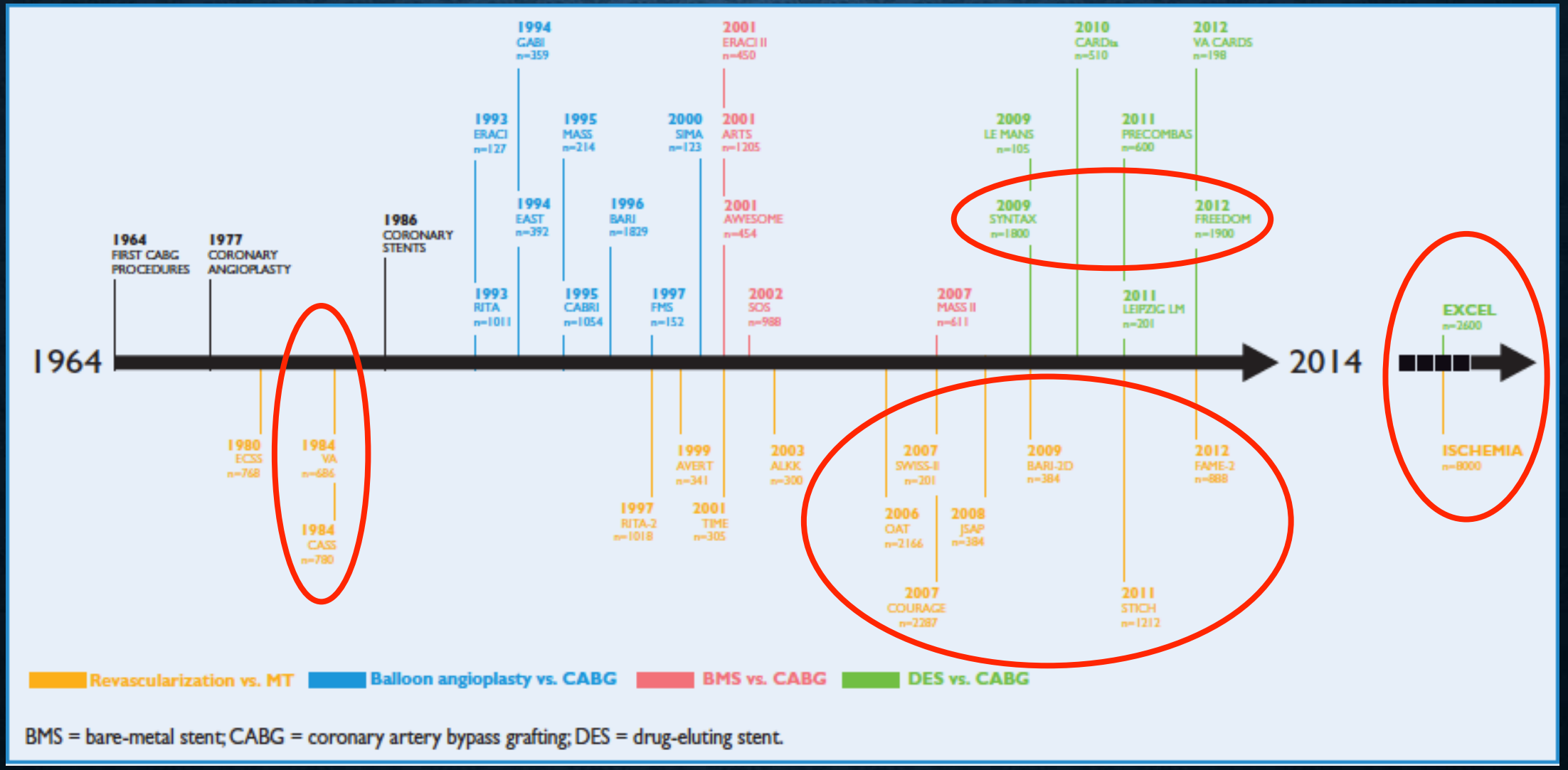
- OMT vs coronary artery bypass grafting
- OMT vs percutaneous coronary intervention
- CABG vs PCI – are there options?
- Stable vs unstable coronary disease
- Diabetes and revascularisation
- Culprit or complete
- Should you trust your eyes?

WHY REVASCULARISE?

- 1. **Prognostic benefit**
  - Improve survival
  - Prevent MI
  - Prevent hospital admission
  - (prevent need for future revascularisation)
- 2. **Symptomatic benefit**
  - Reduce angina
  - Improve QOL

Why are you treating this patient??

REVASCULARISATION TIMELINE



BMS = bare-metal stent; CABG = coronary artery bypass grafting; DES = drug-eluting stent.

Windecker et al. EHJ 2014

IS THERE GOOD EVIDENCE FOR INTERVENTION IN CORONARY DISEASE?

IS THERE GOOD EVIDENCE FOR INTERVENTION IN CORONARY DISEASE?

With CABG?

With PCI?

Are there ‘Special’ groups

Or should we focus on Optimal Medical Therapy (OMT)??

With CABG?

Where did the evidence come from?

- First human CABG performed in 1964
- In the 1970s and 1980s trial data (VA, ECSS, CASS) accumulated supporting CABG over medical therapy alone for the treatment of stable CAD

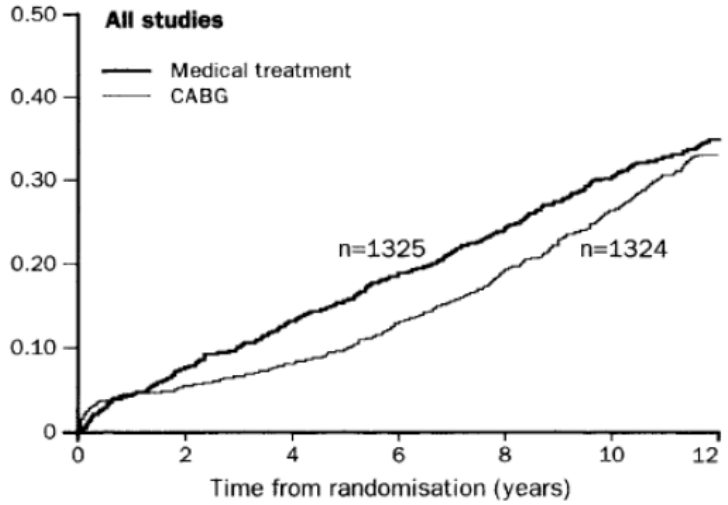


Figure 2: **Survival curve for overall population**

Lancet 1994; **344:** 563–7

Wow, that looks good…early on…

CASS – RANDOMISED TRIAL OF CABG VS MRX

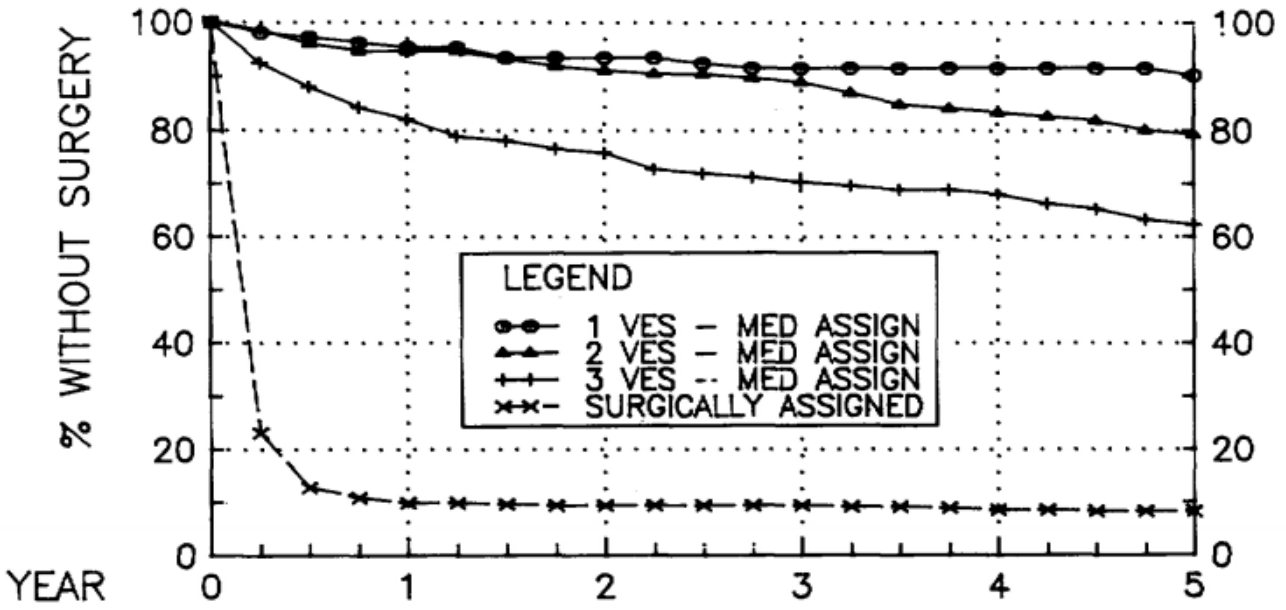
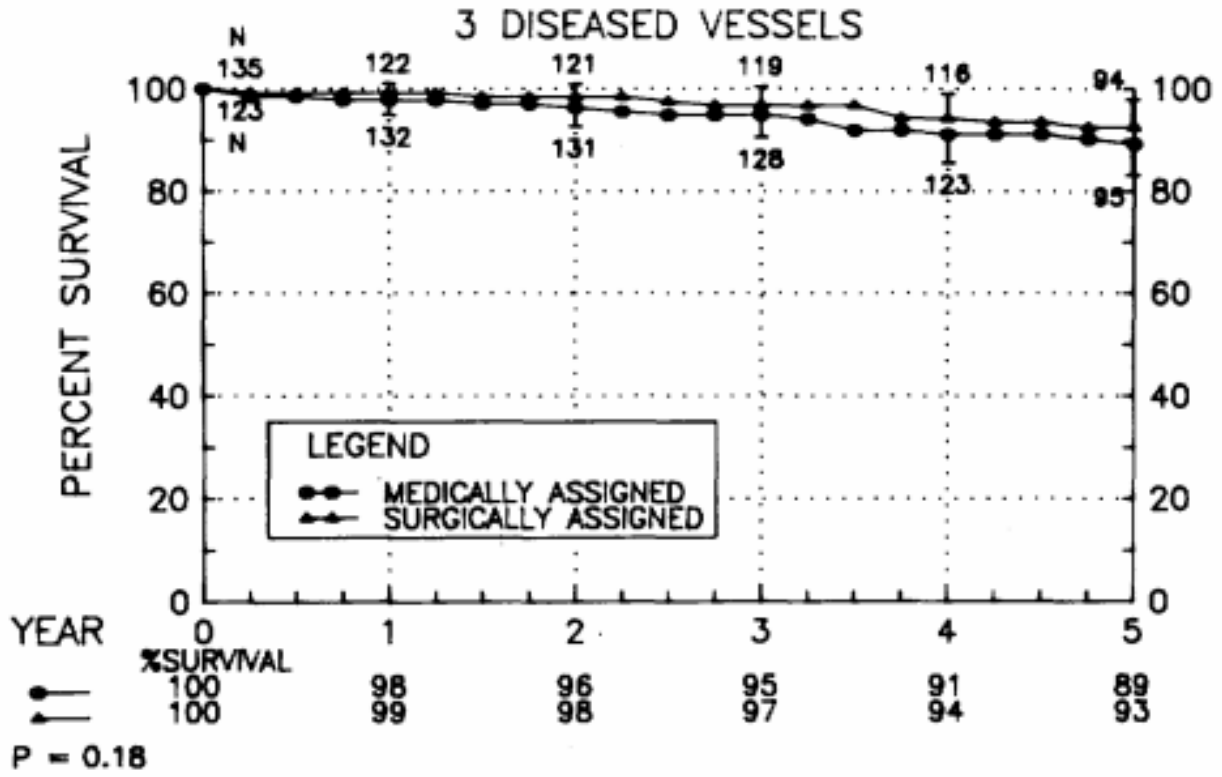
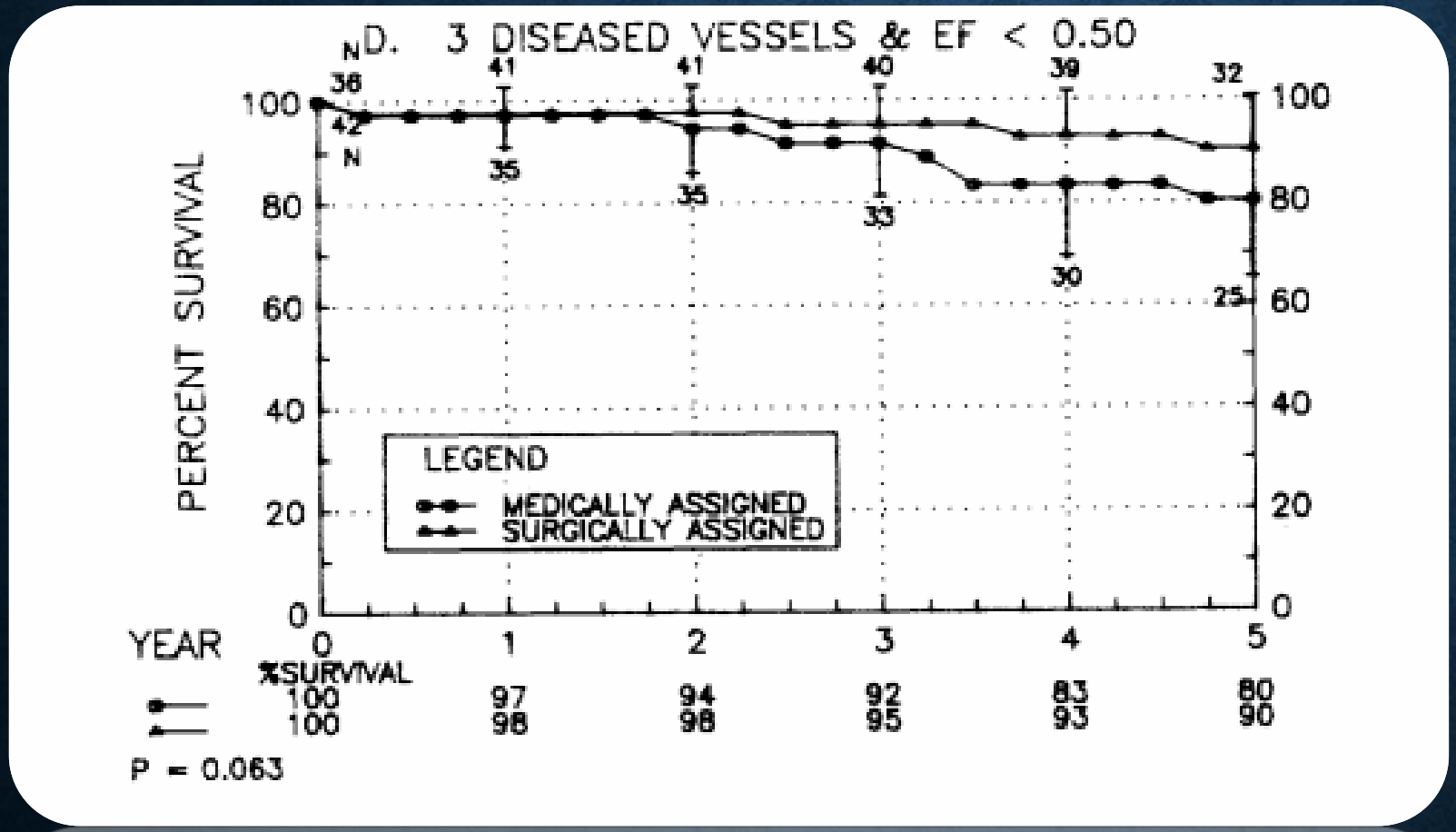


FIGURE 2. Percent of randomly assigned patients in the surgical and medical groups with single-, double-, and triple-vessel disease who had not yet undergone surgery at various time intervals.

Mild or no angina
Many post MI
No aspirin, statins
60% betablockers
90% males
40% smokers

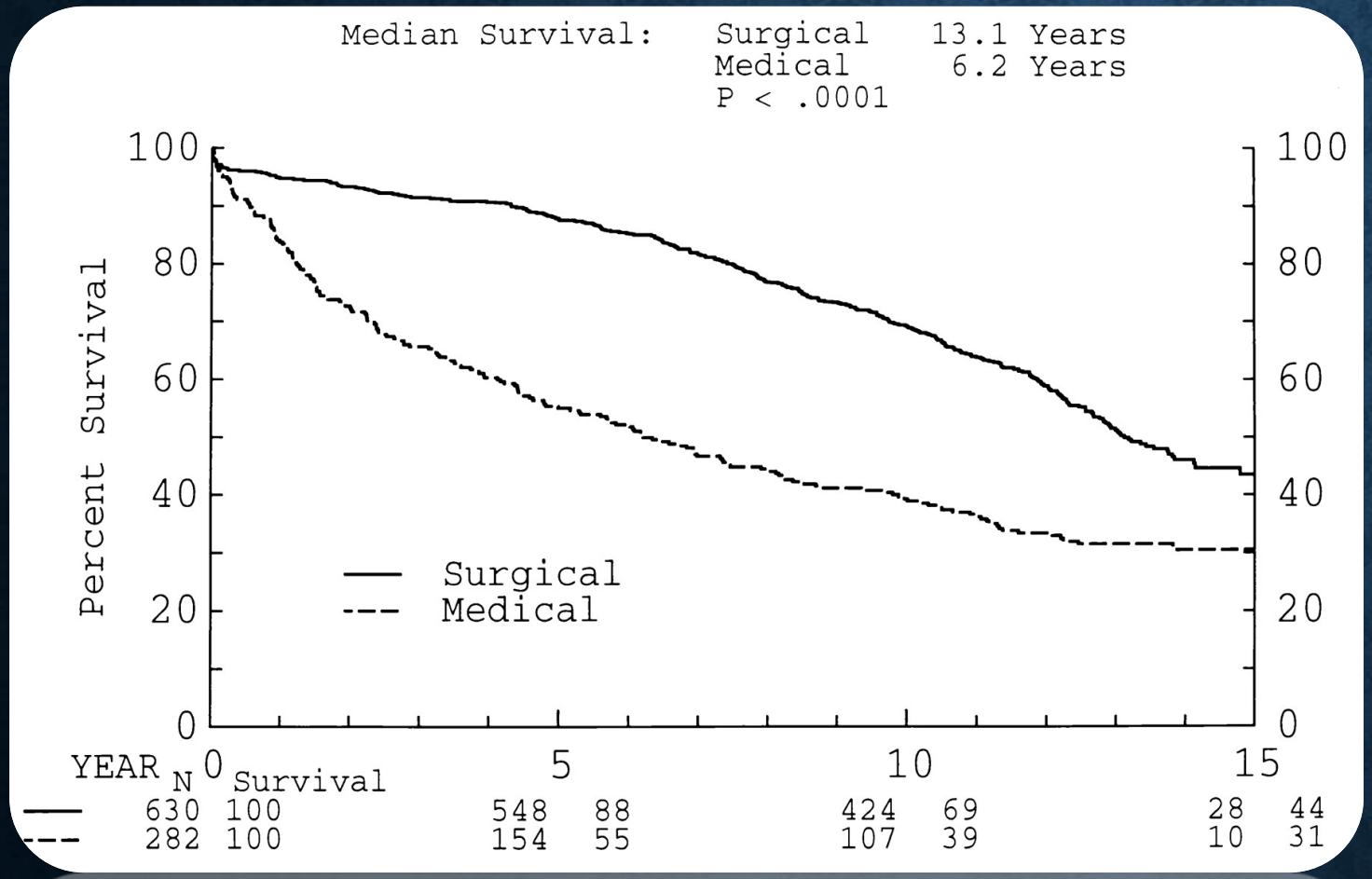


Not much comfort here – even if 3VCD



More comfortable…
3VCD + LVDysf

15YR CASS REGISTRY FOR LMS EQUIVALENT



15-year cumulative survival estimates in 912 Coronary Artery Surgery Study Registry patients with left main equivalent disease, defined as combined stenoses of ≥70% in the proximal left anterior descending coronary artery before the first septal perforator and proximal circumflex coronary artery before the first obtuse marginal branch, who were initially treated with coronary artery bypass graft surgery (630 patients) and nonsurgical therapy (282 patients).

Circulation. 1995;91:2335–2344

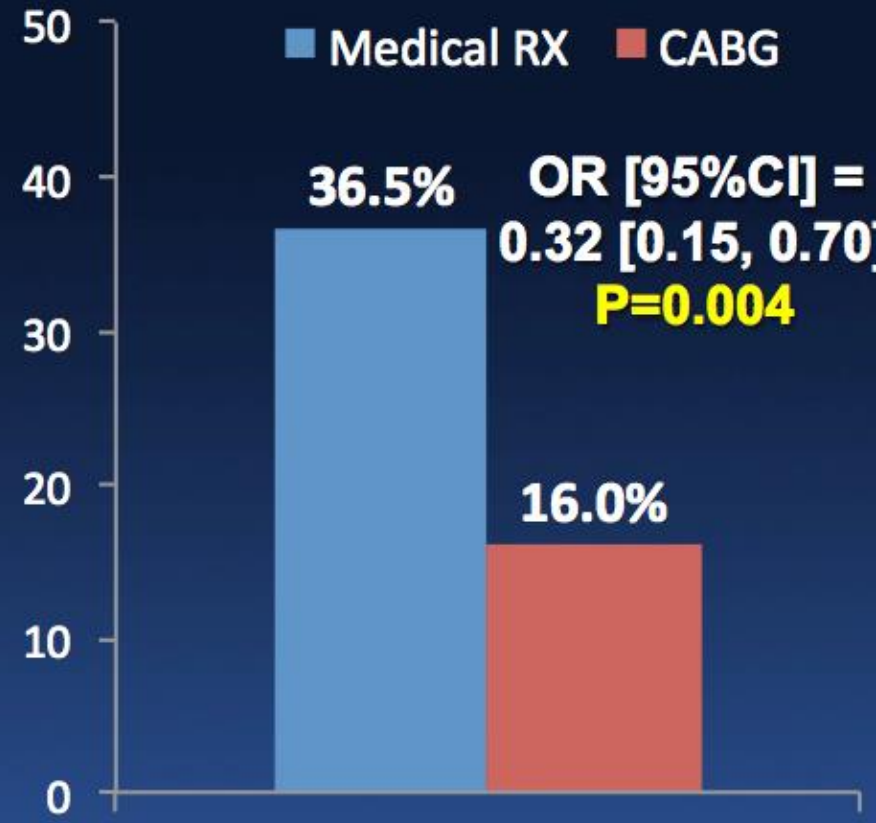
CASS REGISTRY LEARNINGS

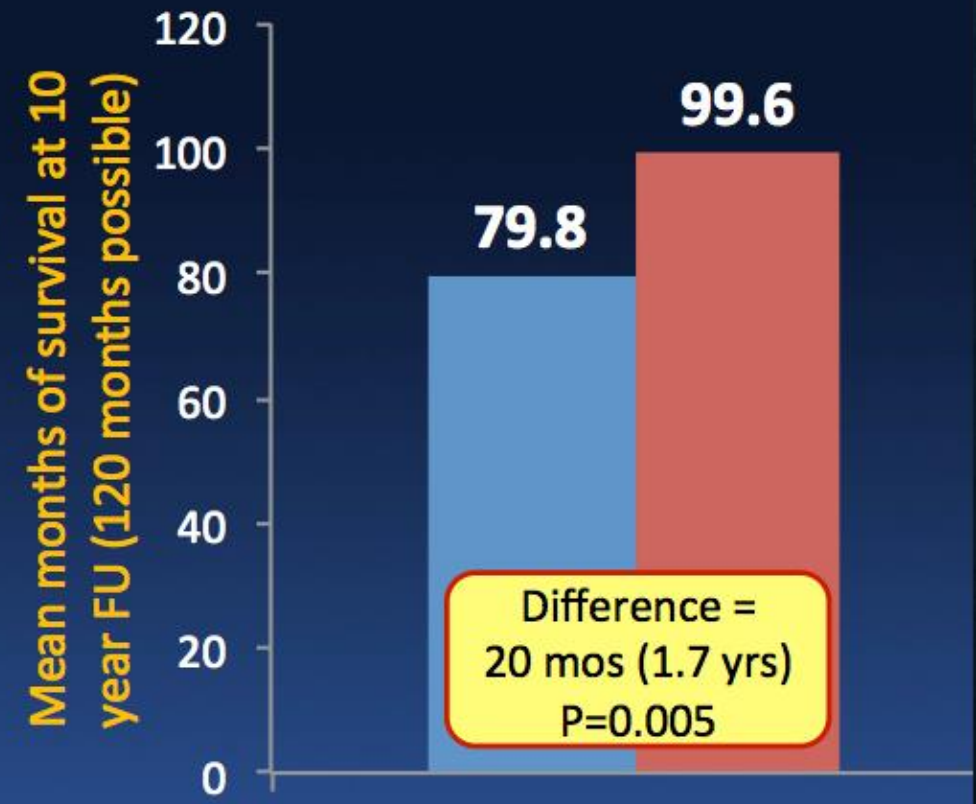
- CABG better than medical Rx with LMS > 50% or LMEQ AND LV dysfunction
- BUT – MRx was – nitrates and Calcium blockers! No statins and mimimal aspirin (it wasn't OMT!)

- Would the results hold true if the trial was done today??

CABG vs. Medical Therapy in LM Ds.

