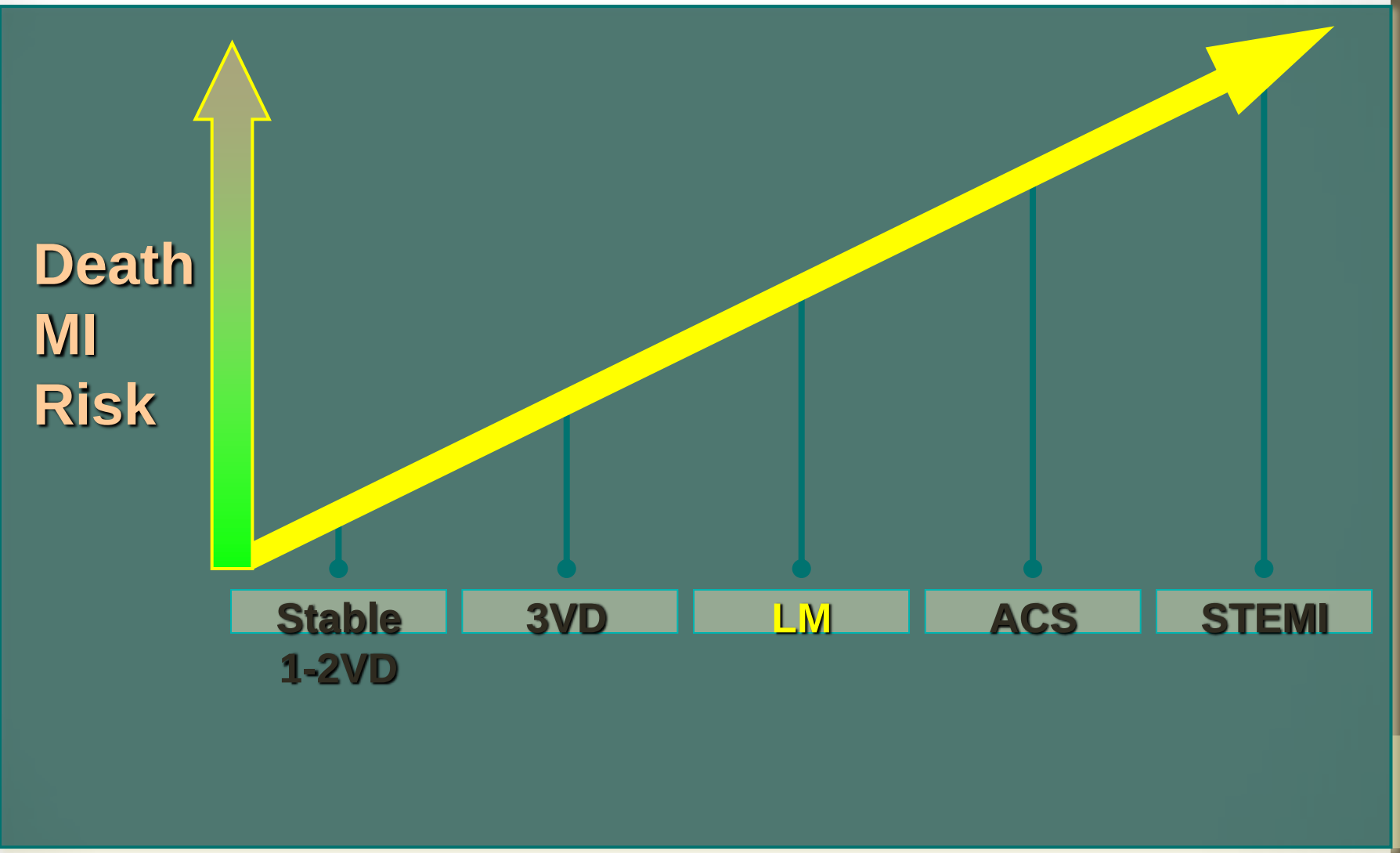
Tronco coronario izquierdo y múltiples vasos. Nuevas evidencias 2015

Fabio B. Jatene
Full Professor of Cardiovascular Surgery, Medical School, University of São Paulo, Brazil

DISCLOSURE

I have no financial relationship to disclose

The Spectrum of CAD



Eighteen-Year Follow-up in the Veterans Affairs Cooperative Study of Coronary Artery Bypass Surgery for Stable Angina

The VA Coronary Artery Bypass Surgery Cooperative Study Group

TABLE 5. Cumulative Survival Rates by the Censored Method

	7 Years		11 Years		15 Years		18 Years	
Group	M	S	M	S	M	S	M	S
All patients	0.70	0.78	0.57	0.58	0.45	0.40	0.26	0.29
Left main	0.59	0.87	0.41	0.59	0.21	0.39	0.21	0.26
Non–left main	0.73	0.77	0.59	0.58	0.47	0.41	0.26	0.30

M, medical; S, surgical; ang., angiographic.

VA study group. Circulation 1992;86(1):121-30

Effect of coronary artery bypass graft surgery on survival: overview of 10-year results from randomised trials by the Coronary Artery Bypass Graft Surgery Trialists Collaboration*

Salim Yusuf, David Zucker, Peter Peduzzi, Lloyd D Fisher, Timothy Takaro, J Ward Kennedy, Kathryn Davis, Thomas Killip, Eugene Passamani, Robin Norris, Cynthia Morris, Virendra Mathur, Ed Varnauskas, Thomas C Chalmers

For patients with Left Main Artery Disease
(Veterans Administration and European studies)

Mortality reduction with CABG:

At 5 years 68% (95% CI 30-85), p = 0.004

At 10 years 33% (30% increase to 65% reduction), p = 0.24

*** Mortality was also significantly lower with CABG among patients with three-vessel disease at 5 years (42%; p =0.001) and 10 years (24%; p = 0.02.)**

Yusuf, S et al. Lancet 1994;344(2):563-70

LEFT MAIN CORONARY ARTERY DISEASE

Characteristics

Isolated Injury

- Proximal / Ostial
- Medium
- Distal

Degree of Obstruction

- Lightweight (<50%)
- Moderate (50% - 75%)
- Severe (> 75%)

Combined injuries

- Monoarterial
- Biarterial
- Triarterial

Protected injury

- Collateral Circulation
- Prior Revascularization

"Coronary Dominant"

LEFT MAIN CORONARY ARTERY DISEASE

- **6% a 10% -** isolated LMCAD
- **70% a 80% -** multivessel lesion associated LMCAD

Am Heart J 2004;148