150 pts with left main disease were randomized to CABG vs. medical therapy in 2 studies (VA and EU)



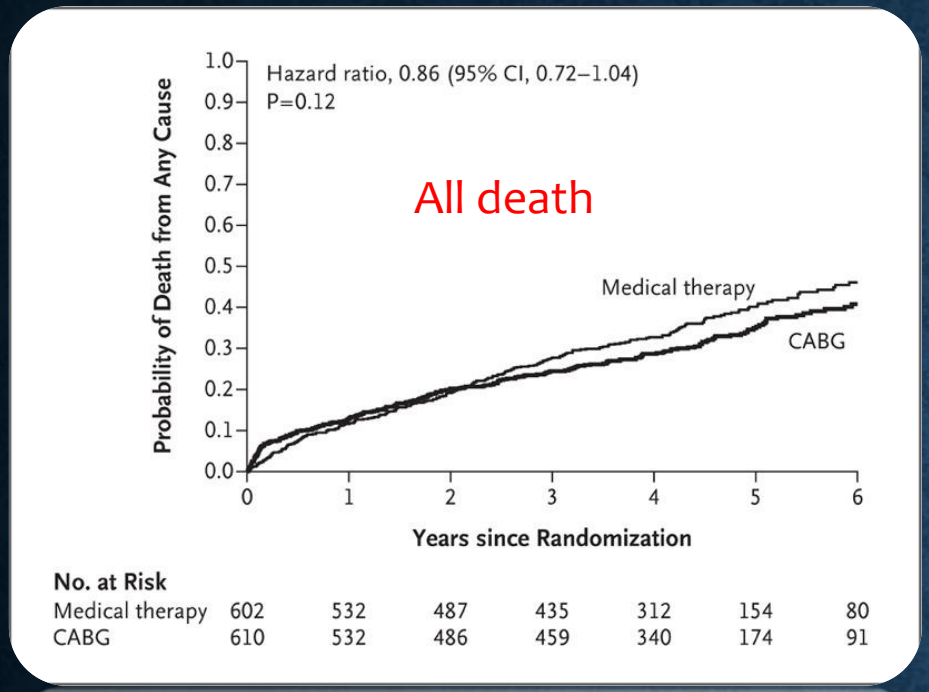


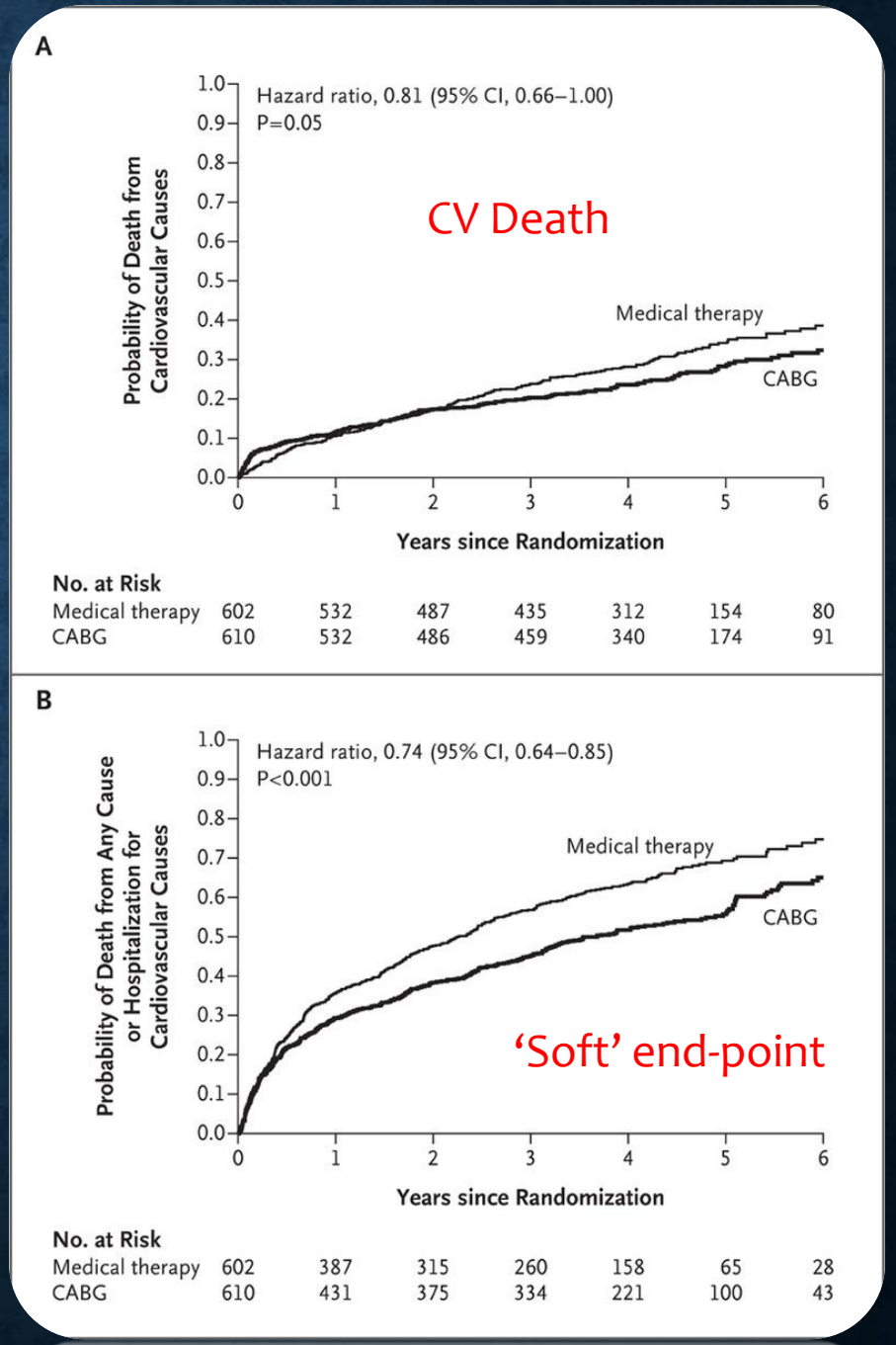
Yusuf S et al. Lancet 1994;344:563-70

STICH (2011)

- 1212 patients with LVEF <35% and CAD amenable to CABG
  - 36% no angina
  - 68% proximal LAD disease / 2% LMCA disease
- OMT v. CABG v. CABG & LV reconstruction
  - No difference in mortality over 4.5 years
  - Less hospitalisations or future revascularisation with CABG
  - No clinical benefit to LV reconstruction

But… significant crossover: as-treated analysis demonstrated a reduction in death with CABG (HR 0.75)





Not entirely a resounding success for CABG in reduced LV function

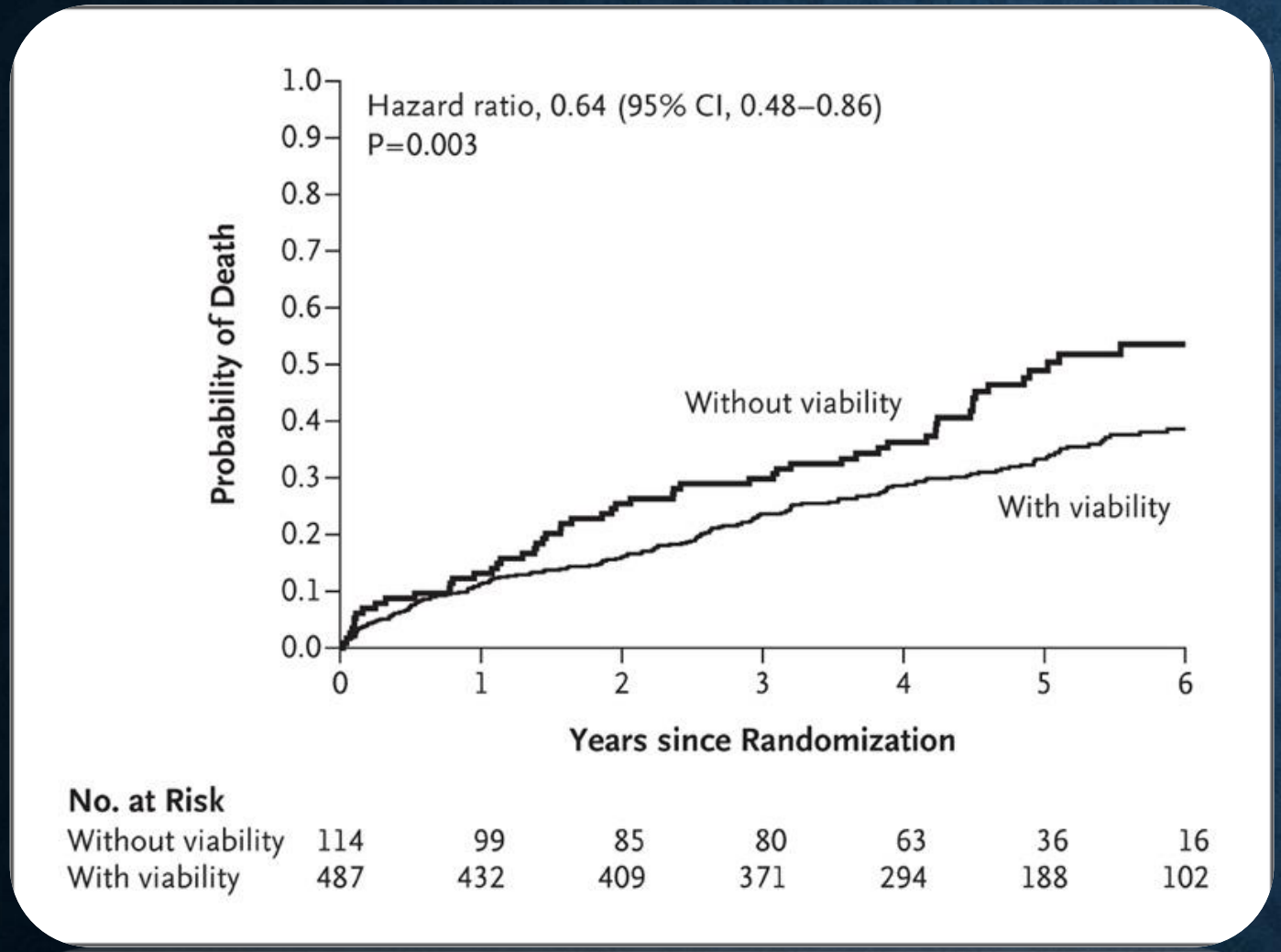


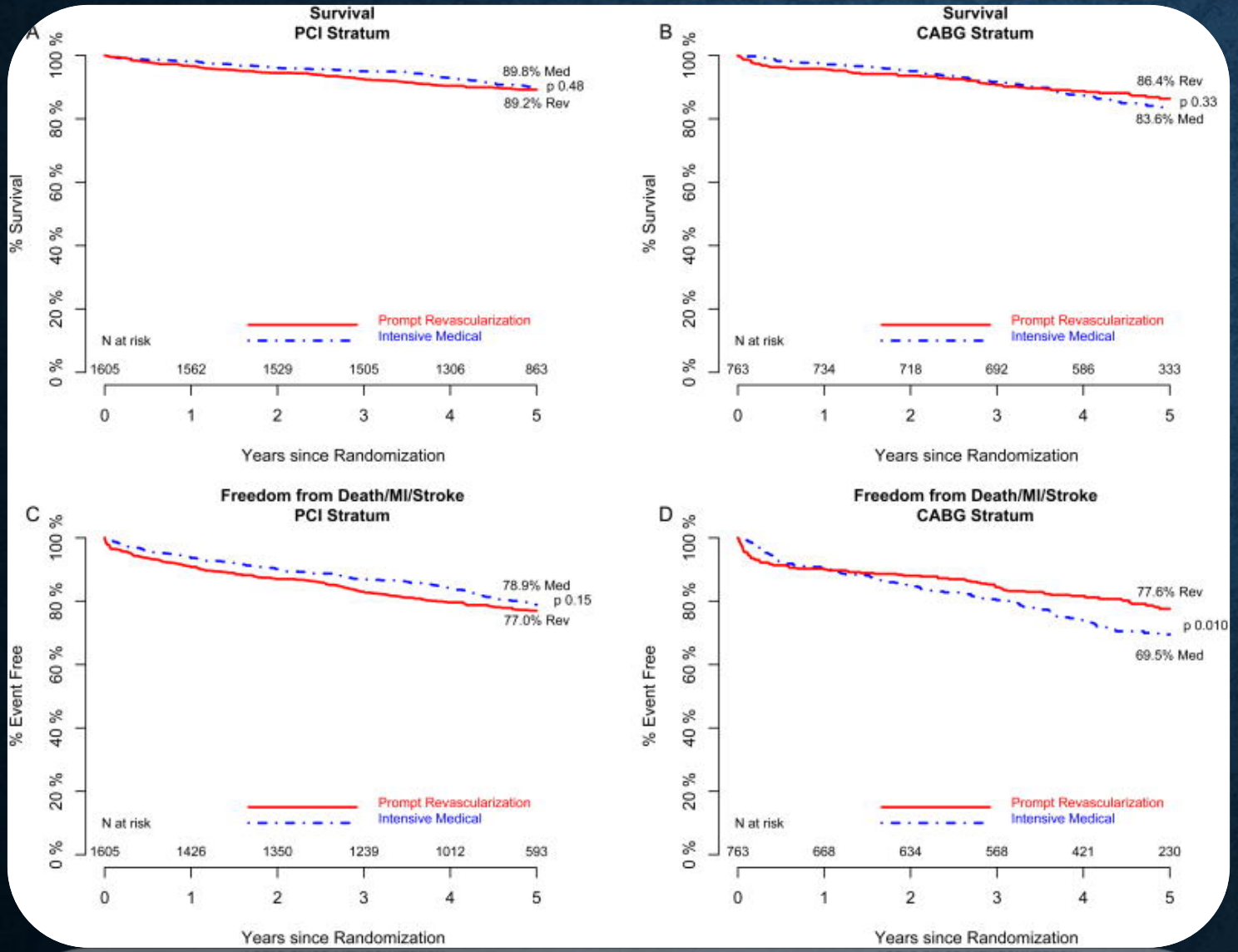
Figure 1. Kaplan–Meier Analysis of the Probability of Death, According to Myocardial Viability Status.
The comparison that is shown has not been adjusted for other prognostic baseline variables. After adjustment for such variables on multivariable analysis, the between-group difference was not significant (P=0.21).

Where does that leave us in the search for viability??

BARI-2D (2009)

- 2368 type 2 diabetics with angina or evidence of ischaemia and CAD (single or multivessel)
- OMT v. OMT & revascularisation (PCI or CABG)
  - At 5.3 years no difference in death or MACCE (~13% mortality)
  - Greater freedom from angina with revascularisation (and less need for revascularisation)
- Caveats:
  - 35% of PCI with DES
  - 42% of medical therapy group underwent revascularisation

A Randomized Trial of Therapies for Type 2 Diabetes and Coronary Artery Disease
The BARI 2D Study Group*



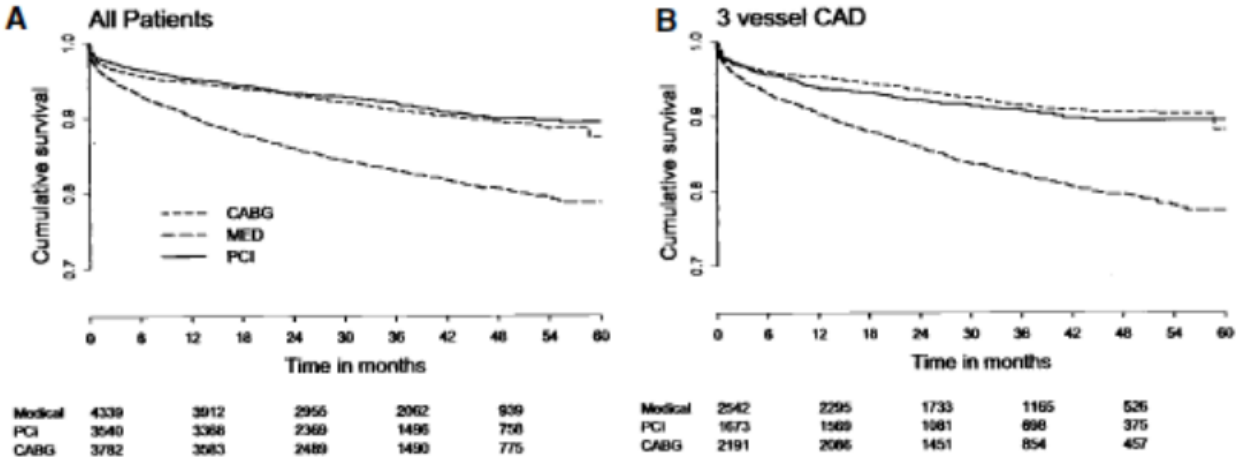
CABG favoured over PCI and OMT for ID diabetics - due to reduced MI

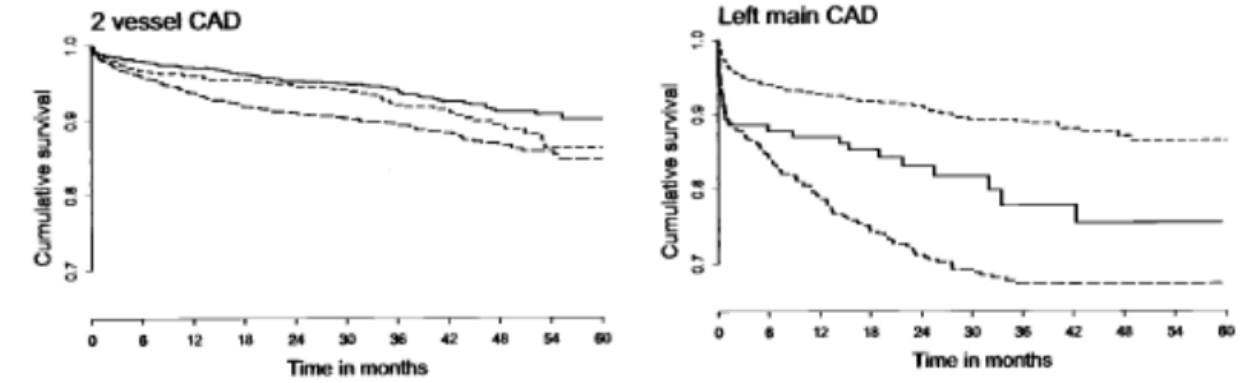
(no LMS patients)

N Engl J Med. 2009 Jun 11; 360(24): 2503–2515.

More contemporary data

APPROACH Registry (Canada) Am Heart J 2001;142:119-26.





CABG for 3VCD and LMS

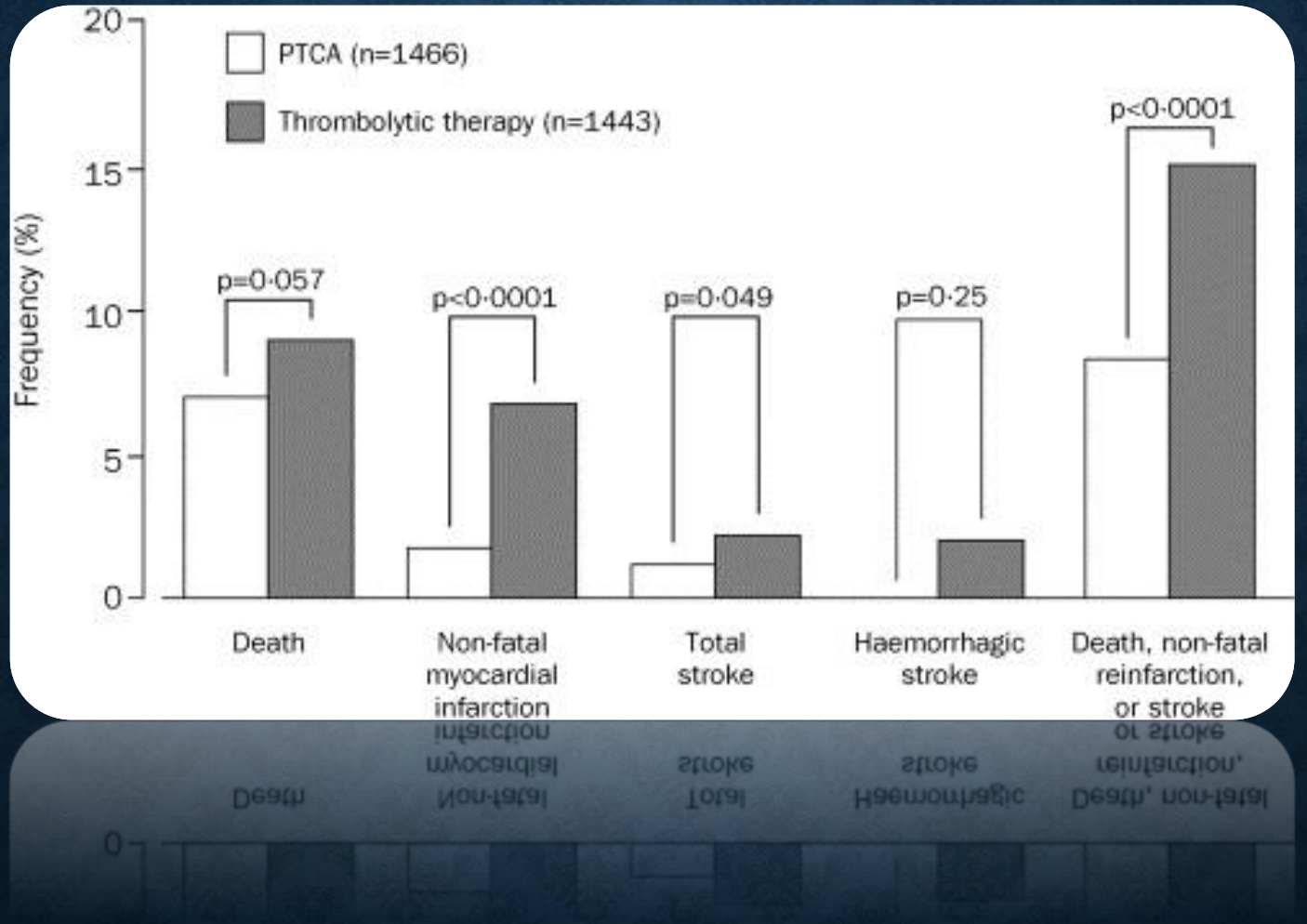
CABG – CONCLUSIONS… ??

- With the ‘eye of faith’ –
- 3VCD + LV dysfunction
- LM or LMEQ
- Multivessel disease in diabetics.

- But the evidence isn’t robust considering OMT

With PCI?

PCI FOR STEMI – IT WORKS!



Keeley EC, Boura JA, Grines CL, . et al. Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomised trials. Lancet. 2003. January 4; 361 9351: 13– 20.

REVASCULARISATION IN ACS – TARGET LESION

- Routine invasive v. conservative strategy leads to less death, MI or rehospitalisation for ACS at 1 year
  - Benefit carried mainly by Troponin positive patients
  - More pronounced in diabetics

N Engl J Med 2001;**344**(25):1879–1887.
. *J Am Coll Cardiol* 2006;**48**(7):1319–1325.
. *JAMA* 2008;**300**(1):71–80.

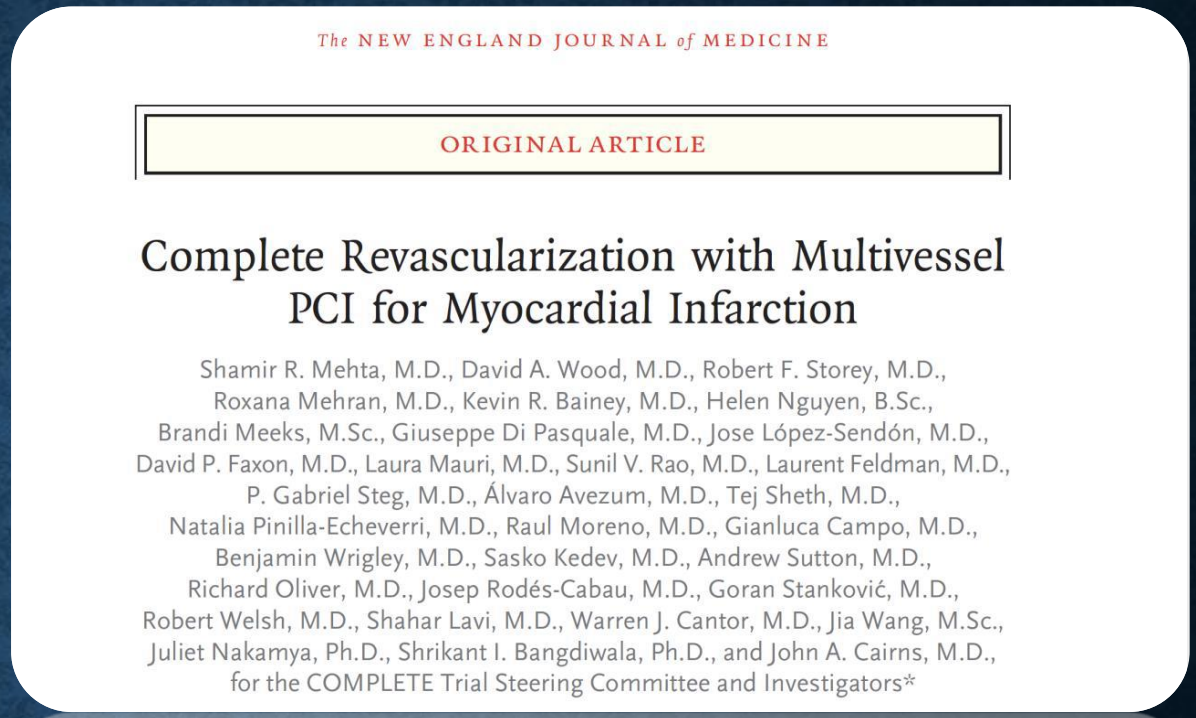
- Routine invasive v. selective invasive leads to less death or MI at 5 years

J Am Coll Cardiol 2010;**55**(22):2435–2445.

- Important to remember what patients were excluded from these trials: e.g. age >75 years, previous PCI or CABG, systemic disease, significant CKD, late presentation, CCF.

DO WE NEED COMPLETE REVASCULARIZATION?

What if multi-vessel disease post MI??



- Patients undergoing primary PCI of the culprit lesion for STEMI are often found to have multivessel CAD, with 1 or more angiographically significant non-culprit lesions.
- There is uncertainty about how best to manage these non-culprit lesions:
  - Routinely revascularise them with PCI?
  - Manage them conservatively with guideline-directed medical therapy alone?

STEMI WITH MULTIVESSEL CAD AND SUCCESSFUL PCI TO THE CULPRIT LESION

≥70% stenosis or 50-69% with FFR ≤0.80

RANDOMISATION

Stratified to in-hospital or after discharge

COMPLETE REVASCULARISATION
N=2,000

CULPRIT LESION ONLY REVASCULARISATION
N=2,000

MEDIAN FOLLOW-UP: 3 YEARS

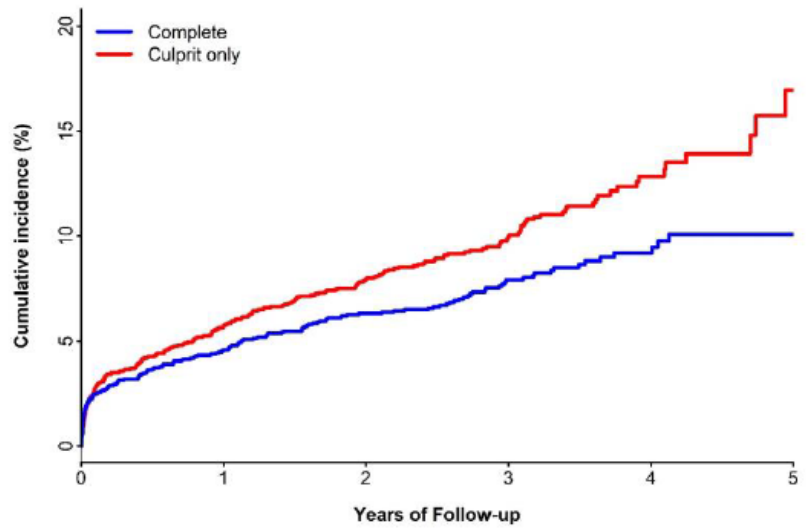
CO-PRIMARY OUTCOMES: 1. Composite of CV death or new MI

2. Composite of CV death, new MI or ischaemia-driven revascularisation

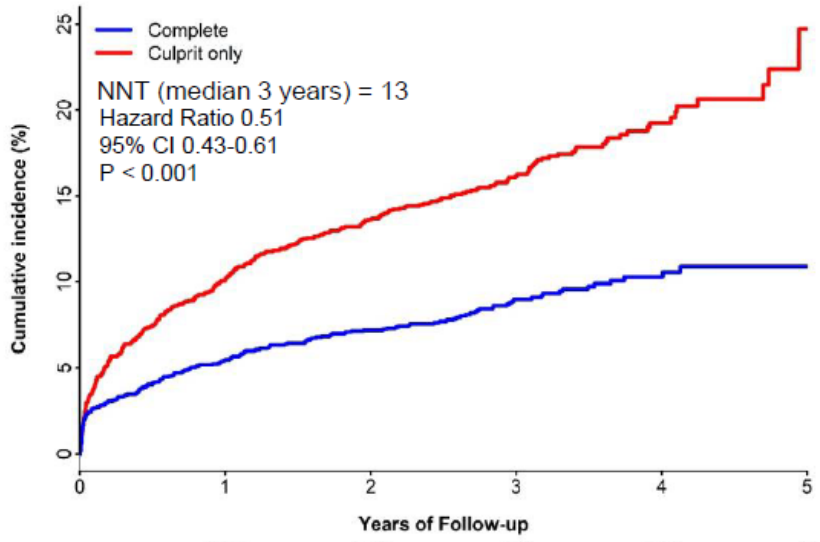
KEY SECONDARY OUTCOME: CV death, new MI, IDR, unstable angina, NYHA class IV heart failure

Mehta SR, et al. Am Heart J. 2019.

- First Co-Primary Outcome: CV Death or New MI



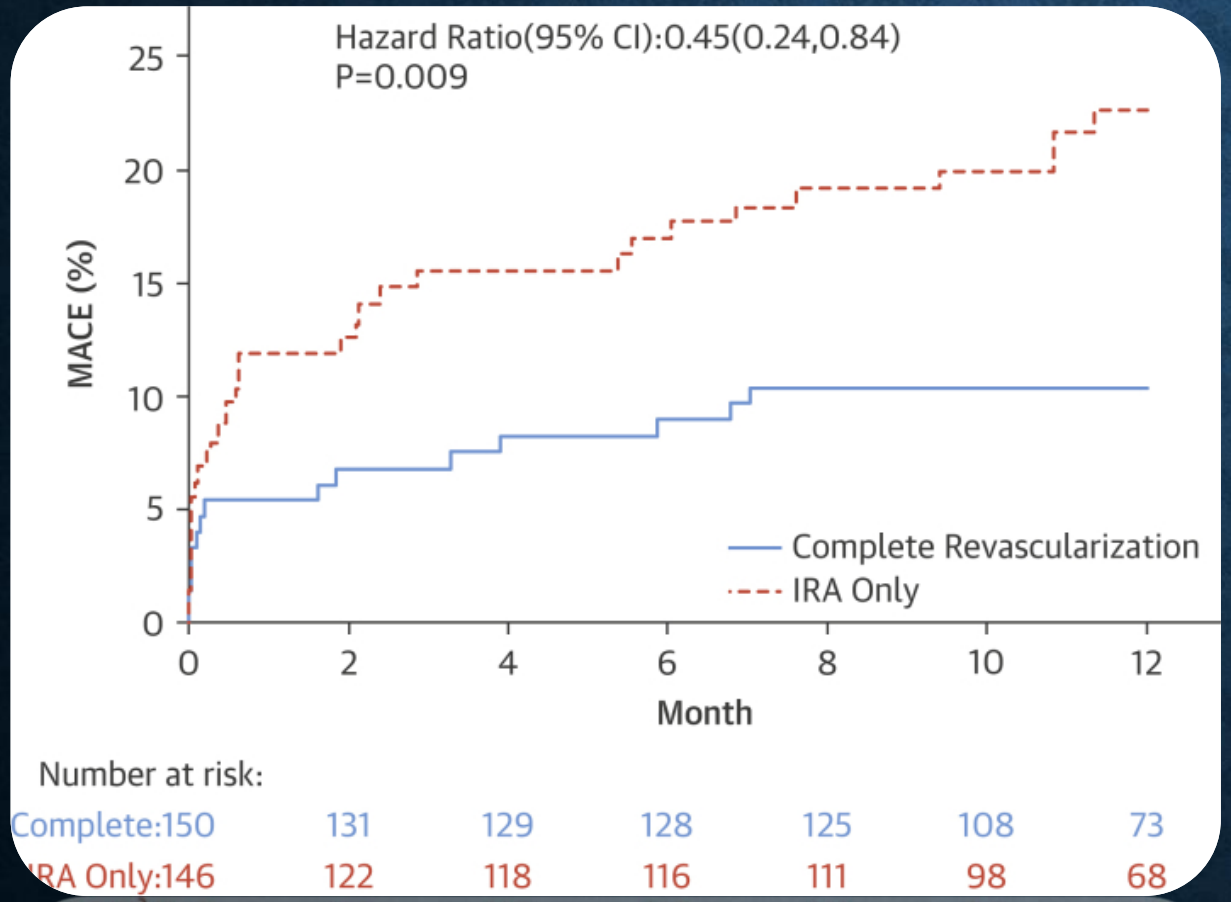
- 2nd Co-Primary Outcome: CV Death, MI, or IDR



Mehta SR, et al. NEJM. 2019.

Complete revascularisation is better

RANDOMIZED TRIAL OF COMPLETE VERSUS LESION-ONLY REVASCULARIZATION IN PATIENTS UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION FOR STEMI AND MULTIVESSEL DISEASE
THE CVLPRIT TRIAL



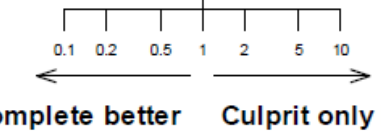
5yr follow-up shows sustained benefit

J Am Coll Cardiol. 2015 Mar 17; 65(10): 963–972.

Timing of non-culprit lesion PCI: During or after initial hospitalisation

CV death or New MI

	Complete *no. of events/total no. (%/yr)*	Culprit Only	HR (95% CI)	Interaction P
Intent to perform non-culprit lesion PCI				0.62
During initial hospitalization	101/1353 (2.7)	130/1349 (3.5)	0.77 (0.59-1.00)	
After initial hospitalization	57/663 (2.7)	83/676 (3.9)	0.69 (0.49-0.97)	



Complete better Culprit only better

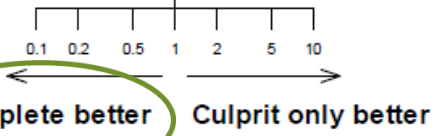
CV death, New MI, or IDR

	Complete *no. of events/total no. (%/yr)*	Culprit Only	HR (95% CI)	Interaction P
Intent to perform non-culprit lesion PCI				0.27
During initial hospitalization	113/1353 (3.0)	227/1349 (6.6)	0.47 (0.38-0.59)	
After initial hospitalization	66/663 (3.1)	112/676 (5.4)	0.59 (0.43-0.79)	

Median Time to study NCL PCI in Complete Group

During initial hospitalisation: 1 day (IQR 1-3)

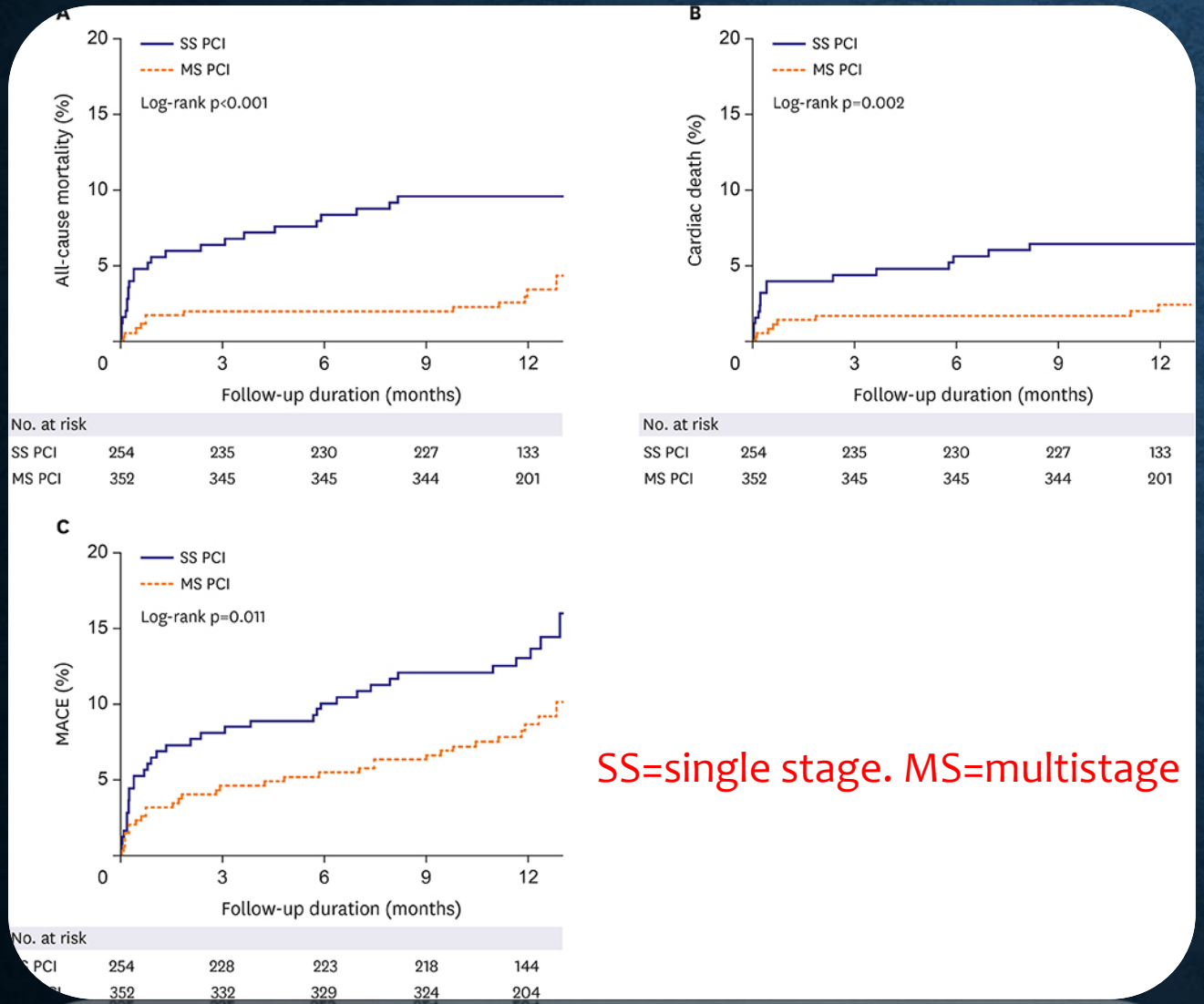
After Hospital discharge: 23 days (IQR 12.5-33.5)



Complete better Culprit only better

Mehta SR, et al. NEJM. 2019.

TIMING OF REVASC FOLLOWING STEMI



SS=single stage. MS=multistage

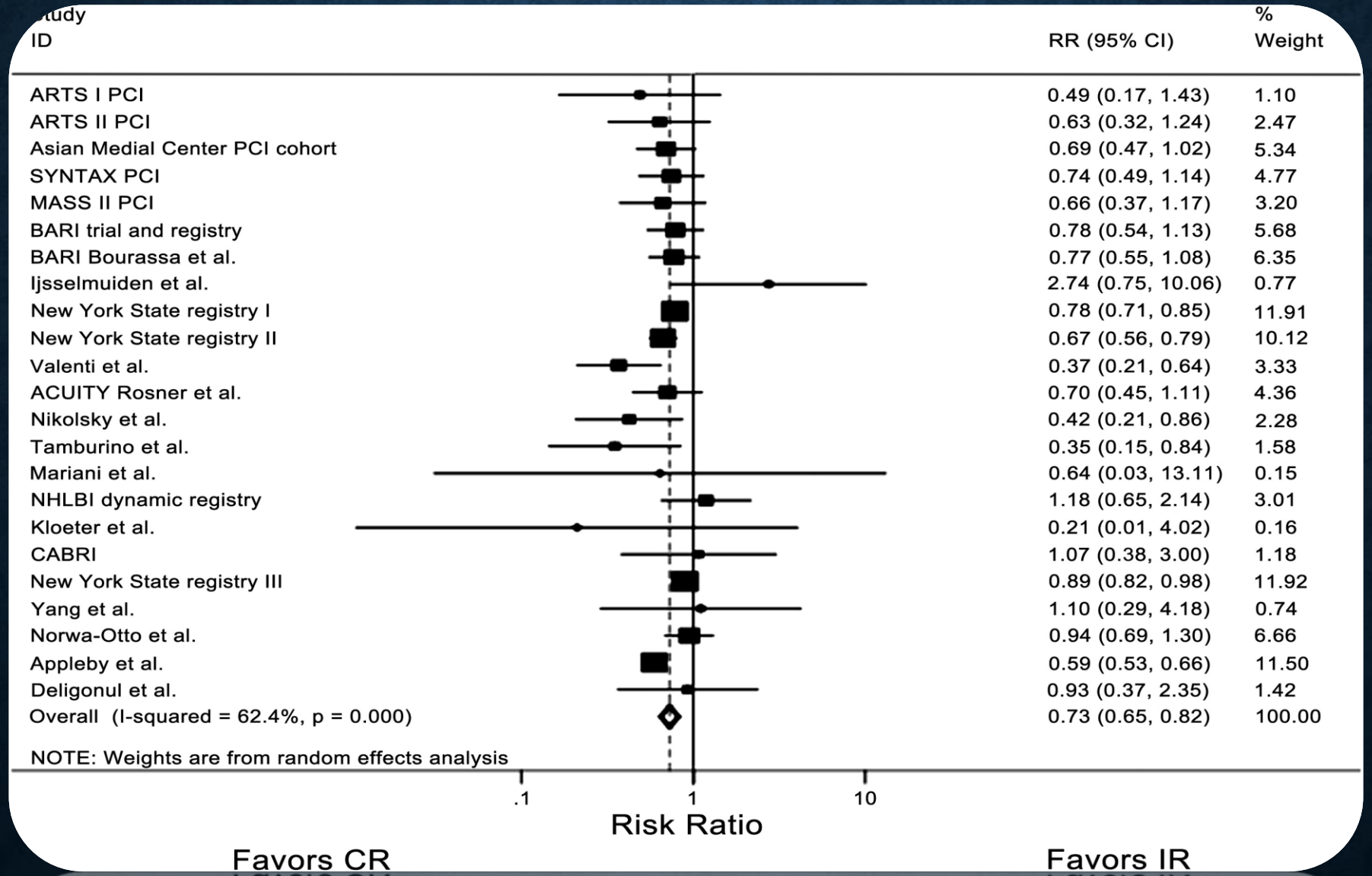
Korean data suggests staged procedures may be better

Korean Circ J. 2020 Mar; 50(3): 234–235.

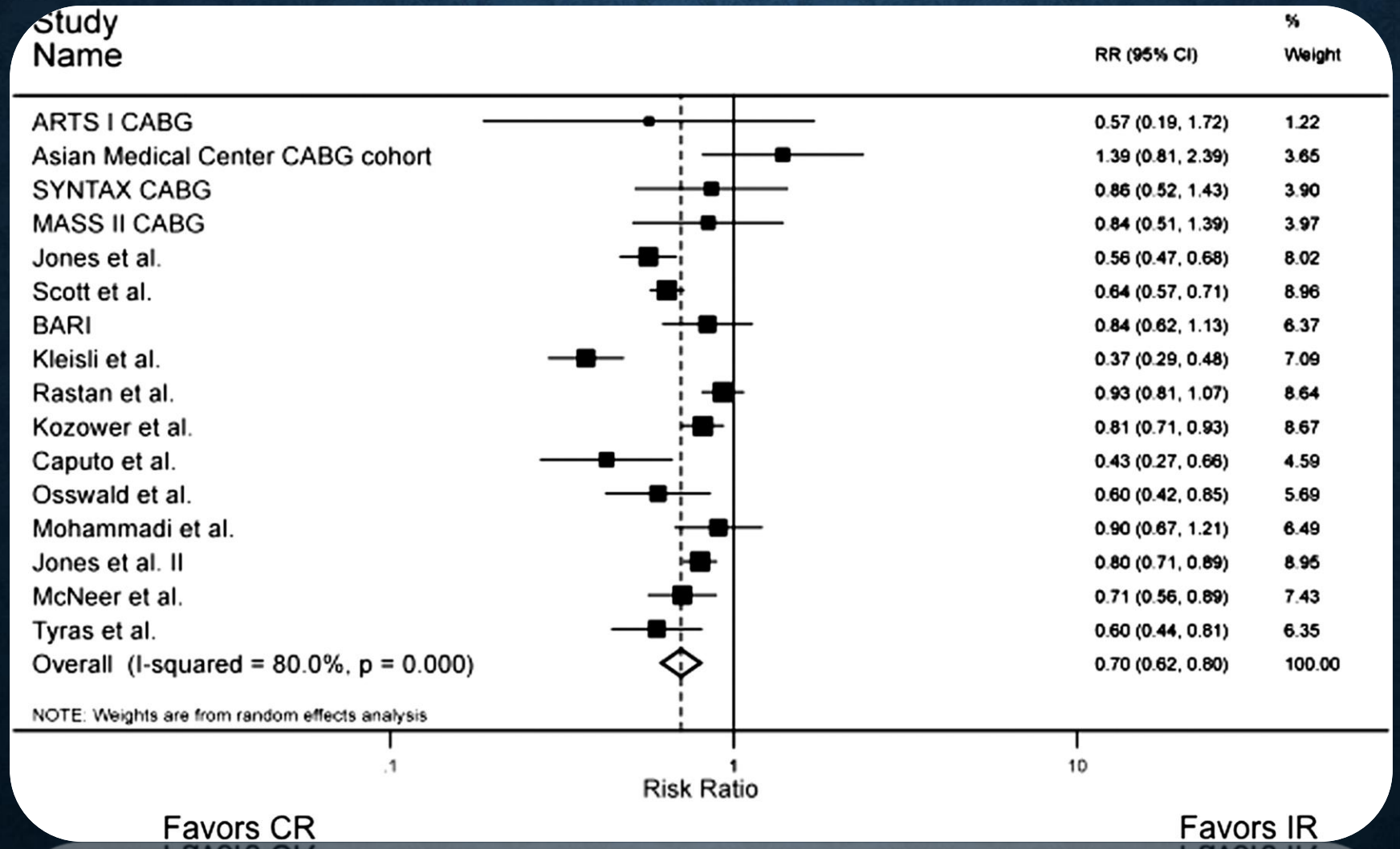
Optimal Timing of Coronary Intervention in Non-Culprit Lesion in ST Elevation Myocardial Infarction with Multi-Vessel Disease

Jongkwon Seo, MD1

? COMPLETE REVASC IN STEMI? – FOR PCI



? COMPLETE REVASC IN STEMI? – FOR CABG



Journal of the American College of Cardiology. Volume 62, Issue 16, 15 October 2013, Pages 1421-1431

STENTS LOOKING PRETTY GOOD, HEY!

As long as we don't compare it to OMT……

IS THERE GOOD EVIDENCE FOR INTERVENTION IN CORONARY DISEASE?

With PCI?

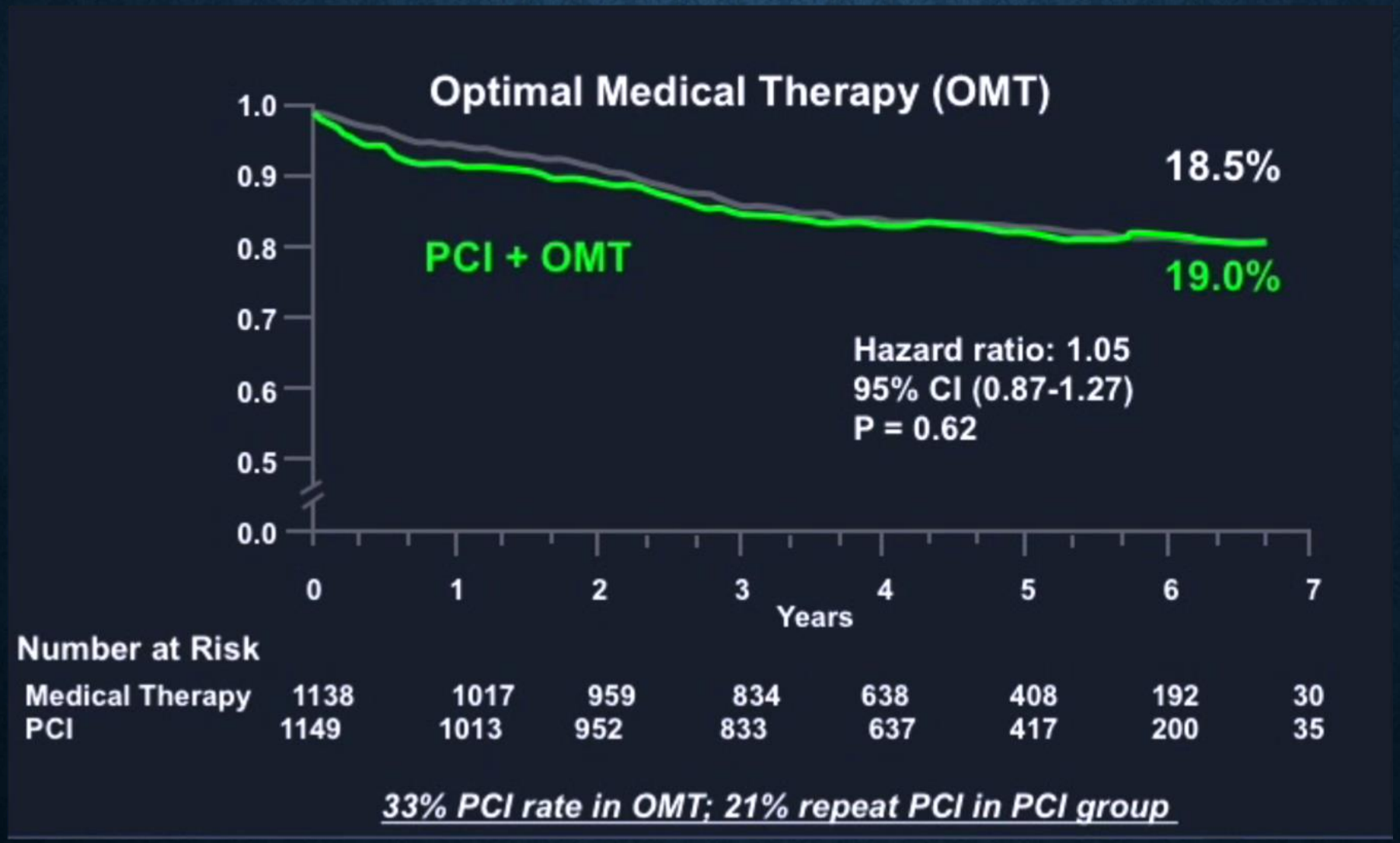
With CABG?

Or should we focus on Optimal Medical Therapy (OMT)??

COURAGE (2007 & 2015)

- Objective ischaemia & significant CAD in 2287 patients
- Optimal medical therapy + selective PCI or routine PCI
  - No difference in death or ACS at 4.6 years (~19% event rate)
- Greater freedom from angina at 1 and 3 years
  - No difference at 5 years (however 33% of OMT group had undergone PCI by this time)
- Survival similar at 12 years

COURAGE



Boden et al. NEJM. 2007

COURAGE: Effect of Medical Therapy

SAQ Freedom From Angina

	PCI + OMT	OMT	p
Baseline	21%	23%	NS
3 Months	53%	42%	<0.001
1 Year	57%	50%	0.005
2 Years	59%	53%	0.010
3 Years	59%	56%	NS

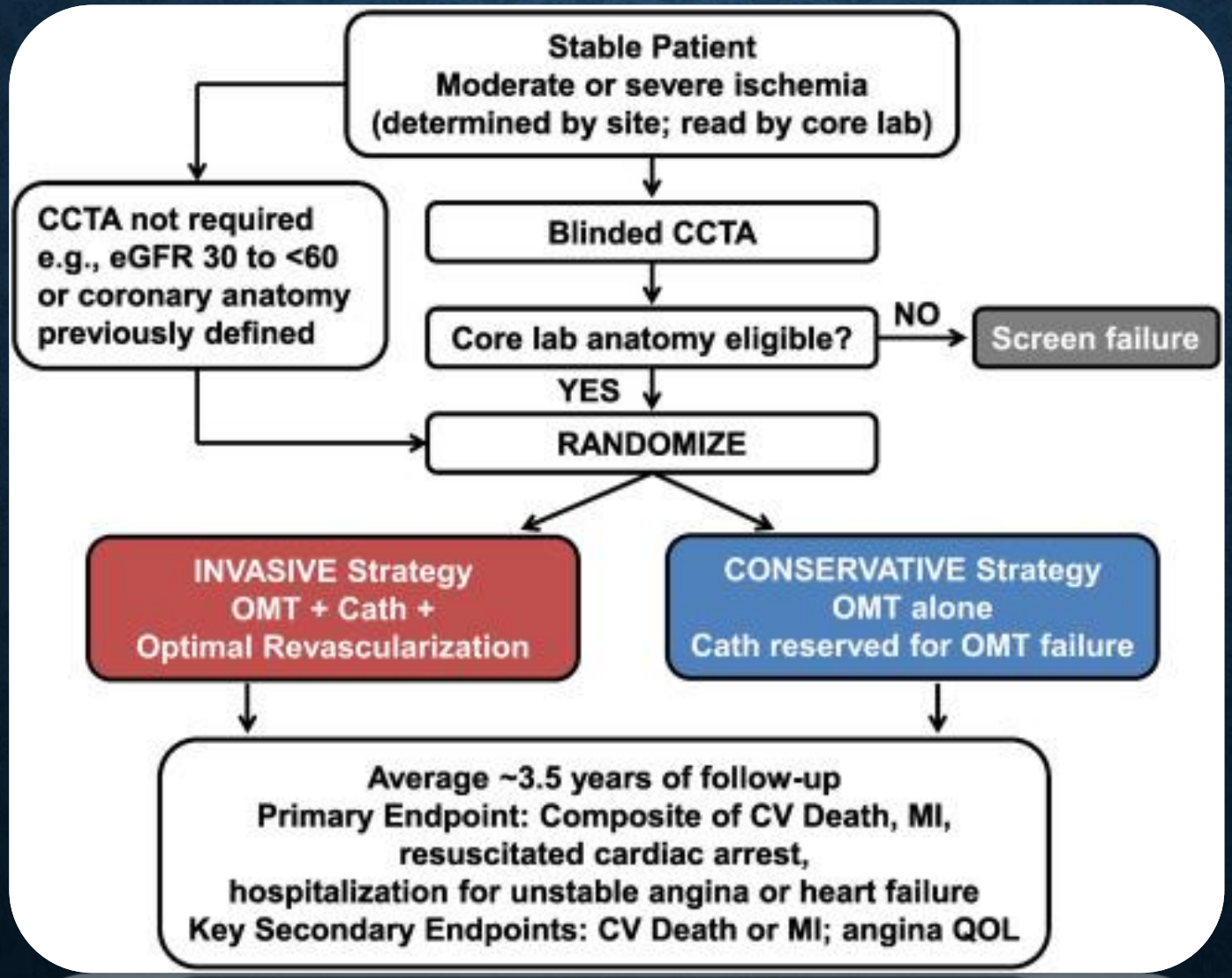
Minimal DES Use and 32% of Medically Treated Patients in the Trial Crossed Over to PCI

IF THAT WASN'T BAD ENOUGH!

INTERVENTIONAL CARDIOLOGY UPDATE

- The ISCHEMIA trial was designed to evaluate the clinical impact of systematic invasive management in patients with stable ischemic heart disease and significant inducible ischemia.
- AUTHORS **Maron DJ, Hochman JS et al; ISCHEMIA Research Group.**
- REFERENCE - **N Engl J Med 2020; 382:1395-1407.** PUBLISHED **April 9, 2020**

ISCHAEMIA TRIAL



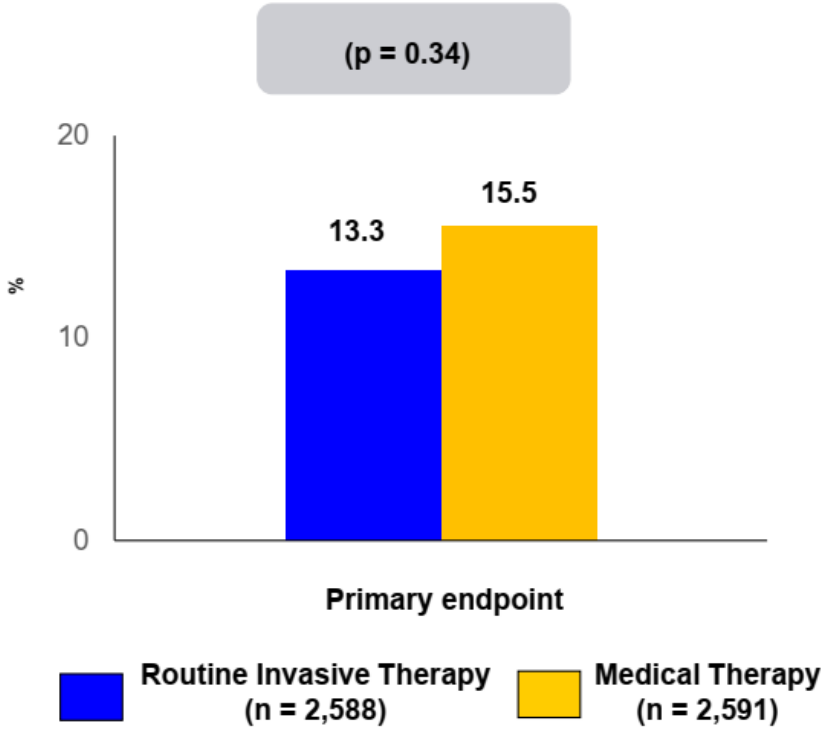
ISCHEMIA

#AHA19

Exclusions - >50% LMS on CT, EF<35%, unstable

AMERICAN COLLEGE of CARDIOLOGY

Trial Description: Patients with stable ischemic heart disease and moderate to severe ischemia were randomized to routine invasive therapy vs. medical therapy.



RESULTS

- Primary efficacy endpoint: CV death, MI, resuscitated cardiac arrest, or hospitalization for unstable angina or HF at 3.3 years occurred in 13.3% of the routine invasive group vs. 15.5% of the medical therapy group (p = 0.34)
- Invasive therapy was associated with harm (~2% absolute increase) within the first 6 months and benefit within 4 years (~2% absolute decrease)
- Improvement in symptoms was observed among those with daily/weekly/monthly angina, but not in those without angina

CONCLUSIONS

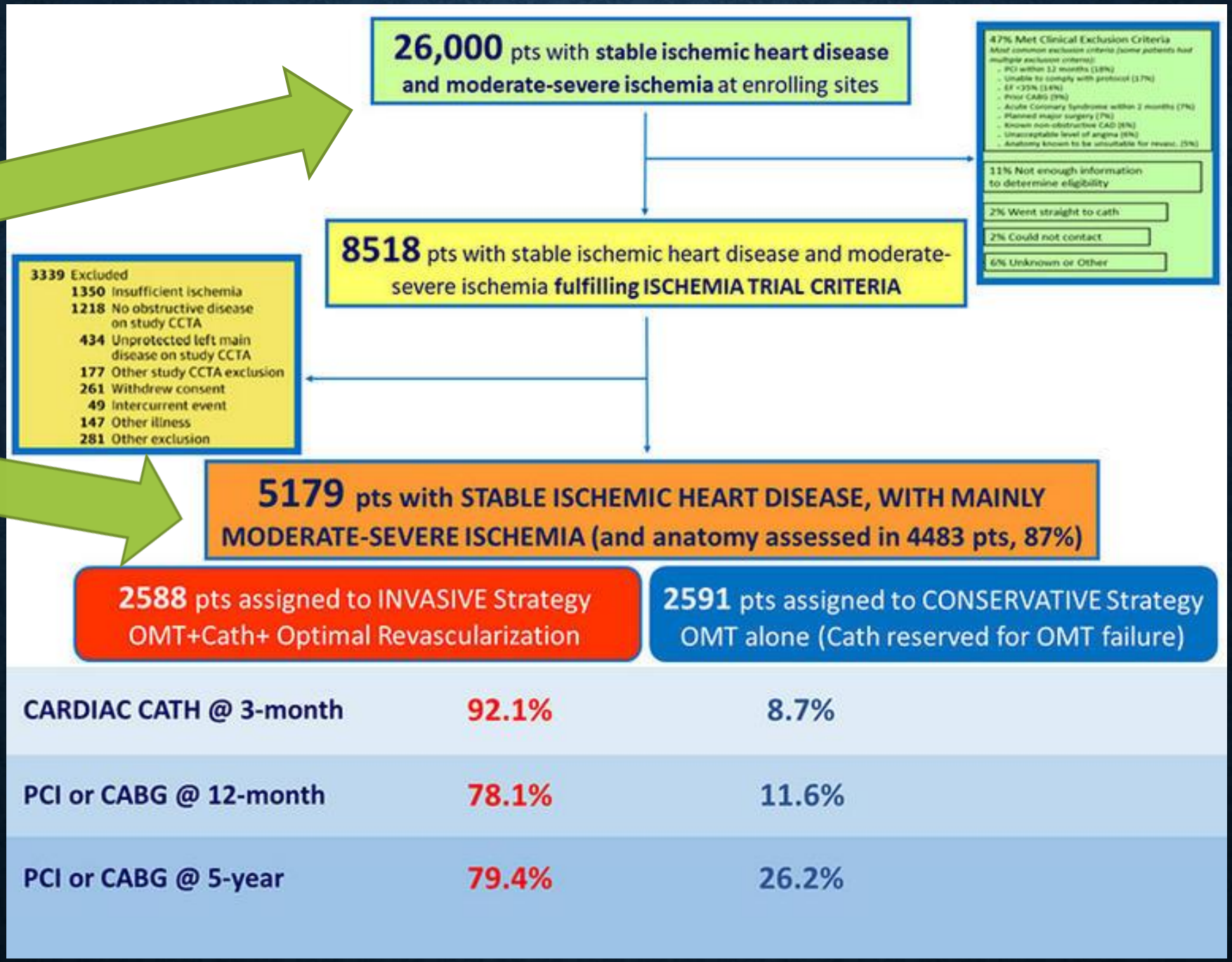
- Among patients with stable ischemic heart disease and moderate to severe ischemia on stress testing, invasive therapy failed to reduce major adverse cardiac events vs. medical therapy. Invasive therapy was associated with increase in periprocedural MI at 6 months and a reduction in spontaneous MI at 4 years.

Presented by Drs. Judith Hochman and John Spertus at AHA 2019

CONCLUSIONS

- Among patients with stable coronary disease and moderate or severe ischemia, we did not find evidence that an initial invasive strategy, as compared with an initial conservative strategy, reduced the risk of ischemic cardiovascular events or death from any cause over a median of 3.2 years.

Still a subset of patients



CARDIAC CATH @ 3-month	92.1%	8.7%
PCI or CABG @ 12-month	78.1%	11.6%
PCI or CABG @ 5-year	79.4%	26.2%

PERCUTANEOUS CORONARY INTERVENTION IN STABLE ANGINA (ORBITA): A DOUBLE-BLIND, RANDOMISED CONTROLLED TRIAL

- ORBITA enrolled 230 patients with ischaemic symptoms. After the medication optimisation phase and between Jan 6, 2014, and Aug 11, 2017, 200 patients underwent randomisation, with 105 patients assigned PCI and 95 assigned the placebo procedure. Lesions had mean area stenosis of 84·4% (SD 10·2), fractional flow reserve of 0·69 (0·16), and instantaneous wave-free ratio of 0·76 (0·22). There was no significant difference in the primary endpoint of exercise time increment between groups (PCI minus placebo 16·6 s, 95% CI −8·9 to 42·0, p=0·200). There were no deaths. Serious adverse events included four pressure-wire related complications in the placebo group, which required PCI, and five major bleeding events, including two in the PCI group and three in the placebo group.

In patients with medically treated angina and severe coronary stenosis, PCI did not increase exercise time by more than the effect of a placebo procedure. The efficacy of invasive procedures can be assessed with a placebo control, as is standard for pharmacotherapy.

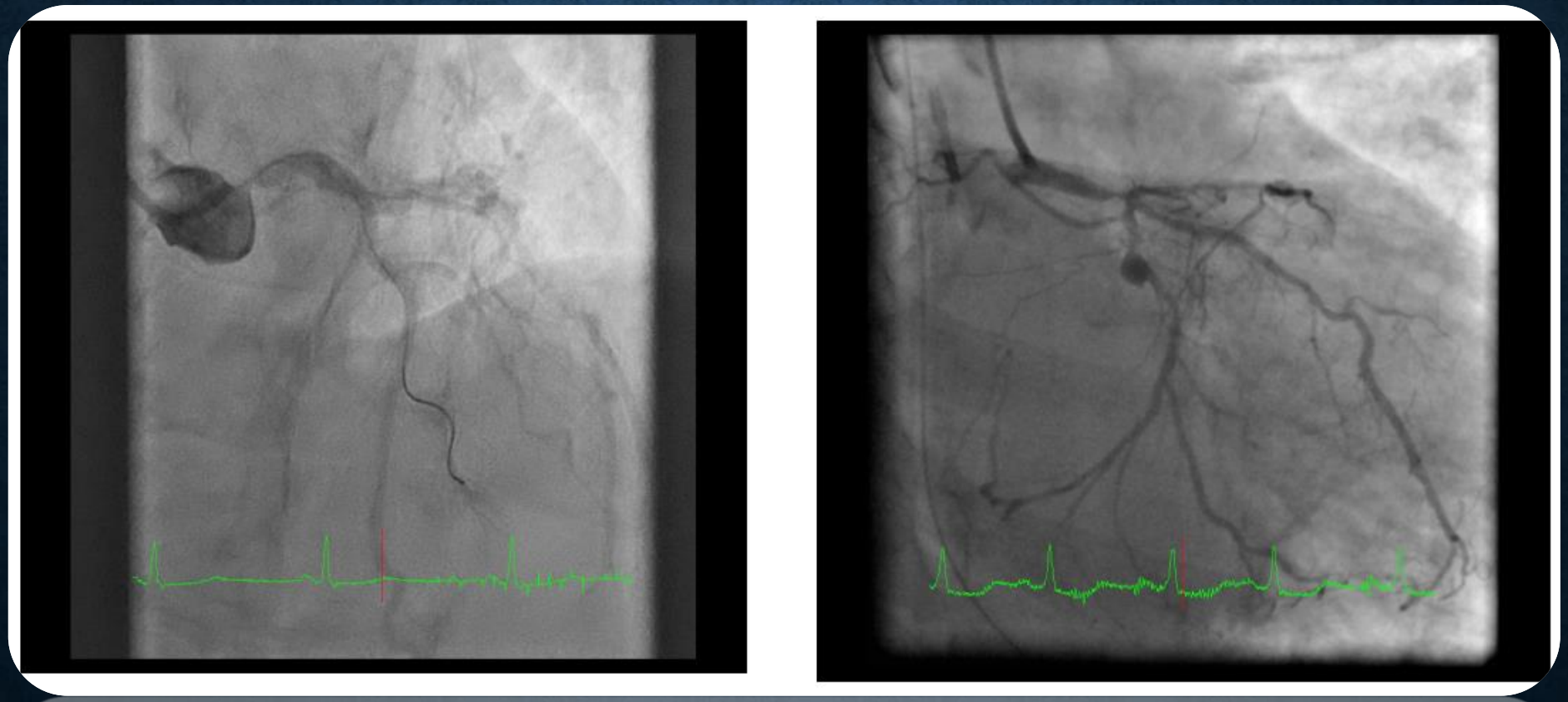
VOLUME 391, ISSUE 10115, P31-40, JANUARY 06, 2018

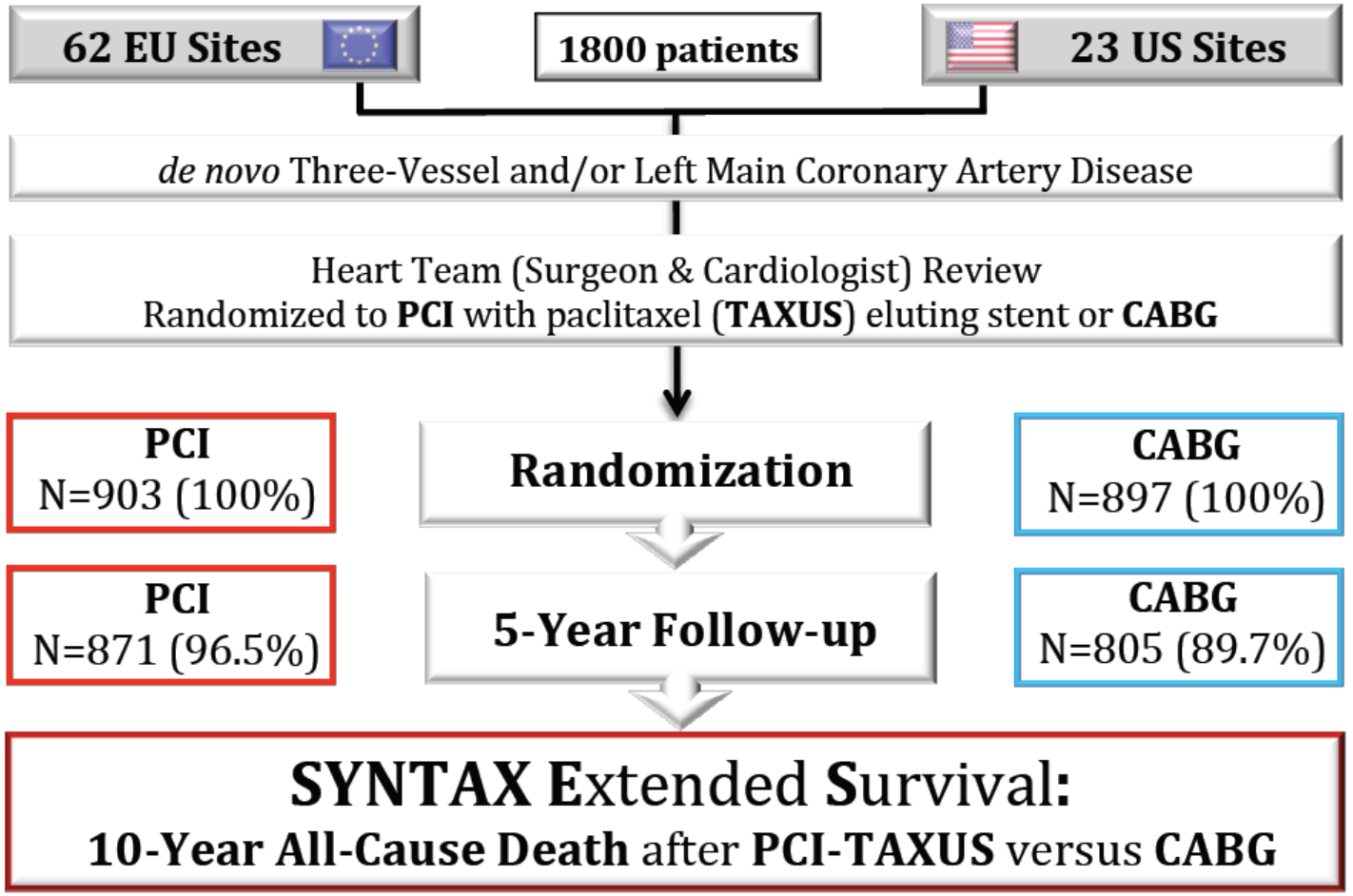

Dad, why don't we get Coronavirus?
Because we have anty bodies.

IS THERE TREATMENT PREFERENCE OVERLAP?

- Should all LM disease have CABG or is PCI an alternative?

CABG VS PCI IN LMS – "THERE'S LMS DISEASE AND THEN THERE'S LMS DISEASE!!!"

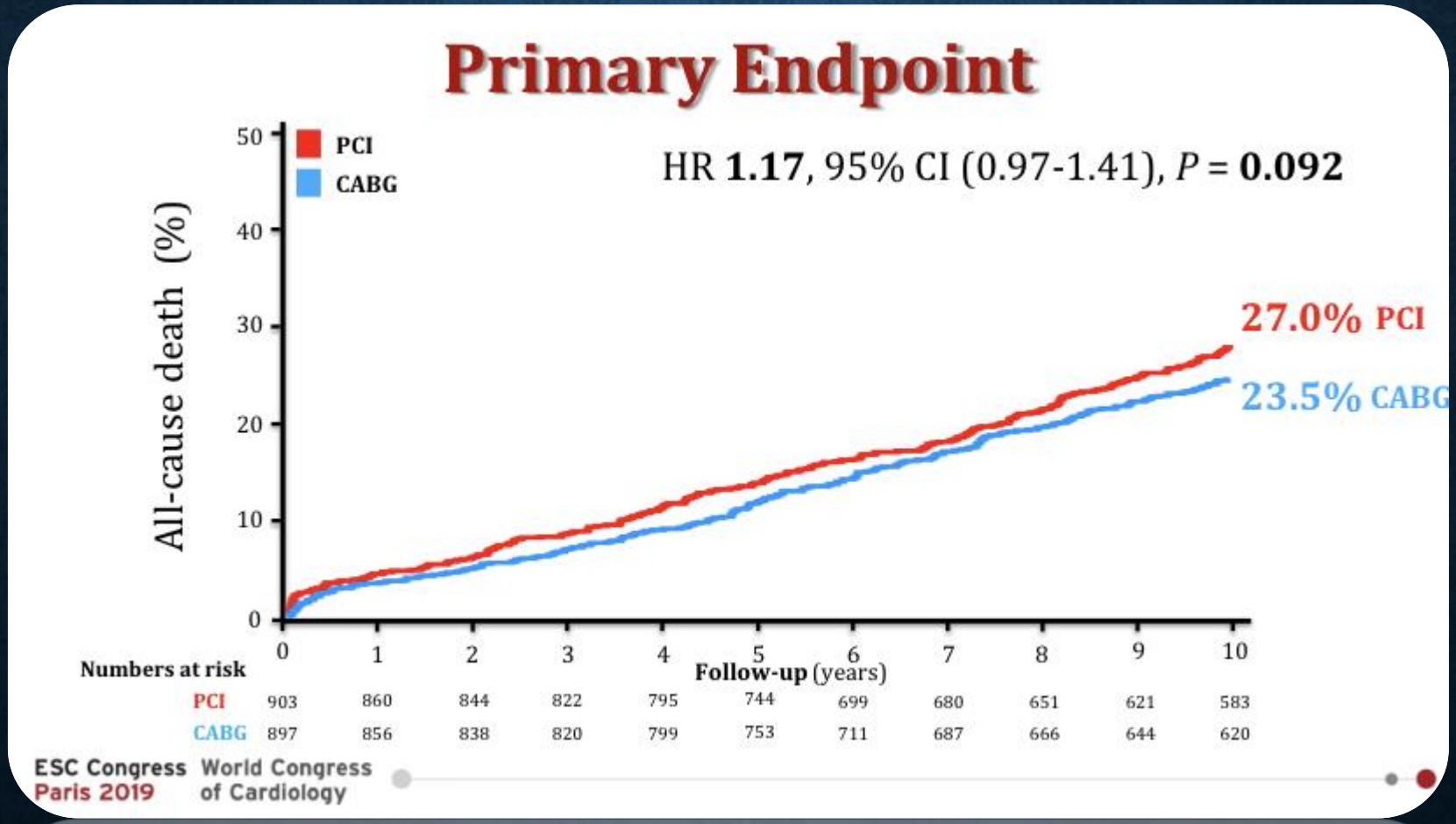




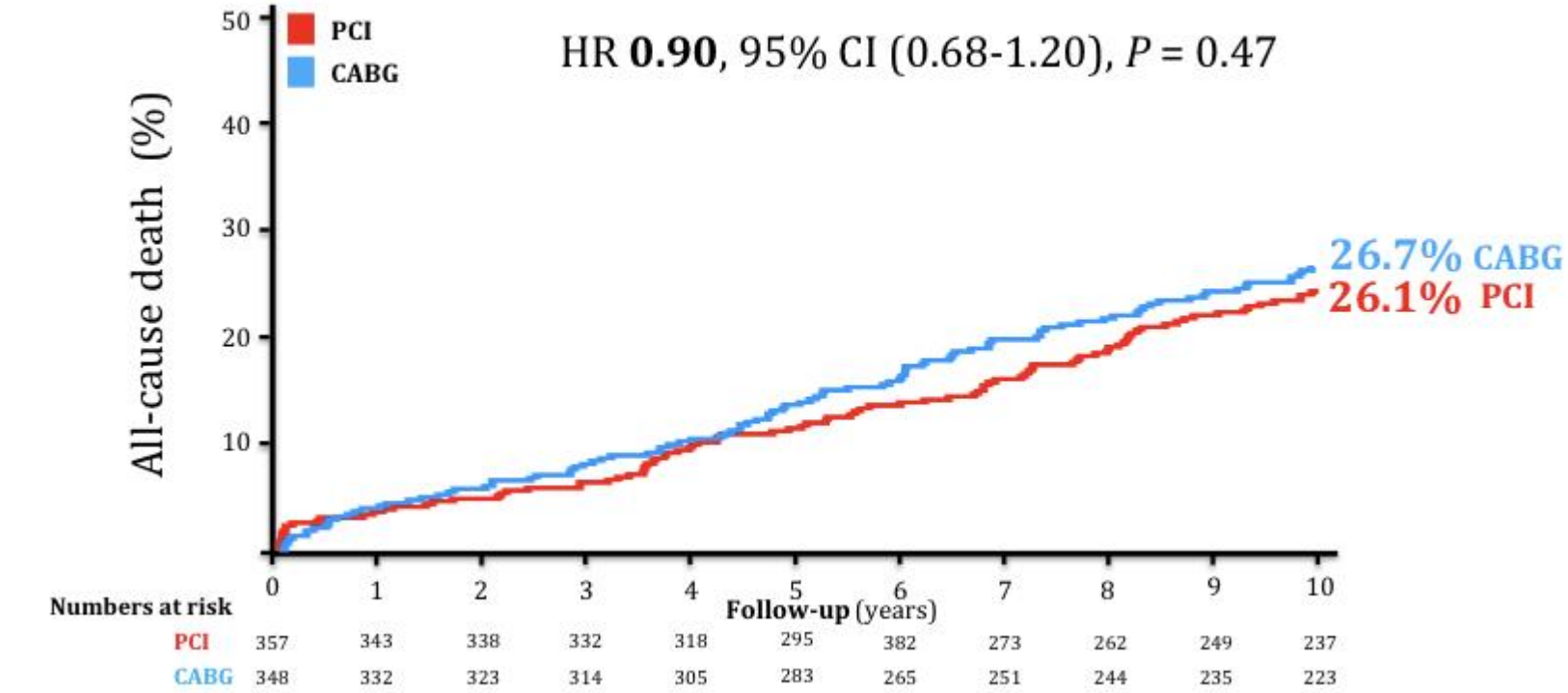
Serruys *et al. N Engl J Med* 2009; Mohr *et al. The Lancet 2013*

SYNTAX ES - TEN-YEAR SURVIVAL AFTER CORONARY ARTERY BYPASS GRAFTING VS PCI: THE SYNTAX EXTENDED SURVIVAL STUDY

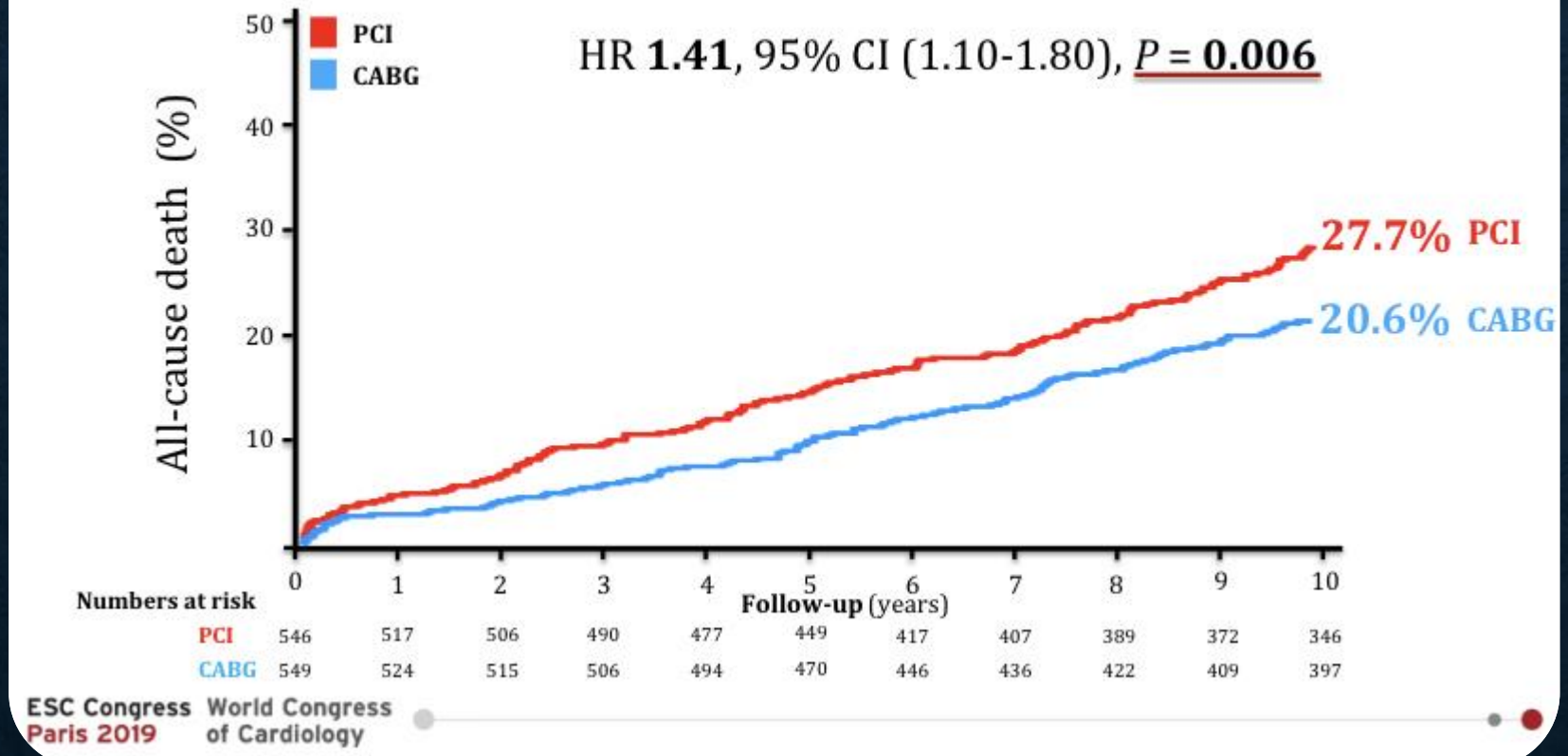
REPORTED FROM THE EUROPEAN SOCIETY OF CARDIOLOGY ESC CONGRESS 2019 IN PARIS



Left Main


PCI
CABG
HR 0.90, 95% CI (0.68-1.20), P = 0.47
All-cause death (%)
50
40
30
20
10
26.7% CABG
26.1% PCI
0
1
2
3
4
5
6
7
8
9
10
Follow-up (years)
Numbers at risk
PCI 357 343 338 332 318 295 382 273 262 249 237
CABG 348 332 323 314 305 283 265 251 244 235 223

Three-Vessel

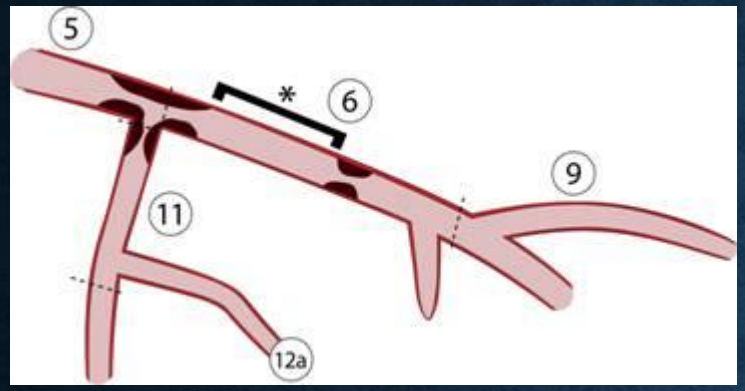


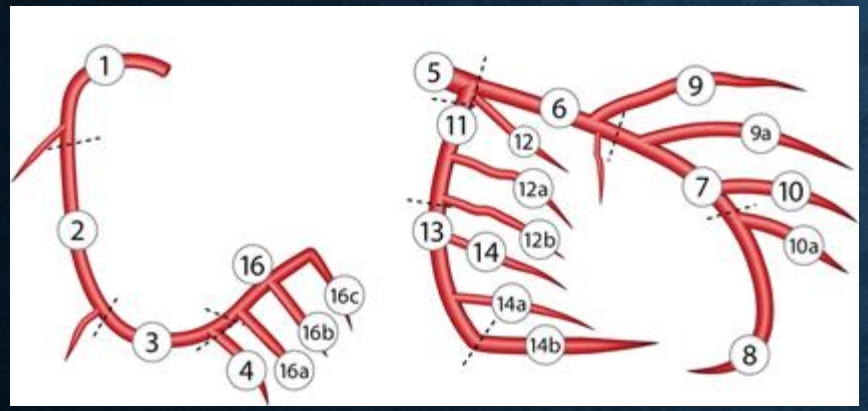
ESC Congress Paris 2019 World Congress of Cardiology

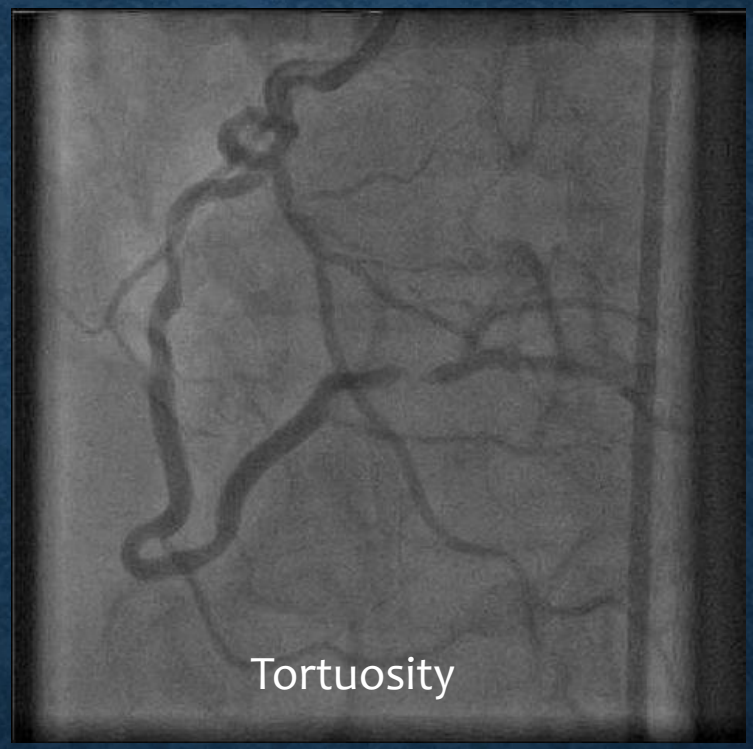
"In patients with left main coronary artery disease of low or intermediate anatomical complexity, there was no significant difference between PCI and CABG with respect to the rate of the composite outcome of death, stroke, or myocardial infarction at 5 years."

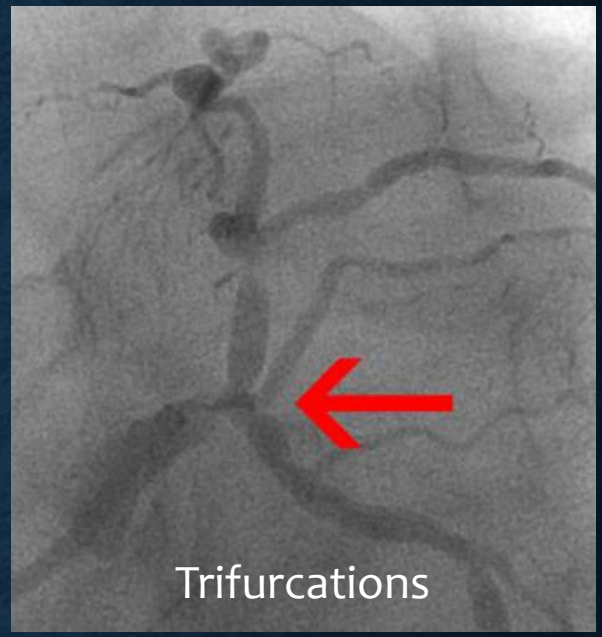
But how do we judge 'complexity' – SYNTAX Score
Better dig a little deeper……

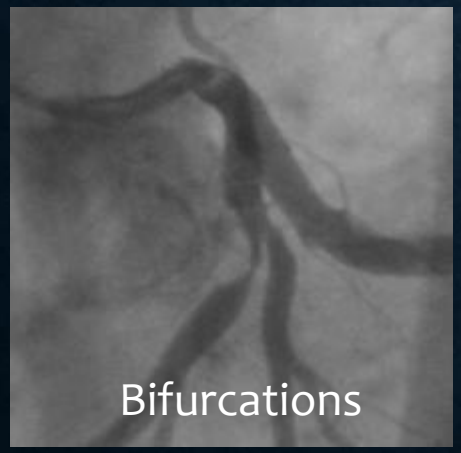
SYNTAX SCORE






Tortuosity


Trifurcations


Bifurcations

Lesion length
Calcification
Thrombus
Diffuseness of disease

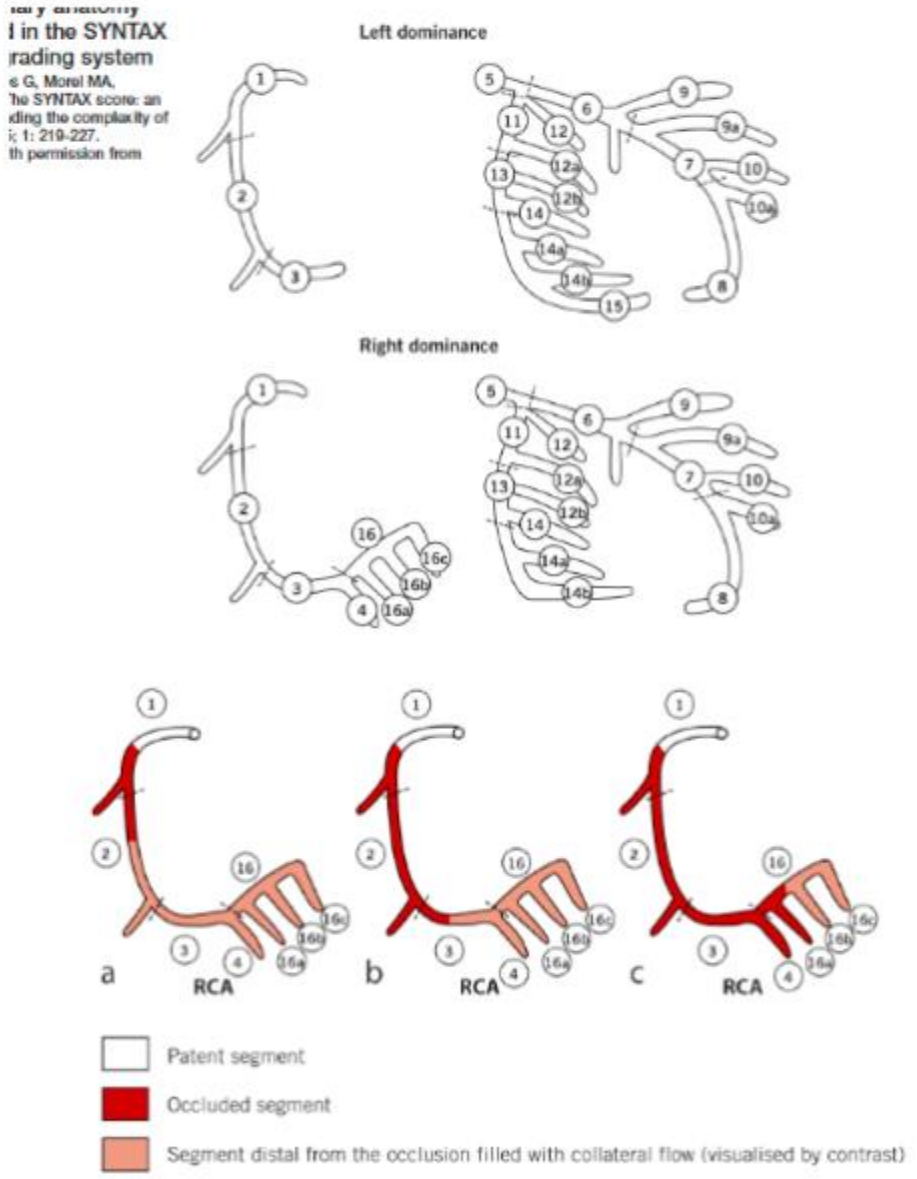
SYNTAX = anatomical complexity scoring system


Aorto-ostial disease

The SYNTAX score

Table 1. The SYNTAX score algorithm

1. Dominance
2. Number of lesions
3. Segments involved per lesion, with lesion characteristics
4. Total occlusions with subtotal occlusions:
   a. Number of segments
   b. Age of total occlusions
   c. Blunt stumps
   d. Bridging collaterals
   e. First segment beyond occlusion visible by antegrade or retrograde filling
   f. Side branch involvement
5. Trifurcation, number of segments diseased
6. Bifurcation type and angulation
7. Aorto-ostial lesion
8. Severe tortuosity
9. Lesion length
10. Heavy calcification
11. Thrombus
12. Diffuse disease, with number of segments



SYNTAX SCORE VS 1YR OUTCOMES FOR MULTI-VESSEL PCI +/- LMS VS CABG

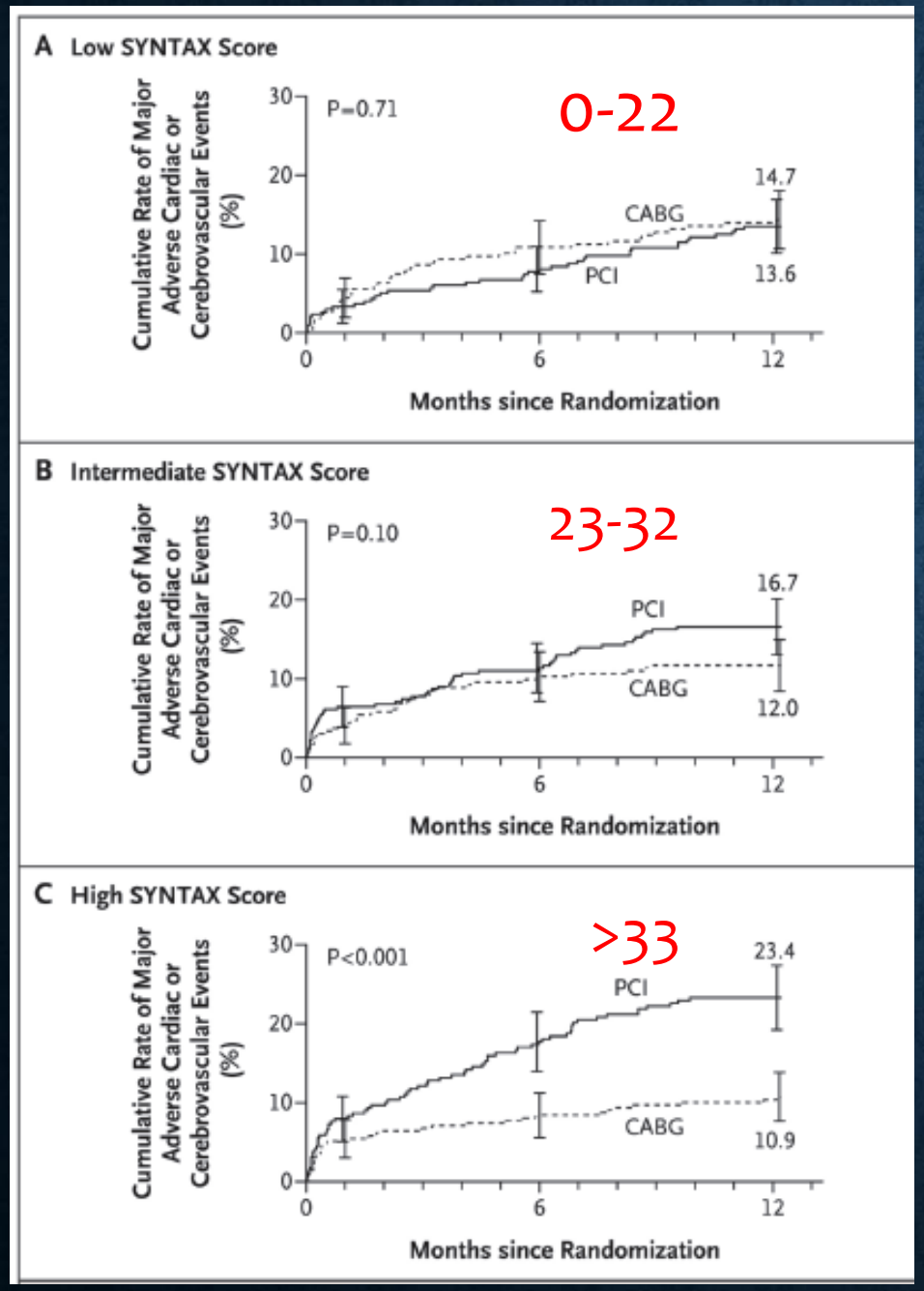


Figure 4. Outcomes of SYNTAX study by SYNTAX scores. Rates of Major Adverse Cardiac or Cerebrovascular Events among the Study Patients, According to Treatment Group and SYNTAX Score Category. Kaplan-Meier curves are shown for the percutaneous coronary intervention (PCI) group and the coronary artery bypass grafting (CABG) group for major adverse cardiac or cerebrovascular events at 12 months. The 12-month event rates were similar between the two treatment groups for patients with low SYNTAX scores (0 to 22) (Panel A) or intermediate SYNTAX scores (23 to 32) (Panel B). Among patients with high SYNTAX scores (≥33, indicating the most complex disease), those in the PCI group had a significantly higher event rate at 12 months than those in the CABG group. SYNTAX scores were calculated at the core laboratory. The I bars indicate 1.5 SE. P values were calculated with the use of the chi-square test.

Reprinted from Serruys PW, Morice, MC, Kappetein AP, et al. Percutaneous coronary intervention versus coronary-artery bypass grafting for severe coronary artery disease. *N Engl J Med* 2009; 360(10):961-972. Copyright © 2009 Massachusetts Medical Society. All rights reserved

1. Sianos G, Morel MA, Kappetein AP, et al. The SYNTAX score: an angiographic tool grading the complexity of CAD. EuroInterv 2005; 1: 219-227.
2. Valgimigli M, Serruys PW, Tsuchida K, et al. Cyphering the complexity of coronary artery disease using the syntax score to predict clinical outcome in patients with three-vessel lumen obstruction undergoing percutaneous coronary intervention. Am J Cardiol 2007 Apr 15;99(8):1072-1081.

Coronary: PCI vs. CABG

The 5 year results of the EXCEL Trial

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 DECEMBER 8, 2016 VOL. 375 NO. 23

Everolimus-Eluting Stents or Bypass Surgery for Left Main Coronary Artery Disease

G.W. Stone, J.F. Sabik, P.W. Serruys, C.A. Simonton, P. Généreux, J. Puskas, D.E. Kandzari, M.-C. Morice, N. Lembo W.M. Brown III, D.P. Taggart, A. Banning, B. Merkely, F. Horkay, P.W. Boonstra, A.J. van Boven, I. Ungi, G. Bogáts S. Mansour, N. Noiseux, M. Sabaté, J. Pomar, M. Hickey, A. Gershlick, P. Buszman, A. Bochenek, E. Schampaert P. Pagé, O. Dressler, I. Kosmidou, R. Mehran, S.J. Pocock, and A.P. Kappetein, for the EXCEL Trial Investigators*

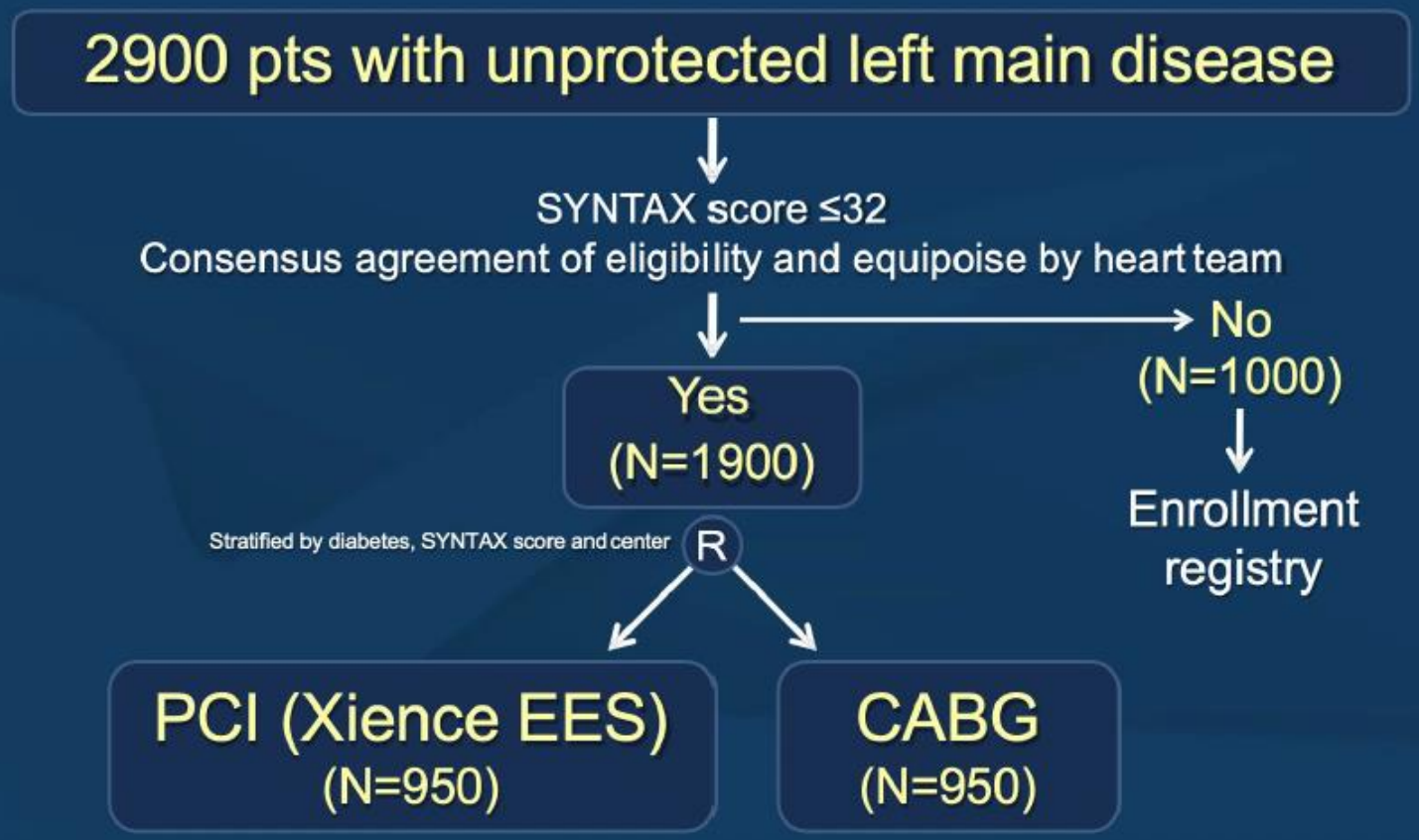
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease

G.W. Stone, A.P. Kappetein, J.F. Sabik, S.J. Pocock, M.-C. Morice, J. Puskas, D.E. Kandzari, D. Karmpaliotis, W.M. Brown III, N.J. Lembo, A. Banning, B. Merkely, F. Horkay, P.W. Boonstra, A.J. van Boven, I. Ungi, G. Bogáts, S. Mansour, N. Noiseux, M. Sabaté, J. Pomar, M. Hickey, A. Gershlick, P.E. Buszman, A. Bochenek, E. Schampaert, P. Pagé, R. Modolo, J. Gregson, C.A. Simonton, R. Mehran, I. Kosmidou, P. Généreux, A. Crowley, O. Dressler, and P.W. Serruys, for the EXCEL Trial Investigators*

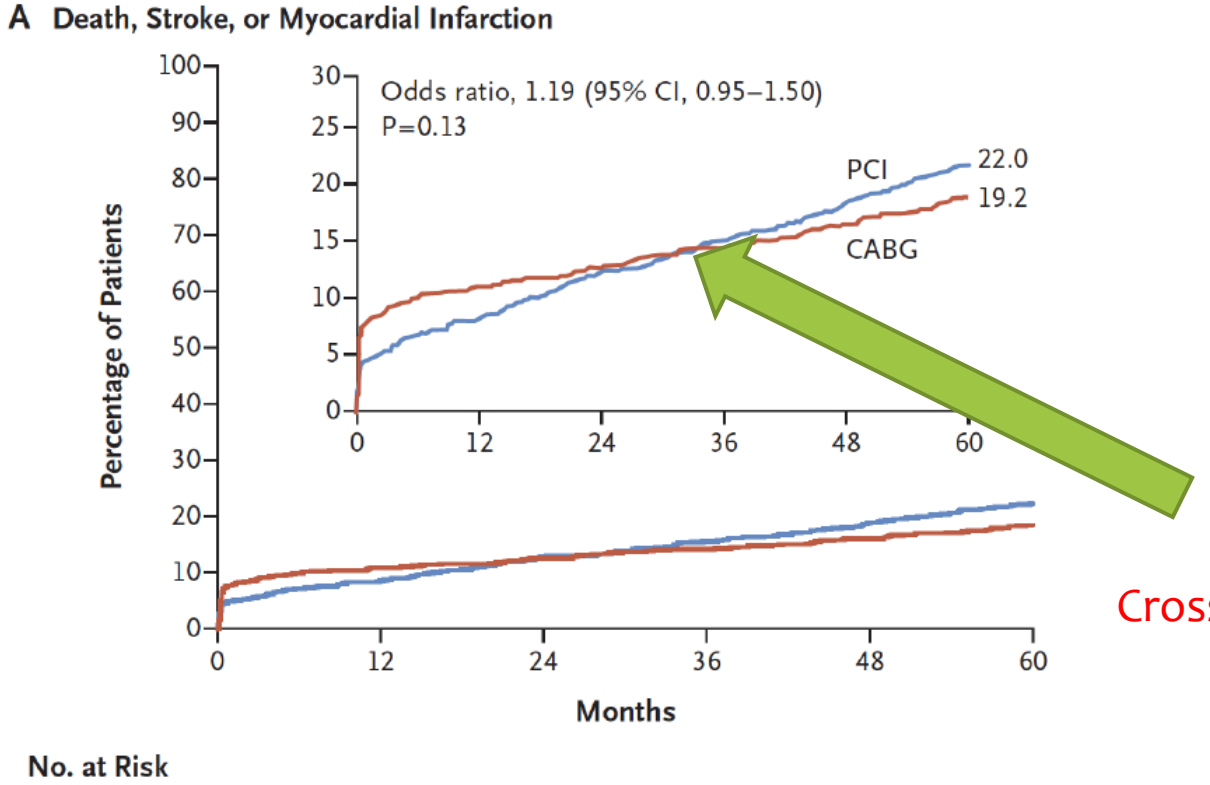
Study Design



Follow-up: 1 month, 6 months, 1 year, annually through 5 years

Primary endpoint: Measured at a median 3-yr FU, minimum 2-yr FU

Primary Endpoint
All-cause Death, Stroke or MI at 5 Years

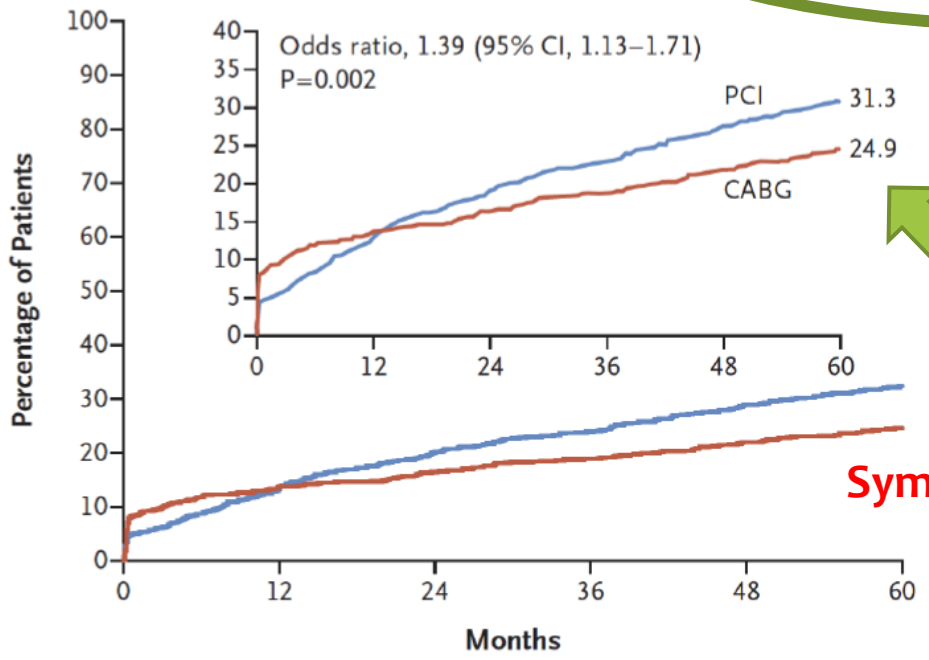


Cross over at 3yrs

No. at Risk						
PCI	948	854	809	778	738	486
CABG	957	818	789	763	734	532

Death Stroke MI or Ischemia Driven Revasc

B Death, Stroke, Myocardial Infarction, or Ischemia-Driven Revascularization



No. at Risk						
PCI	948	813	746	706	653	428
CABG	957	795	757	725	686	494

Symptomatic end-point

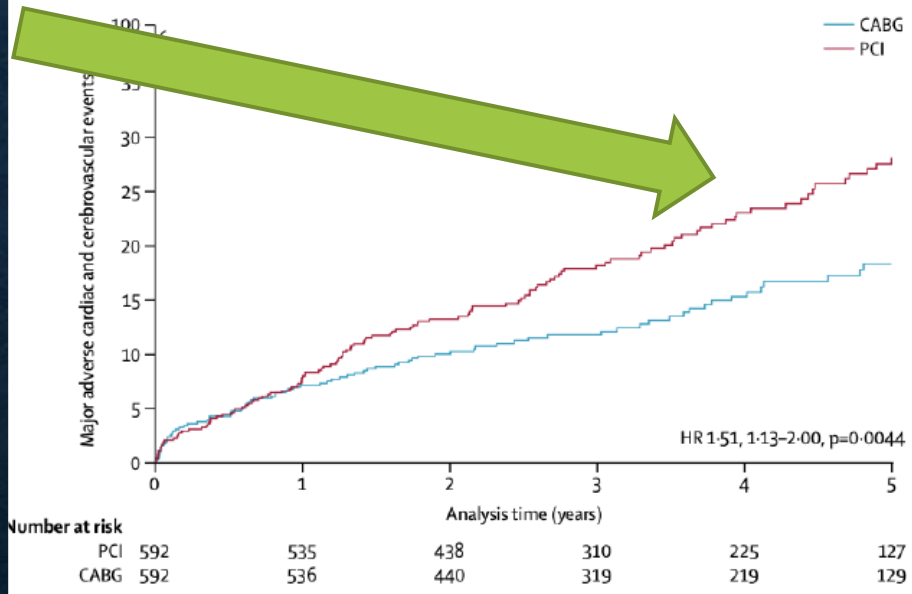
Driven by - repeat revasc, late MI and higher stroke risk in PCI…

? Apples vs Pears….

gulf PCR 2019

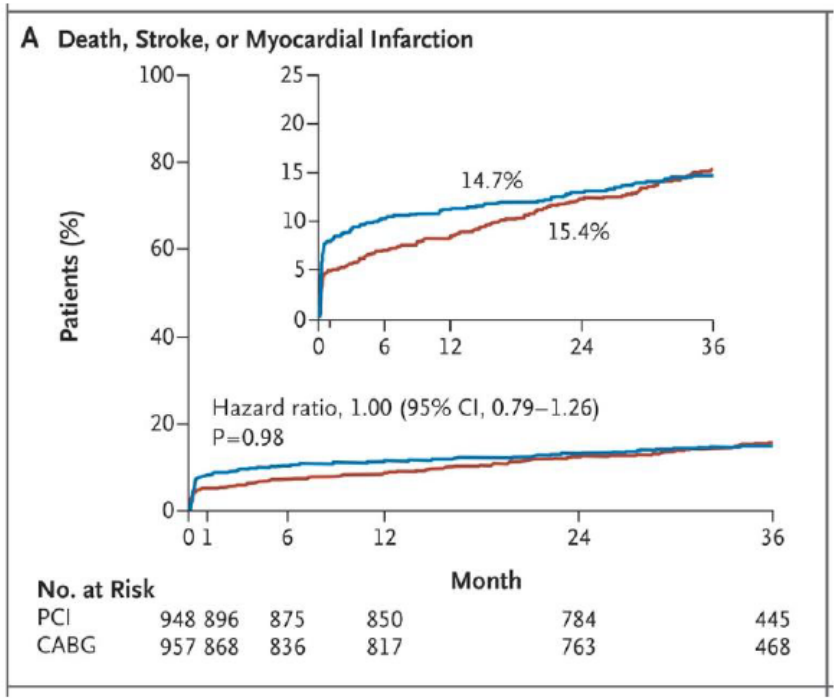
The Data in 2016

NOBLE



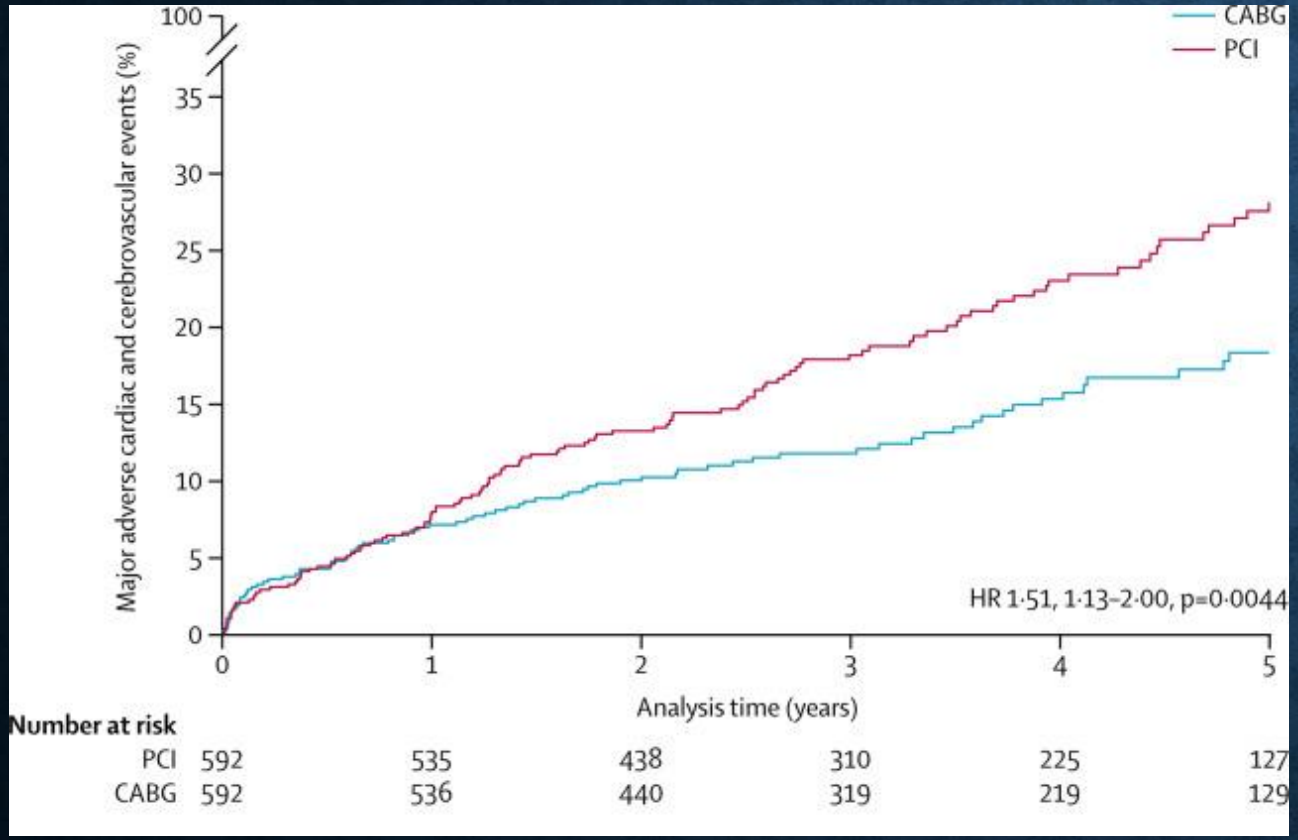
Lancet 2016; 388: 2743–52

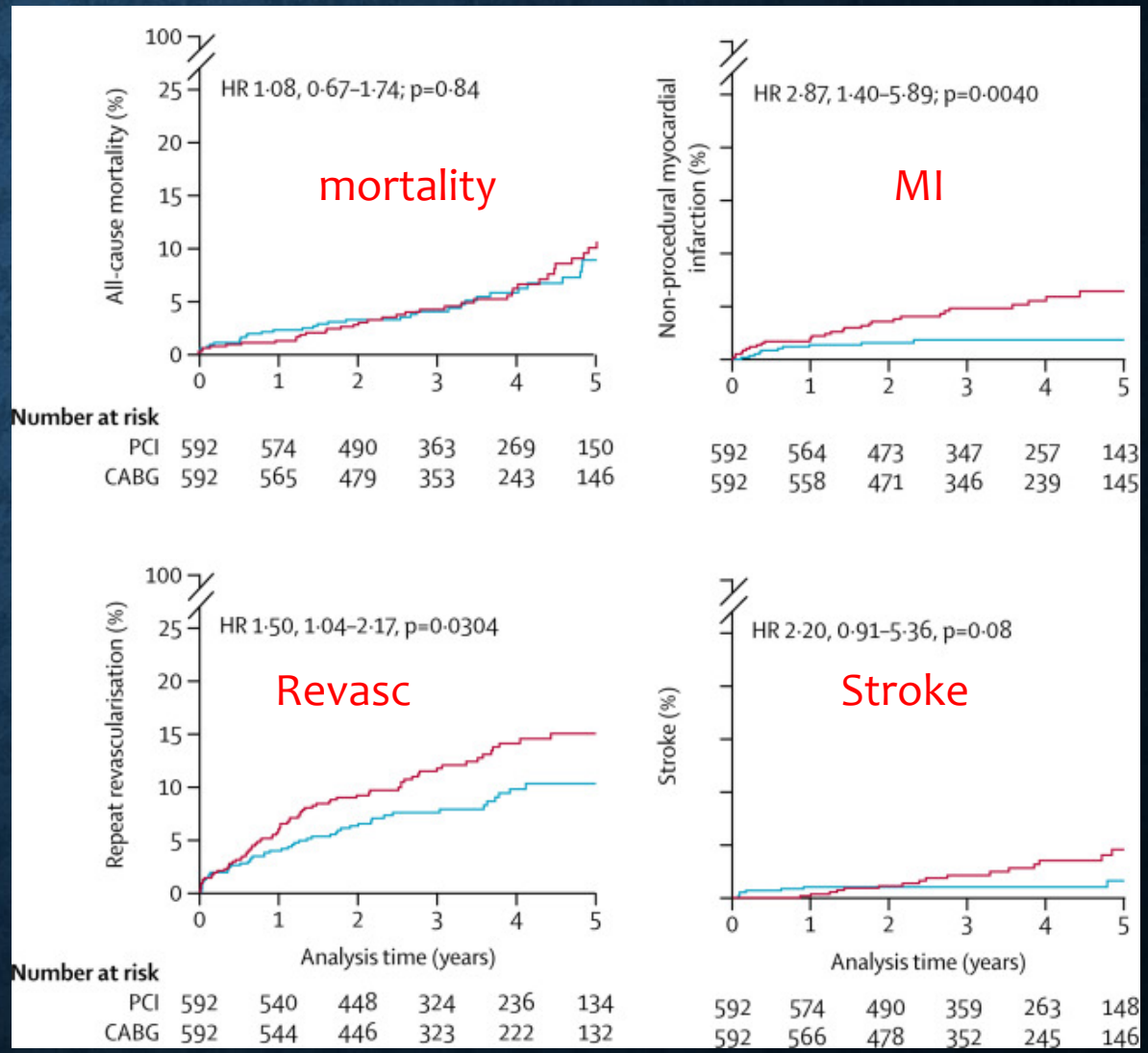
EXCEL



N Engl J Med 2016; 375:2223-2235

PERCUTANEOUS CORONARY ANGIOPLASTY VERSUS CORONARY ARTERY BYPASS GRAFTING IN TREATMENT OF UNPROTECTED LEFT MAIN STENOSIS (NOBLE): A PROSPECTIVE, RANDOMISED, OPEN-LABEL, NON-INFERIORITY TRIAL





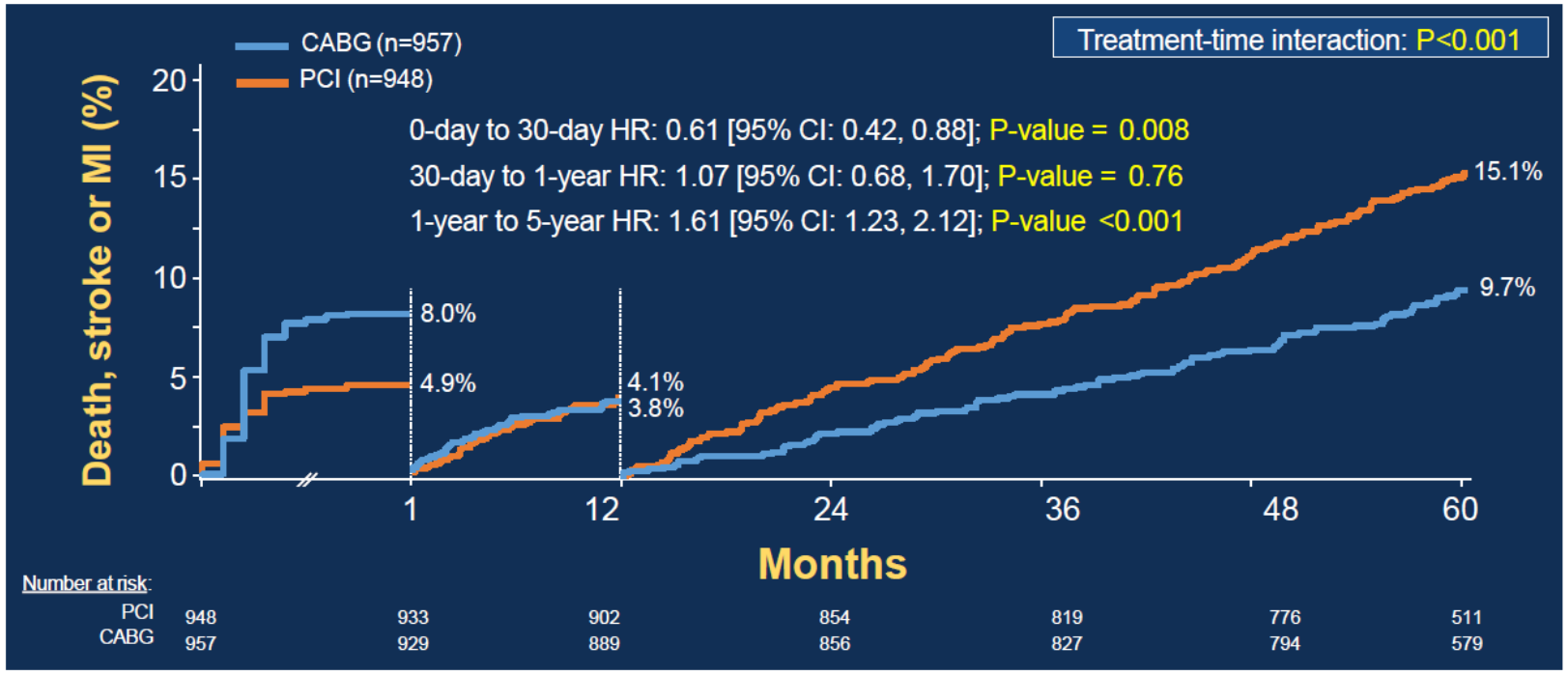
Principle driver is repeat revasc + late MI

The Lancet Volume 388, Issue 10061, 3–9 December 2016, Pages 2743-2752

2019 gulf PCR

Piecewise Hazards
All-cause Death, Stroke or MI

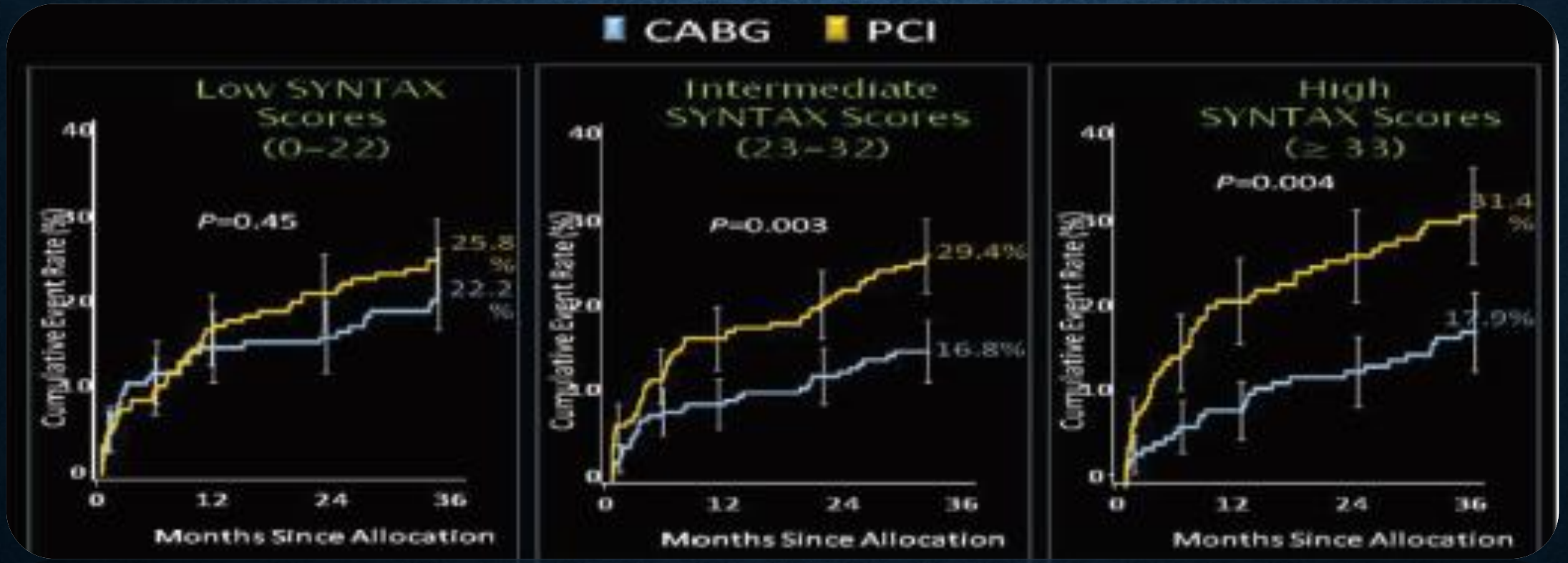
Three distinct periods of varying relative risk



As expected – CABG risk up front, then better.

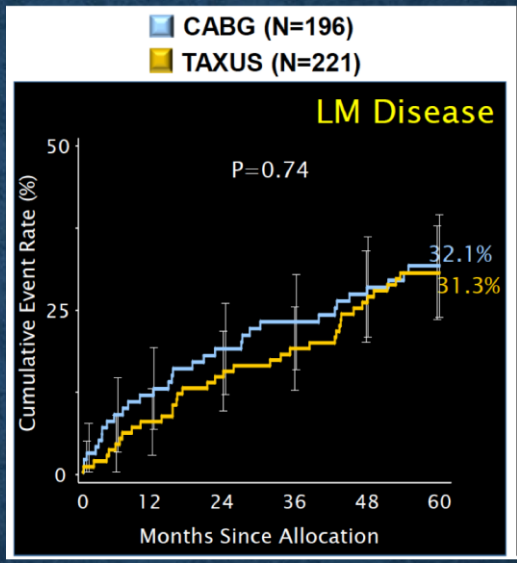
Is the decision about surgical risk and life expectancy?

NOT ALL 3V CAD IS THE SAME



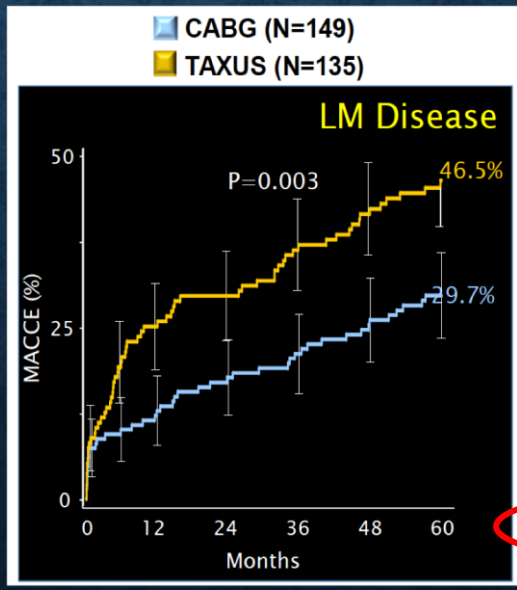
MACCE AT 5 YEARS - LMCA

Low to intermediate score (0-32)



	CABG	PCI	*P* value
Death	15.1%	7.9%	**0.02**
CVA	3.9%	1.4%	0.11
MI	3.8%	6.1%	0.33
Death, CVA or MI	19.8%	14.8%	0.16
Revasc.	18.6%	22.6%	0.36

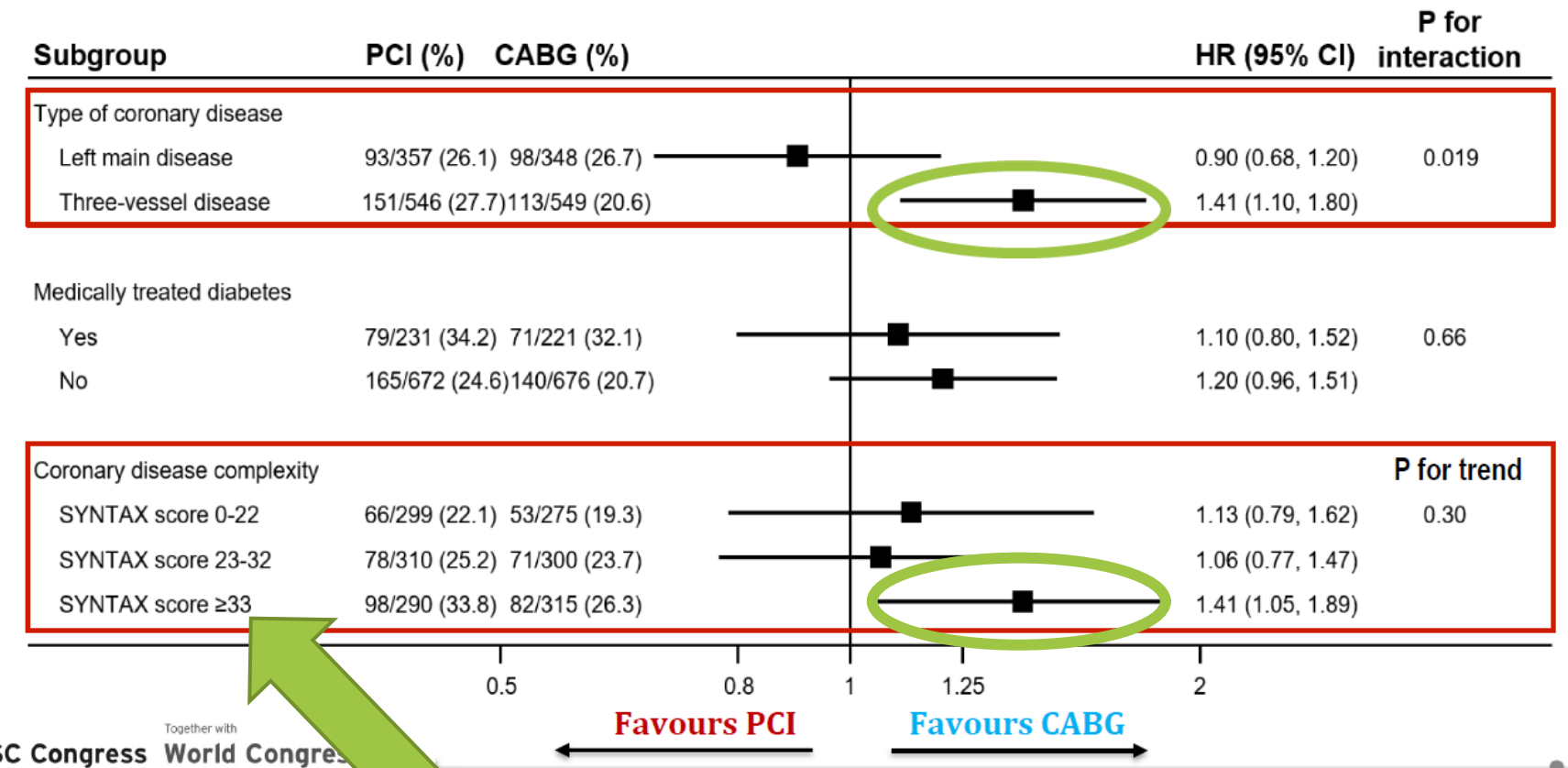
High score (>32)



	CABG	PCI	*P* value
Death	14.1%	20.9%	0.11
CVA	4.9%	1.6%	0.13
MI	6.1%	11.7%	0.13
Death, CVA or MI	22.1%	26.1%	0.40
Revasc.	11.6%	34.1%	<0.001

Serruys et al. Lancet. 2013

Treatment-by-Subgroup Interaction



ESC Congress
Paris 2019
Together with
World Congress
of Cardiology

LMS – PCI VS CABG

- Meta-analysis of the 4 RCTs (Capodanno et al. (2011)):
  - LEMANS / PRECOMBAT / SYNTAX / Boudriot et al.
- Important points:
  - 96% DES (1st generation)
  - 95% LIMA-LAD
  - Mean syntax score 24-30
  - Mean logistic Euroscore <4%
  - Complete revascularisation 71% in PCI group; 76% CABG

LMS – PCI VS CABG

Table 3 1-Year Outcomes In Left Main Patients Revascularized by PCI or CABG

Endpoint	PCI (n = 809)	CABG (n = 802)	Absolute Difference (95% CI)	Number Needed to Treat	Number Needed to Harm	p Value
MACCE	14.5 (117/807)	11.8 (93/790)	2.7 (−0.6 to 6.0)	—	37	0.11
Death/MI/CVA	5.3 (35/655)	6.8 (43/636)	−1.5 (−4.1 to 1.2)	67	—	0.26
Death	3.0 (24/807)	4.1 (32/790)	−1.1 (−3.0 to 0.8)	91	—	0.29
MI	2.8 (23/807)	2.9 (23/790)	−0.1 (−1.8 to 1.6)	1,000	—	0.95
CVA	0.1 (1/707)	1.7 (12/689)	−1.6 (−2.9 to −0.6)	63	—	0.013
TVR	11.4 (92/807)	5.4 (43/790)	6.0 (3.3 to 8.7)	—	17	<0.001

- Pooled analysis of PRECOMBAT & SYNTAX data on patients with LMCA + 3vCAD
  - →Less MACE with CABG
- Results consistent out to 5 years

International Journal of Cardiology 195 (2015) 79–81

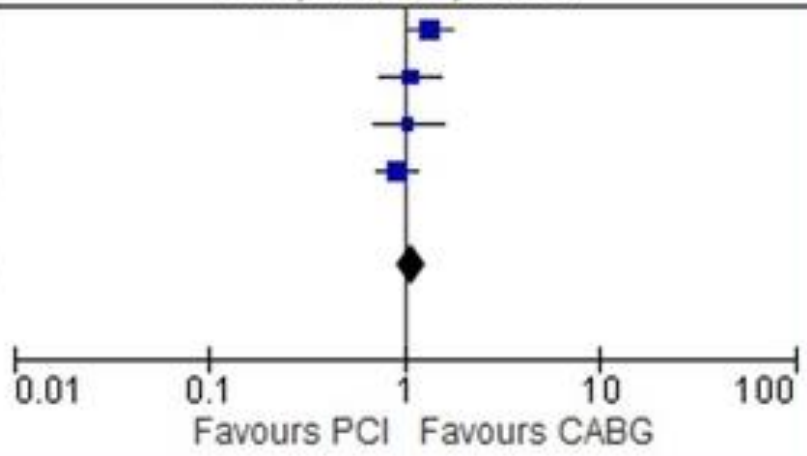
TEN-YEAR OUTCOMES AFTER DES VERSUS CABG FOR LM CORONARY DISEASE: EXTENDED FOLLOW-UP OF THE PRECOMBAT TRIAL

600 patients with LM disease (65% distal bifurcation) and mean SYNTAX score of 25 were randomised to PCI vs. CABG in 1:1 fashion.

	PCI		CABG			Risk Ratio
Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Random, 95% CI
EXCEL 5 years	119	948	89	957	30.8%	1.35 [1.04, 1.75]
NOBLE 5 years	54	592	50	592	19.2%	1.08 [0.75, 1.56]
PRECOMBAT 10 years	42	300	40	300	16.7%	1.05 [0.70, 1.57]
SYNTAX 10 years	93	357	98	348	33.4%	0.93 [0.73, 1.18]
Total (95% CI)		**2197**		**2197**	**100.0%**	**1.09 [0.91, 1.32]**
Total events	308		277			

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 4.43$, df = 3 (P = 0.22); $I^2 = 32\%$

Test for overall effect: Z = 0.94 (P = 0.35)



Circulation . 2020 Mar 30. doi: 10.1161/CIRCULATIONAHA.120.046039.

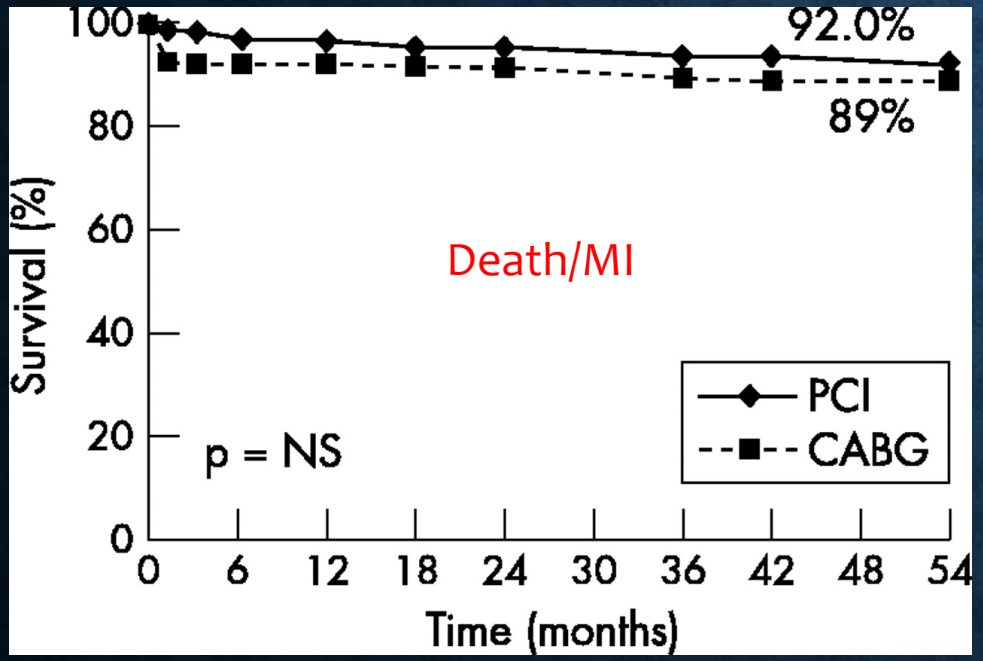
Summary

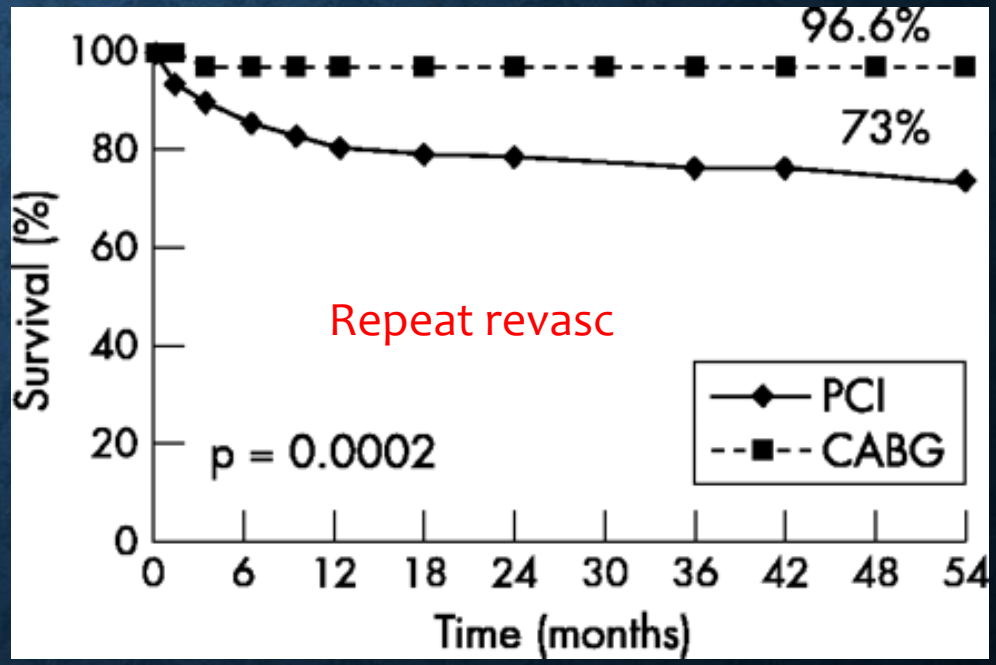
- CABG favoured over PCI in diabetic multivessel disease

Caveats:

- Low to intermediate syntax scores
- Second generation DES have not been compared to CABG
- All trials are of a select population:
  - Euroscore ≤4%
  - Only 5-10% of patients screened made it into the trials!

CORONARY STENTING VERSUS CORONARY BYPASS SURGERY IN PATIENTS WITH MULTIPLE VESSEL DISEASE AND SIGNIFICANT PROXIMAL LAD STENOSIS: RESULTS FROM THE ERACI II STUDY





Prox LAD =/- other
N=230
93% LIMA
GR2 stents!

Heart. 2003 Feb;89(2):184-8. doi: 10.1136/heart.89.2.184.

The Guidelines

ESC European Society of Cardiology
European Heart Journal (2018) 00, 1–96
doi:10.1093/eurheartj/ehy394

ESC/EACTS GUIDELINES

2018 ESC/EACTS Guidelines on myocardial revascularization

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

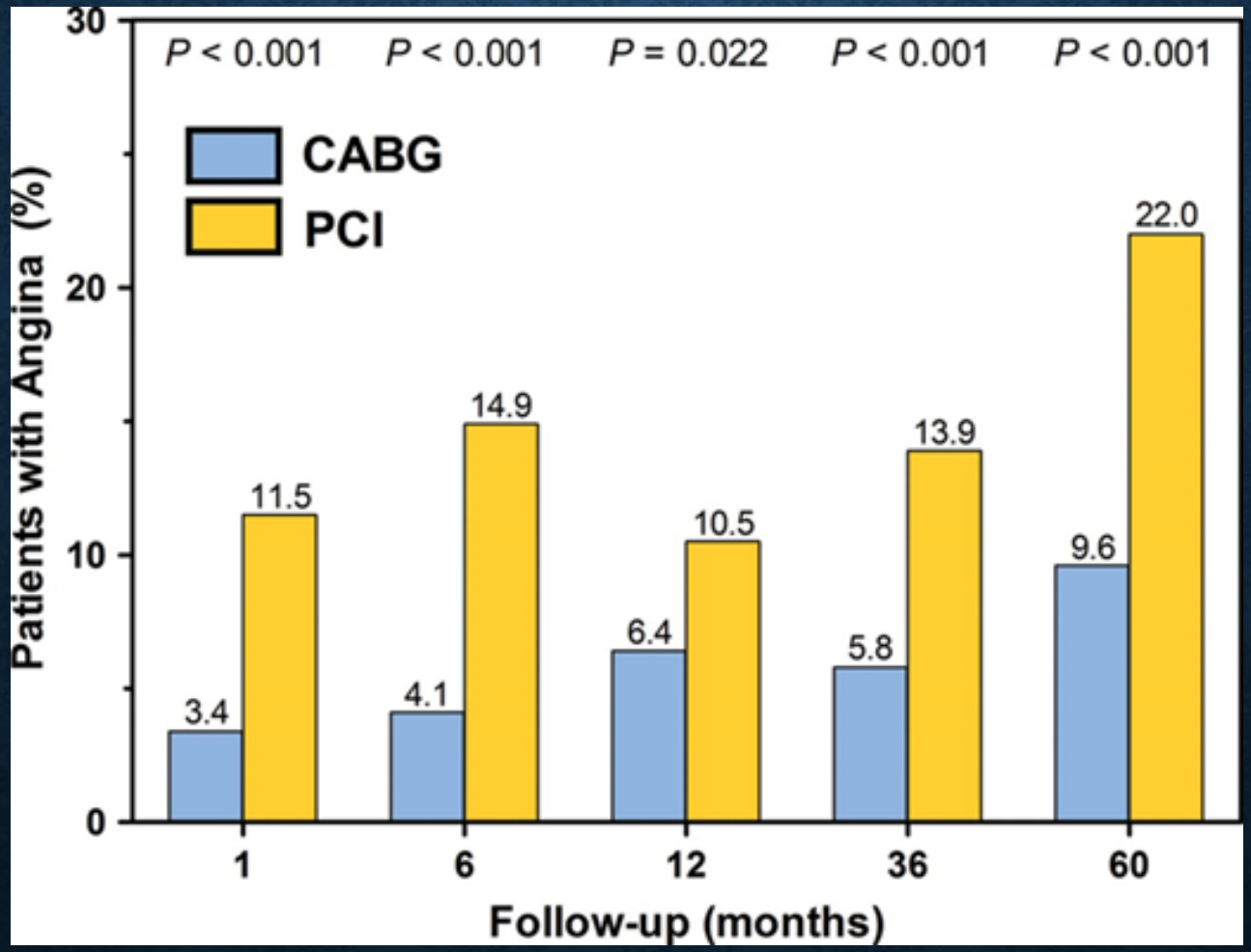
Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)

Recommendations according to extent of CAD	CABG		PCI	
	Class[a]	Level[b]	Class[a]	Level[b]
Left main CAD				
Left main disease with low SYNTAX score (0 - 22).[69,121,122,124,145–148]	I	A	I	A
Left main disease with intermediate SYNTAX score (23 - 32).[69,121,122,124,145–148]	I	A	IIa	A
Left main disease with high SYNTAX score (≥33).[c 69,121,122,124,146–148]	I	A	III	B

IVUS should be considered to optimize treatment of unprotected left main lesions.[35]	IIa	B

Neumann et al, EHJ 2018

ANGINA AT FOLLOW-UP – CABG BETTER!

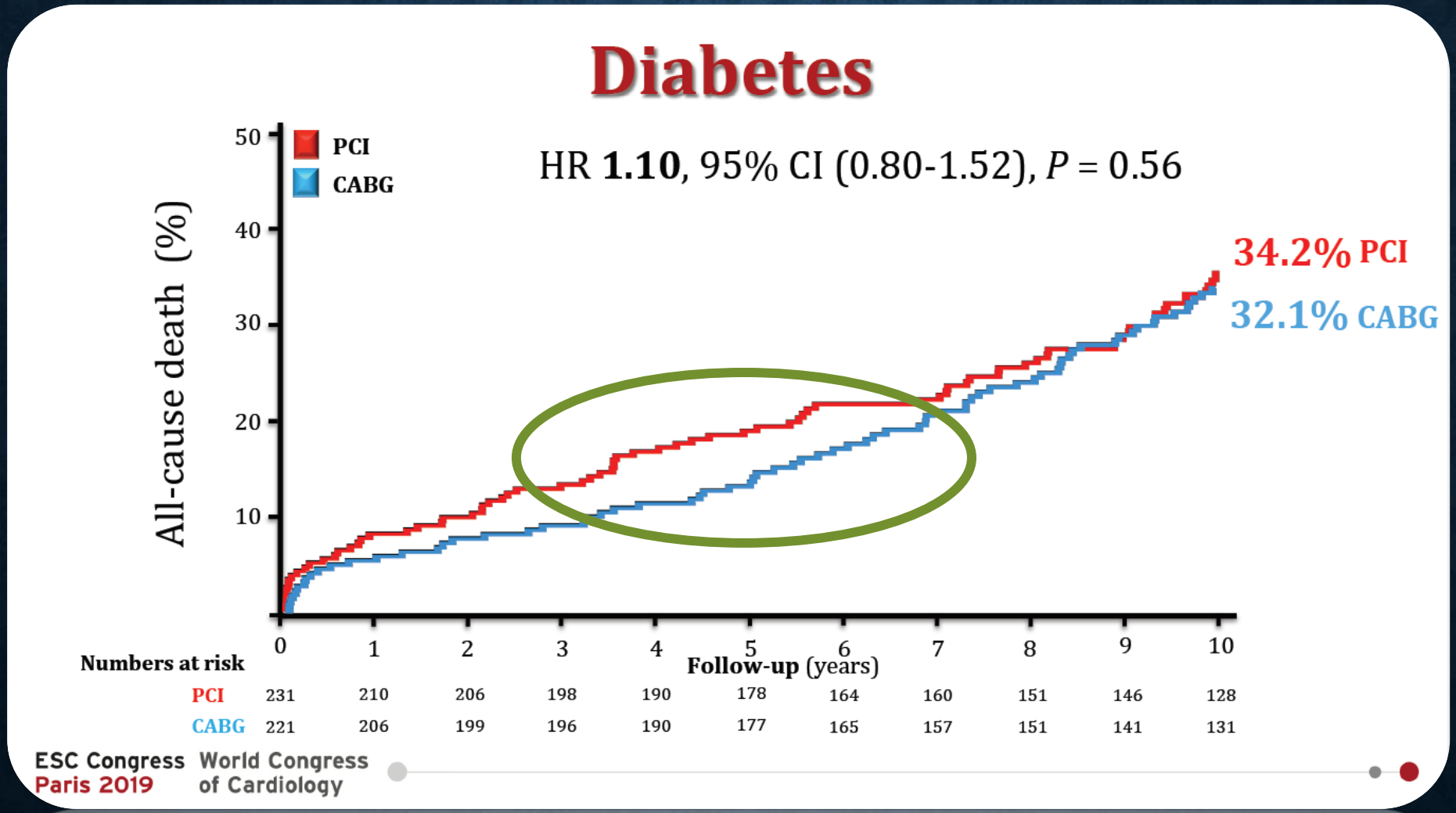


WHAT ABOUT DIABETES?

Clinical outcome	Non-diabetic (*n* = 1348)			Diabetic (*n* = 452)			Non-diabetic vs diabetic		
	CABG (*n* = 676)	PCI (*n* = 672)	*P*-value	CABG (*n* = 221)	PCI (*n* = 231)	*P*-value	*P*-value (CABG)	*P*-value (PCI)	Interaction *P*-value[a]
MACCE[b]	26.3% (167)	34.1% (226)	0.002	29.0% (59)	46.5% (105)	<0.001	0.37	<0.001	0.17
All-cause death/stroke/myocardial infarction	15.9% (101)	19.8% (131)	0.069	19.1% (39)	23.9% (54)	0.26	0.25	0.18	0.76
All-cause death	10.9% (68)	12.0% (79)	0.48	12.9% (26)	19.5% (44)	0.065	0.34	0.003	0.43
Cardiac death	4.9% (30)	7.7% (50)	0.035	6.5% (13)	12.7% (28)	0.034	0.31	0.018	
Stroke	3.5% (22)	2.2% (14)	0.15	4.7% (9)	3.0% (6)	0.34	0.49	0.55	0.97
Myocardial infarction	3.4% (22)	9.9% (64)	<0.001	5.4% (11)	9.0% (19)	0.20	0.22	0.66	0.18
Repeat revascularization	13.4% (82)	22.8% (145)	<0.001	14.6% (28)	35.3% (75)	<0.001	0.60	<0.001	0.081
PCI	12.9% (78)	19.3% (123)	0.001	12.9% (24)	28.5% (60)	<0.001	0.95	0.004	
CABG	1.1% (7)	5.8% (36)	<0.001	1.9% (4)	8.7% (18)	0.004	0.35	0.12	
Graft occlusion/stent thrombosis	3.9% (24)	5.6% (36)	0.14	4.3% (8)	5.3% (11)	0.61	0.84	0.84	0.73

SYNTAX. 5yr data. 3VCD only

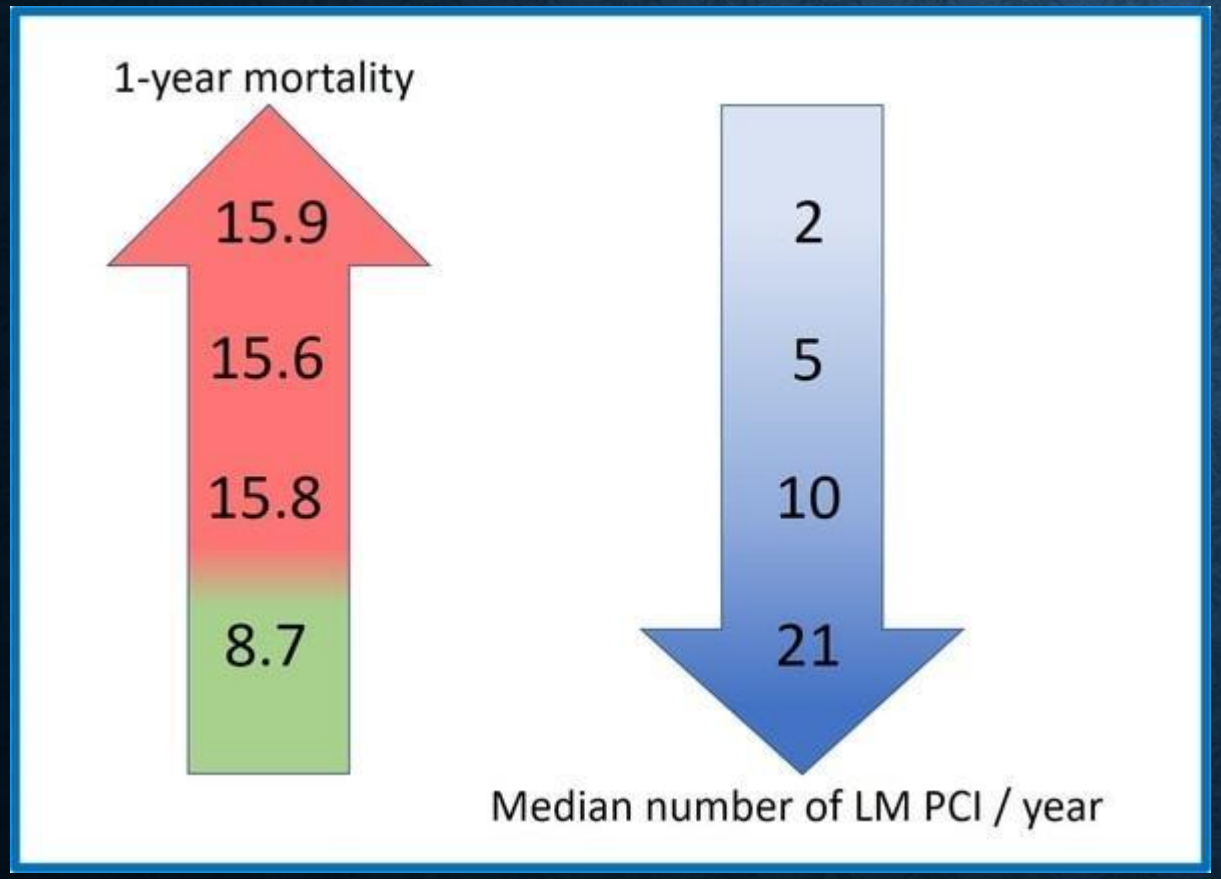
10 year SYNTAX data – maybe all strategies revert to the norm?



CABG VS 'MODERN' PCI

- Early CABG up-front 'cost' vs PCI
- Late CABG benefit in - 3VCD and 'complex' LMS
- CABG advantage for diabetics, probably
- CABG and PCI equipoise for 'less complex' LMS disease
- Considerations – life expectancy, life style, targets, conduit, co-morbidities, patient preference.
- At 10yrs – 'all bets are off'!

OPERATOR EXPERIENCE IN LM STENTING



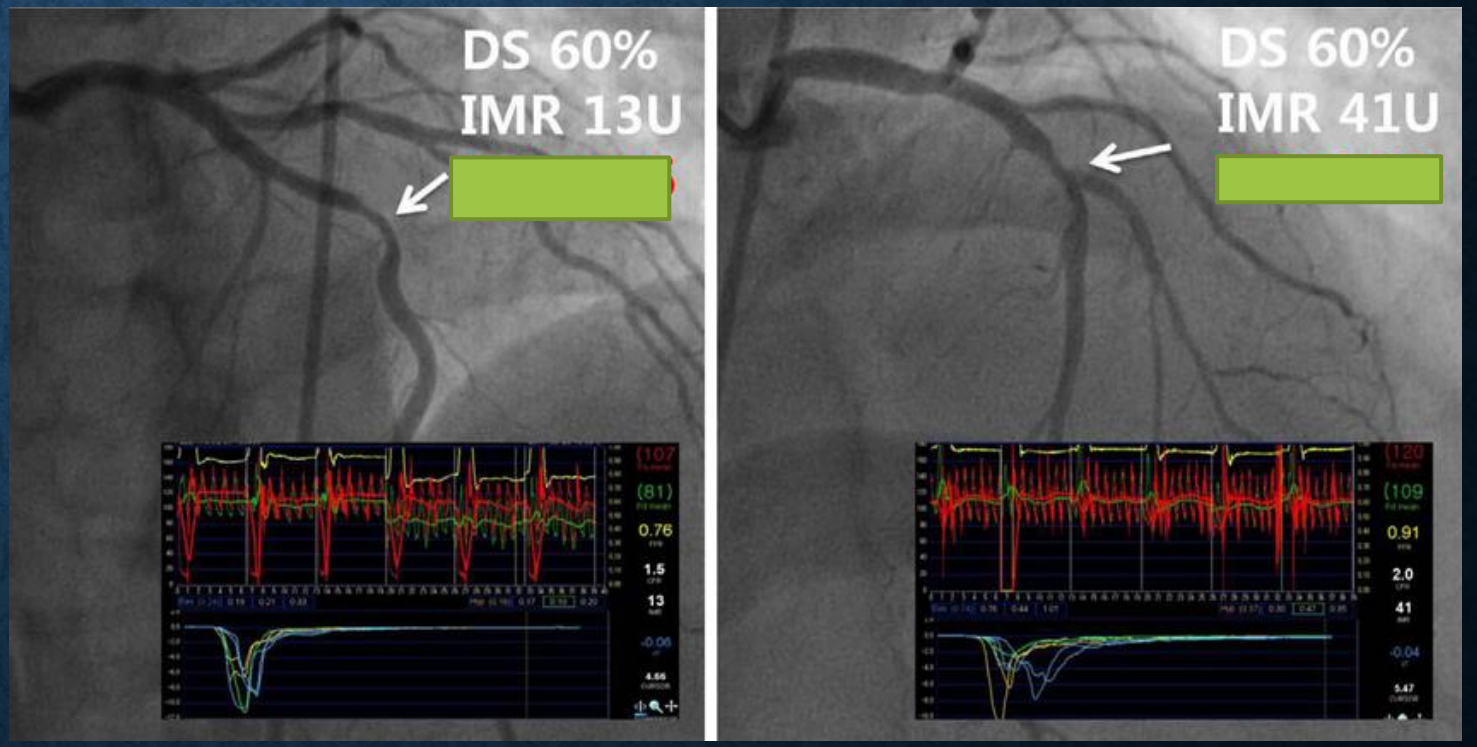
6724 unprotected LM PCI were analyzed from the British Cardiovascular Intervention Society (BCIS) National Database from the period 2012-2014 for which the number of procedures per operator was available.

Not a ‘game’ for the enthusiastic amateur!

Circ Cardiovasc Interv. 2020;13:e008782

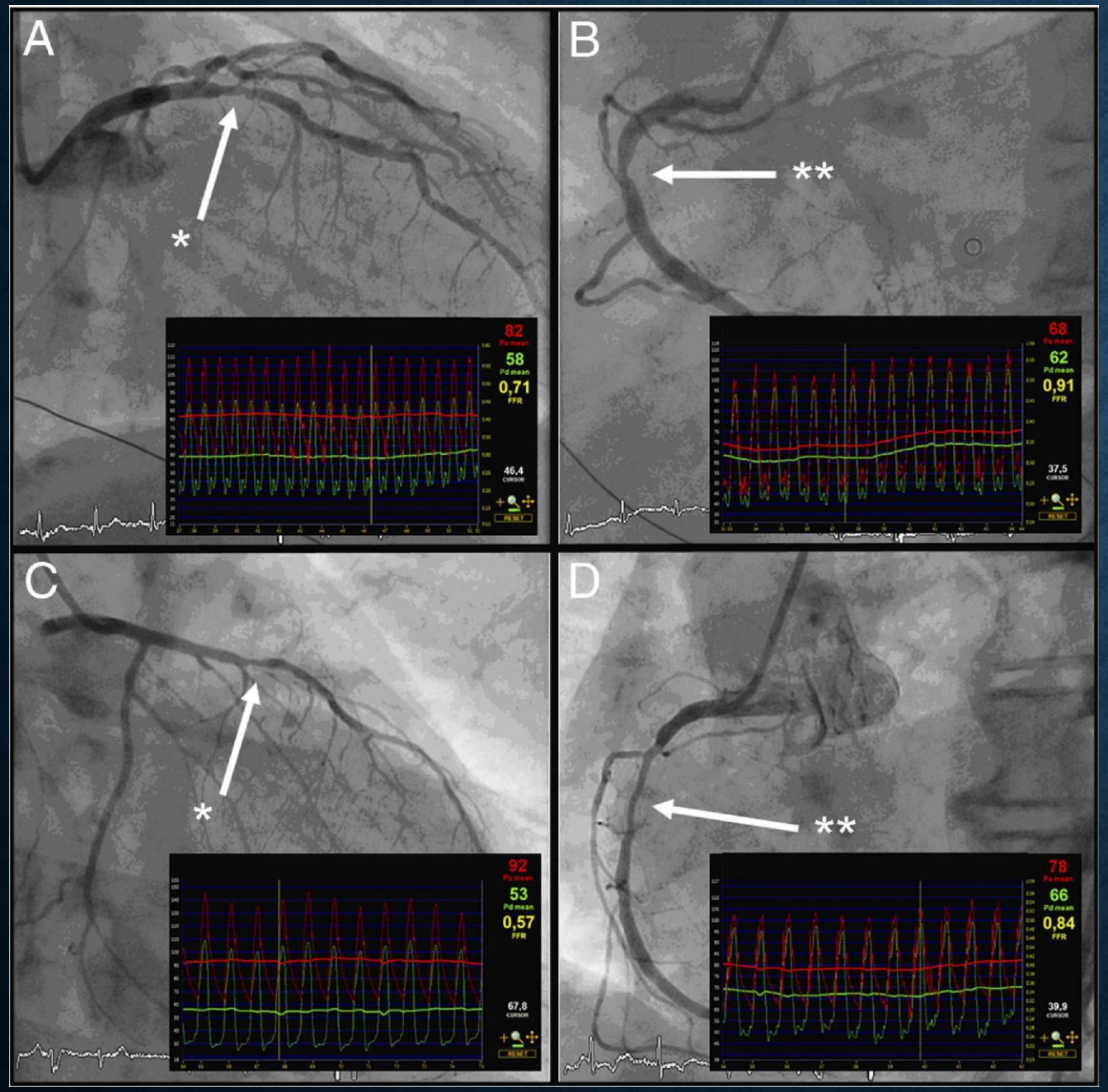
HOW DO WE PICK WHICH VESSELS TO ‘FIX’?

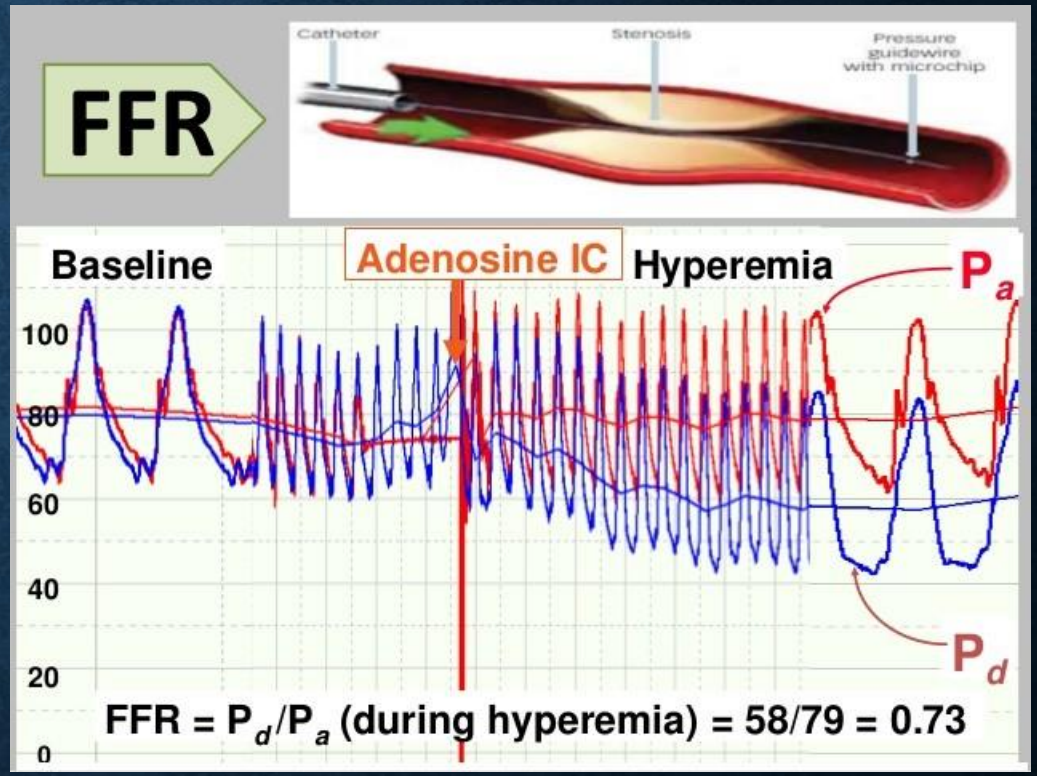
- ‘Occulo stenotic’ reflex
- Stress imaging
- Cath lab techniques



Which lesion is ischaemic???

THE ROLE OF FFR



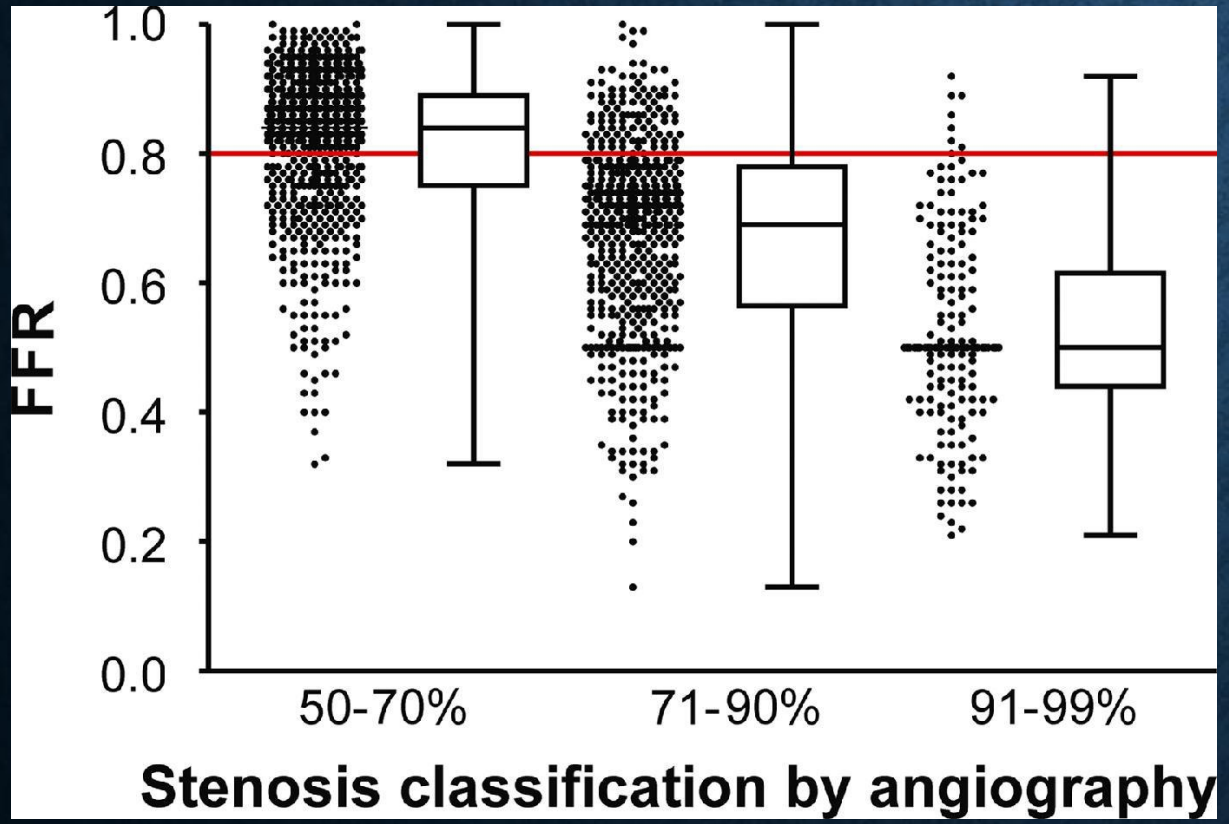


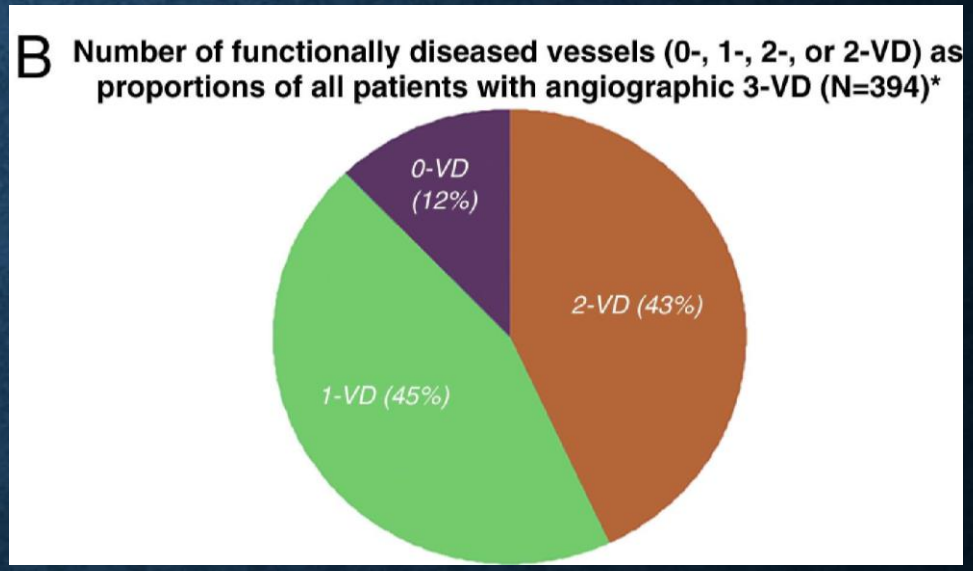
Journal of the American College of Cardiology
Volume 55, Issue 25, 22 June 2010, Pages 2816-2821

ANGIOGRAPHIC VERSUS FUNCTIONAL SEVERITY OF CORONARY ARTERY STENOSES IN THE FAME STUDY: FRACTIONAL FLOW RESERVE VERSUS ANGIOGRAPHY IN MULTIVESSEL EVALUATION

PIM A.L. ET AL.

HTTPS://DOI.ORG/10.1016/J.JACC.2009.11.096

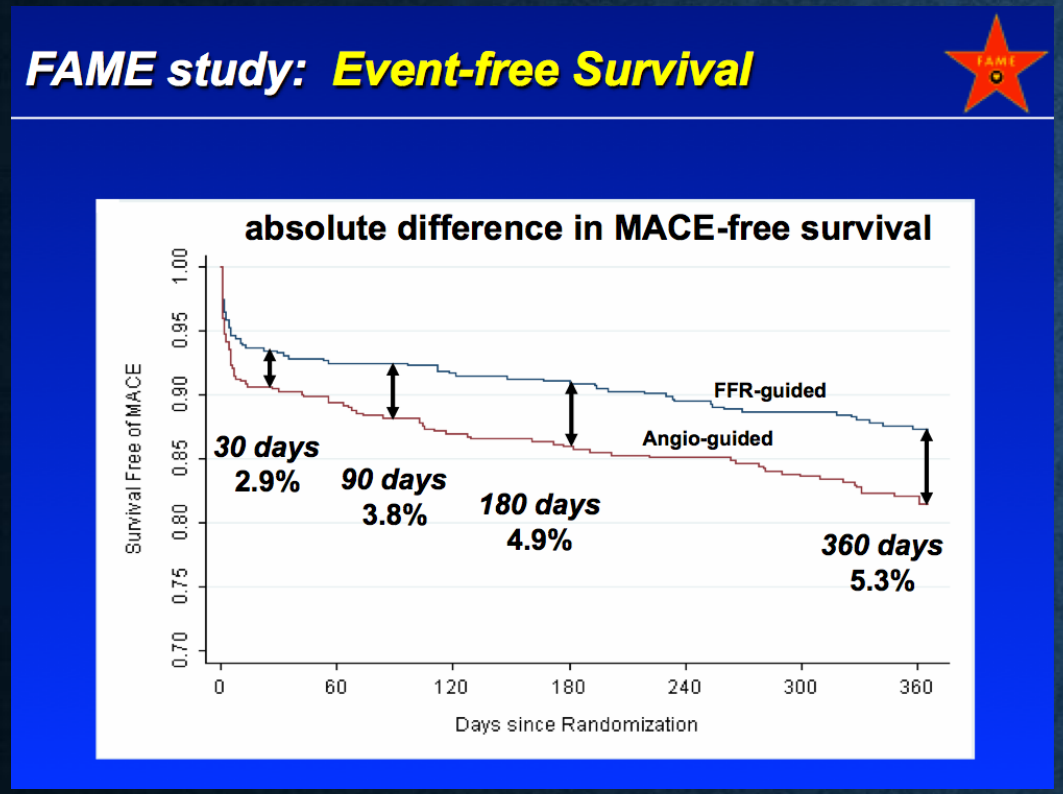


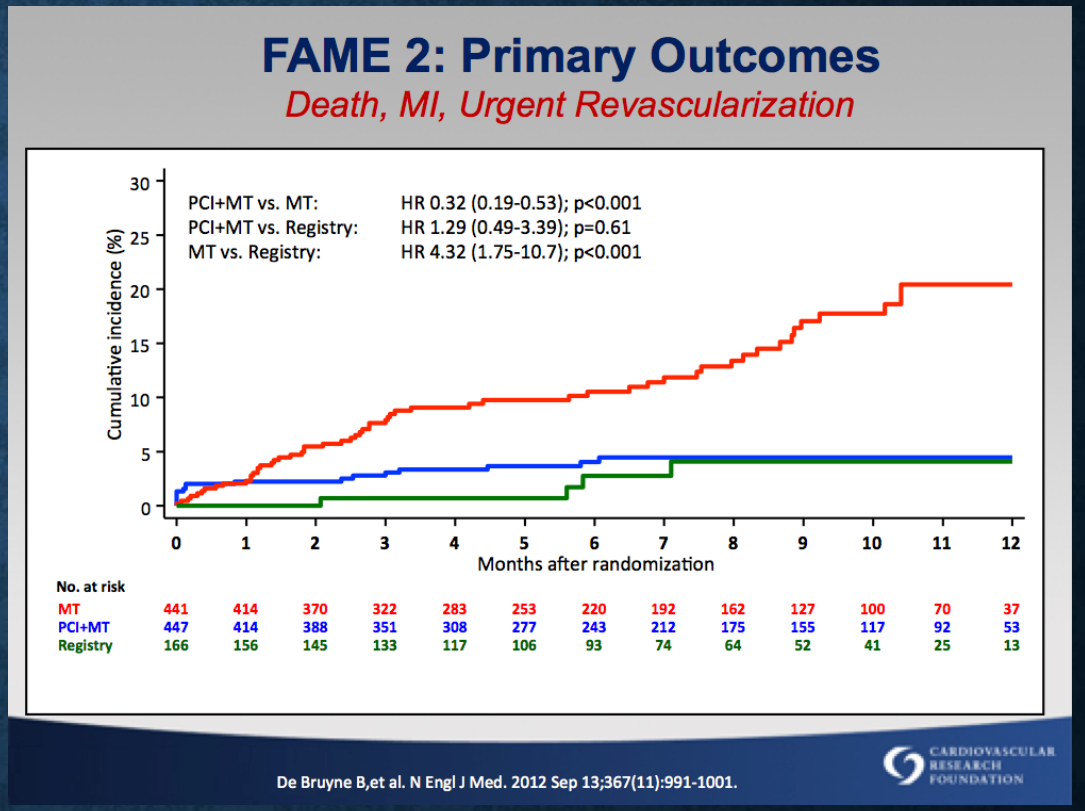


Angiographic 'severity' is NOT Functional severity

Journal of the American College of Cardiology
Volume 55, Issue 25, 22 June 2010, Pages 2816-2821

FAME TRIALS





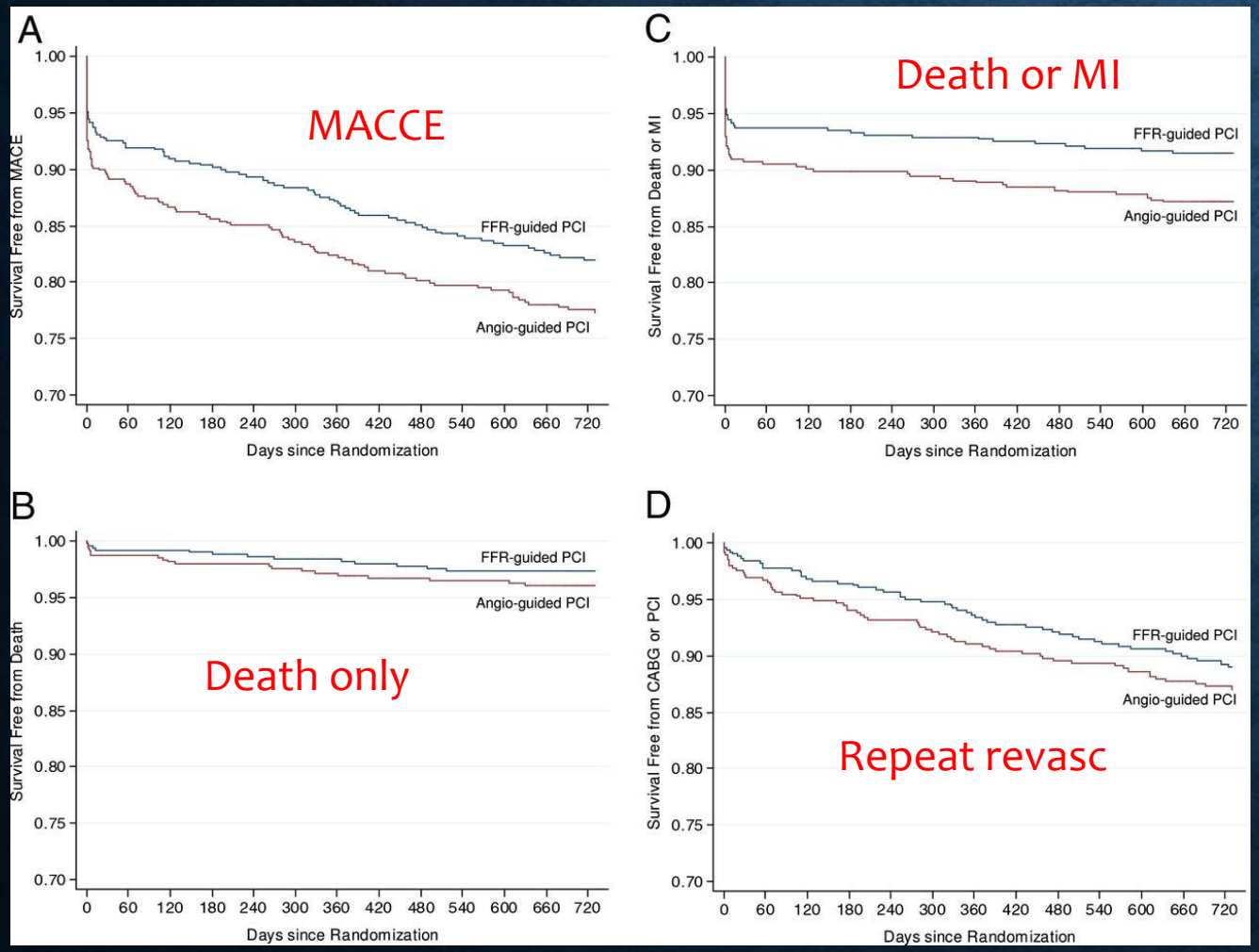
- If FFR < 0.80, OMT plus PCI is superior to OMT alone
- If FFR > 0.80, safe to defer PCI and continue OMT

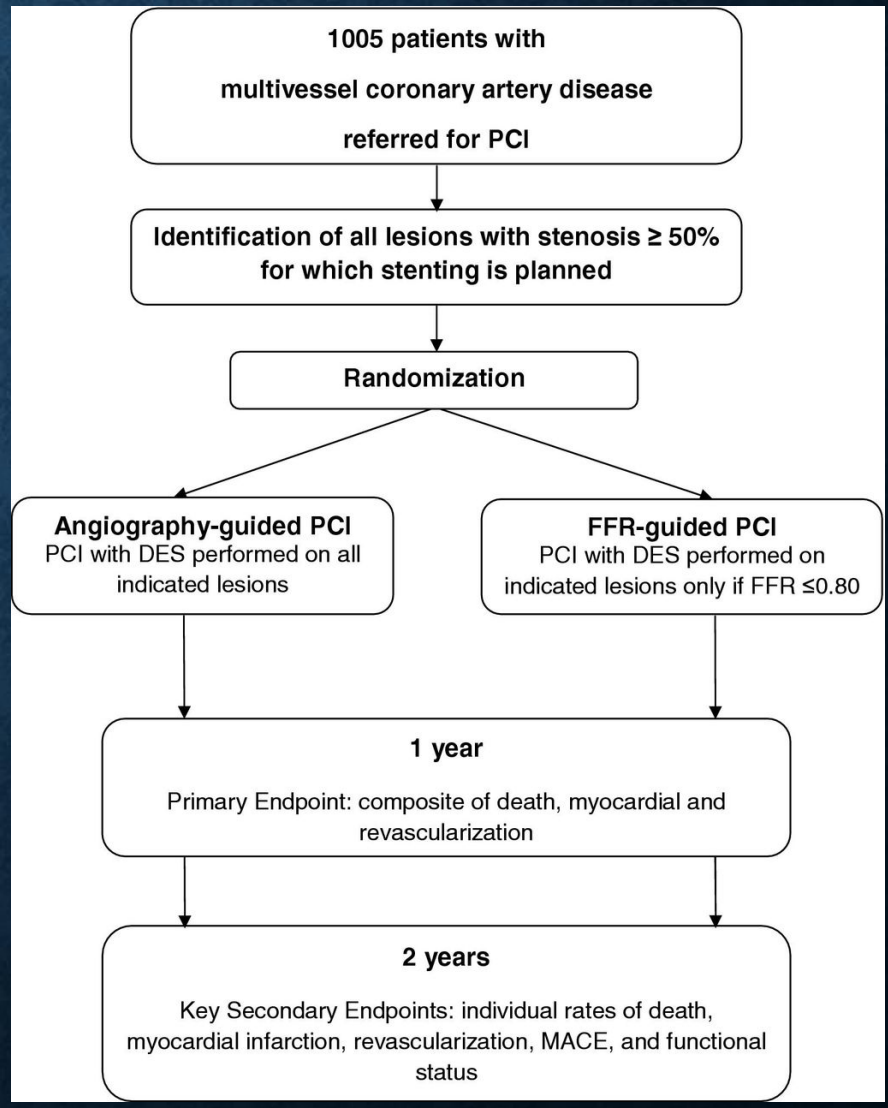
Tonino et al. NEJM. 2009
De Bruyne et al. NEJM. 2012

FRACTIONAL FLOW RESERVE VERSUS ANGIOGRAPHY FOR GUIDING PERCUTANEOUS CORONARY INTERVENTION IN PATIENTS WITH MULTIVESSEL CORONARY ARTERY DISEASE

2-YEAR FOLLOW-UP OF THE FAME (FRACTIONAL FLOW RESERVE VERSUS ANGIOGRAPHY FOR MULTIVESSEL EVALUATION) STUDY

NICO H.J. ET AL FAME STUDY INVESTIGATORS





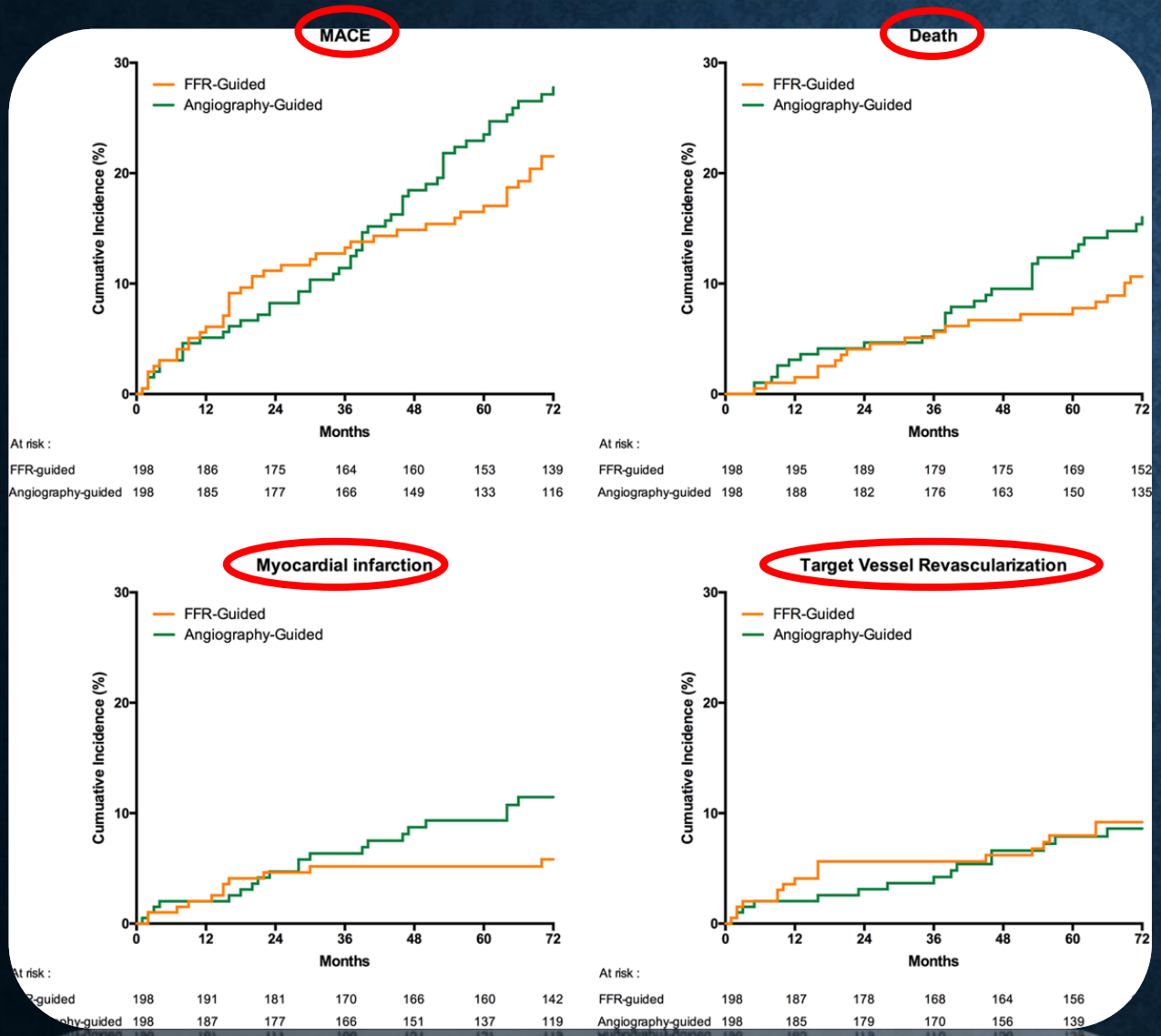
Journal of the American College of Cardiology Volume 56, Issue 3, July 2010

FAME II (2012)

- 888 patients with at least one functionally significant lesion (FFR ≤0.8)
- OMT v. OMT + FFR-guided PCI (DES)
  - No difference in death or MI
  - Less urgent revascularisation for UA with PCI
- Caveats:
  - 50% of UA episodes in the OMT group were “subjective”

Stents help angina but probably not prognosis in SVCD

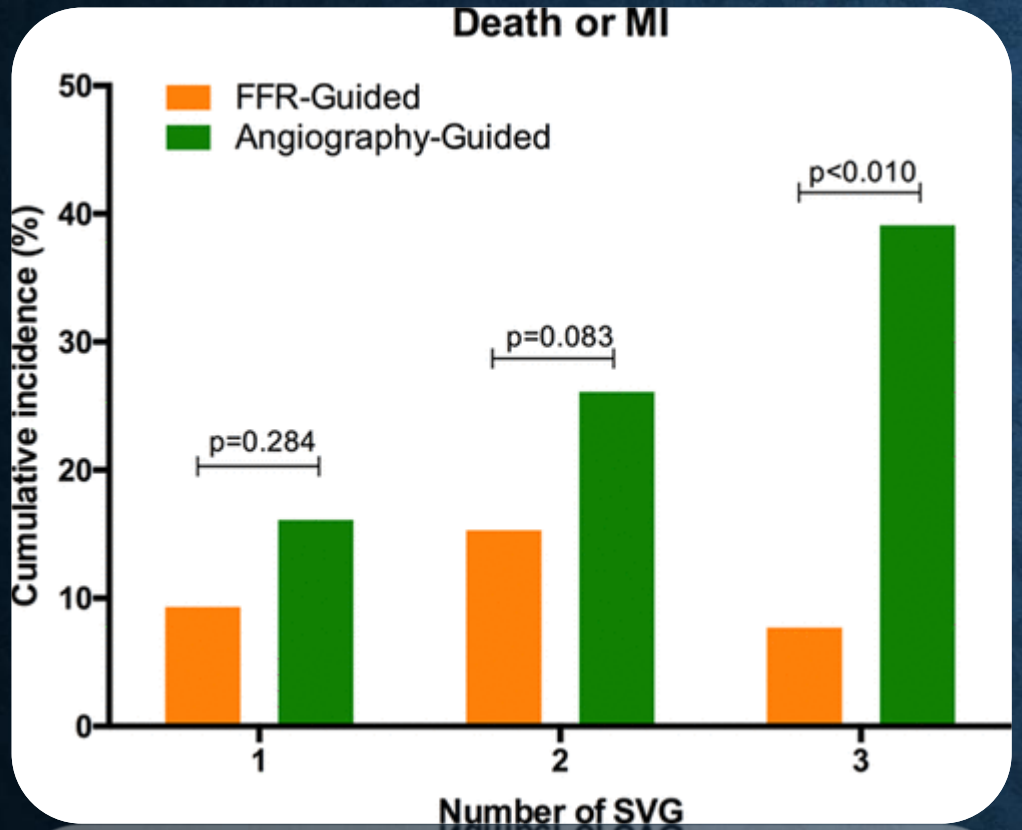
FFR GUIDED CABG

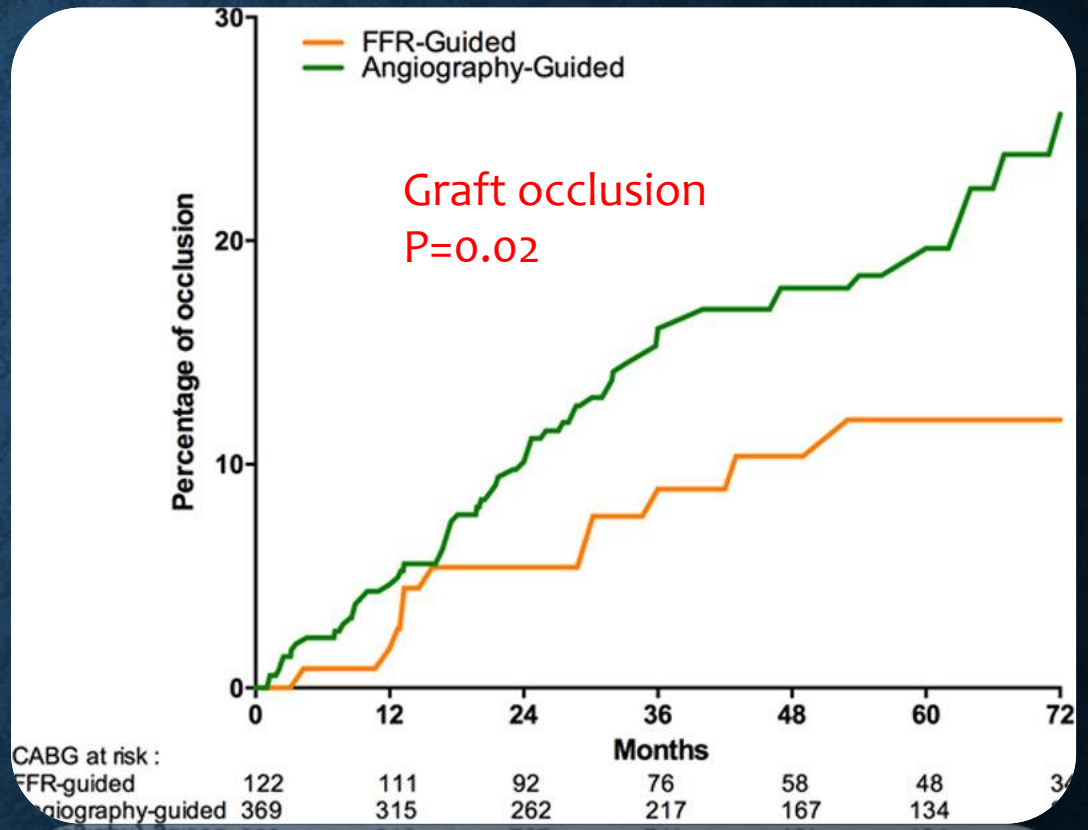


N=627
FFR graft guidance, n=198

Six-Year Follow-Up of Fractional Flow Reserve-Guided Versus Angiography-Guided Coronary Artery Bypass Graft Surgery
Stephane Fournier,

11 Jul 2018https://doi.org/10.1161/CIRCINTERVENTIONS.117.006368Circulation: Cardiovascular Interventions. 2018;11

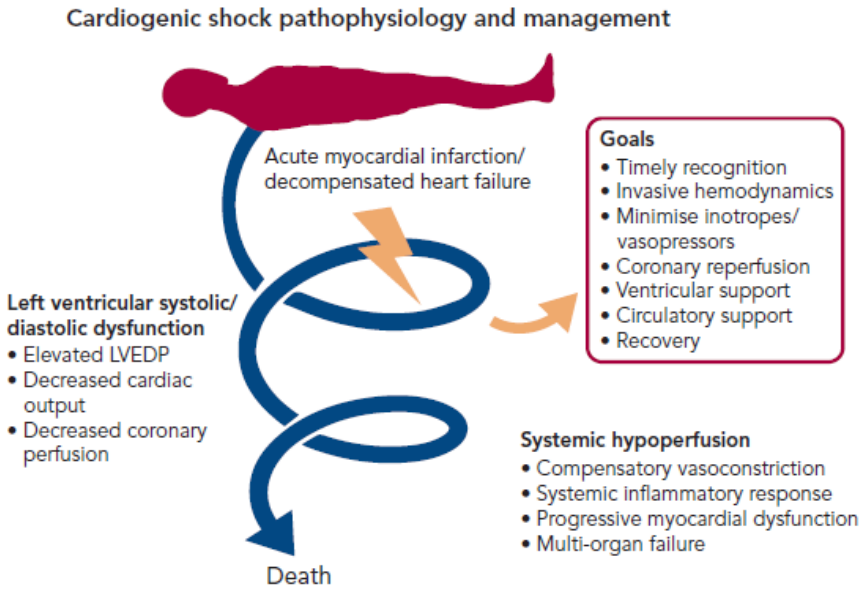




Interesting data but not practice changing

ACS WITH SHOCK

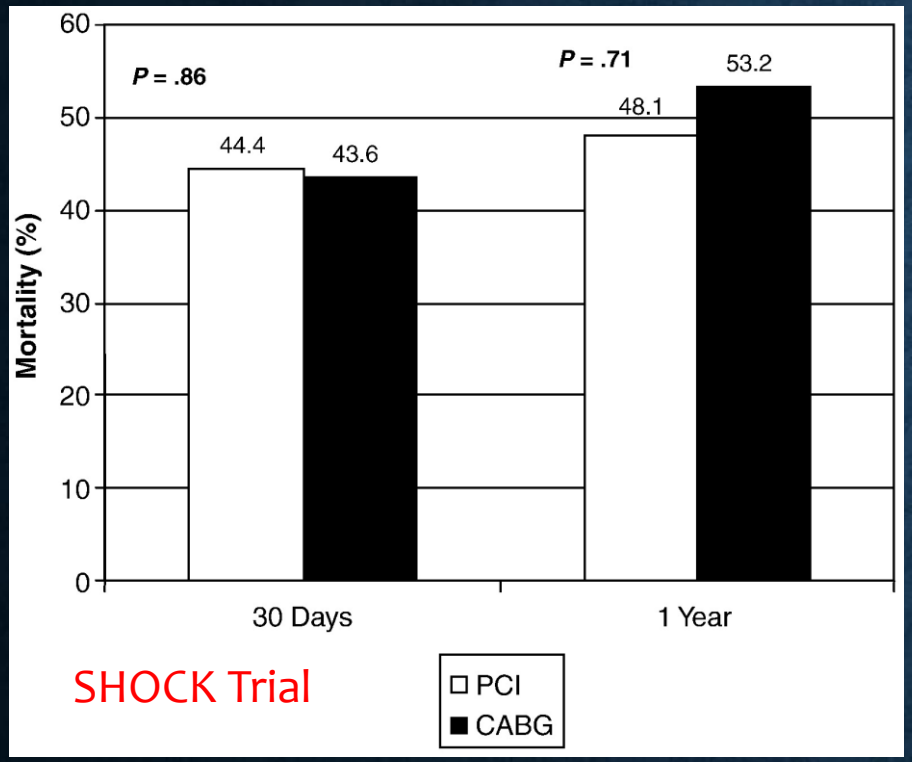
Figure 1: Cardiogenic Shock Pathophysiology and Management Considerations



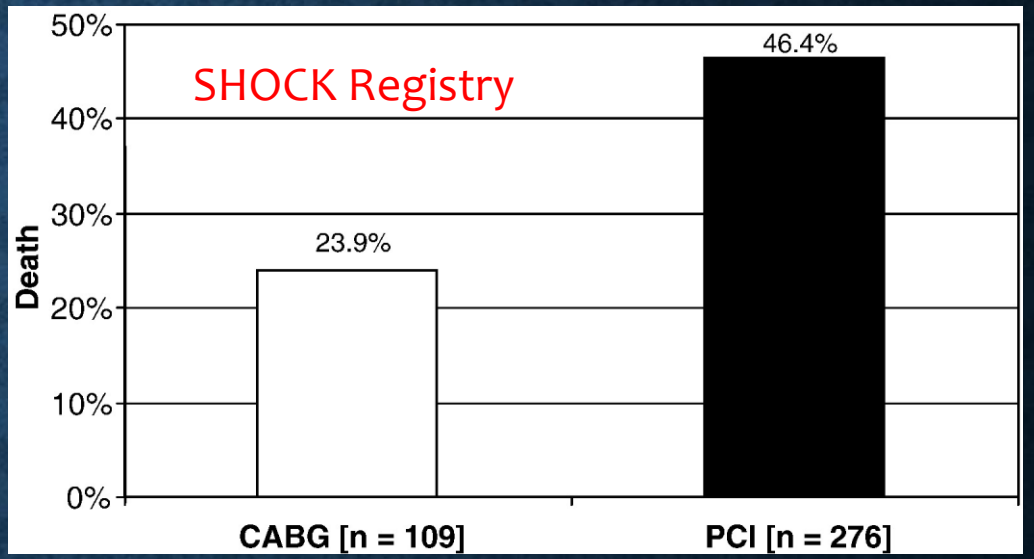
LVEDP = left ventricular end-diastolic pressure; MCS = mechanical circulatory support.
Reproduced and modified with permission from Abiomed.

PERCUTANEOUS CORONARY INTERVENTION OR CORONARY ARTERY BYPASS SURGERY FOR CARDIOGENIC SHOCK AND MULTIVESSEL CORONARY ARTERY DISEASE?

RAJENDRA H.MEHTA ET AL American Heart Journal Volume 159, Issue 1, January 2010, Pages 141-147



SHOCK Trial



SHOCK Registry

Limited data from observational studies in patients with CS and multivessel disease suggest that CABG (*better for 2/3 VCD*) should be considered a complementary reperfusion strategy to PCI (**only 37% had stents, most IRA only**!) and may be preferred, especially when complete revascularization with PCI is not possible.

Answer – Poor data. Fix what you can, the best way you can. Attempt full revasc.

“The hardest thing of all is to find a black cat in a dark room, especially if there is no cat.”
— **Confucius**

CONCLUSIONS

- Step one = optimal medical therapy and risk factor control
- Defining anatomy important (? CT emerging role)
- Left main, 3 vessel disease incl proximal LAD disease all **PROGNOSTICALLY** important
- If diabetic LAD + another vessel = probably CABG
- If LMCA and high syntax score = CABG
- If 3V CAD and high syntax score = CABG
- If low syntax score (and non-diabetic) = PCI
- FFR guided PCI is superior. Cut-off 0.8. Uncertain role in CABG
  - BUT, watch this space……

THERES A LOT WE DON'T KNOW!

- Think about patient factors
- Think about disease complexity
- Think about the objectives of care
- Remember that modern medical therapy works if the revasc options are not ideal.

THANK-YOU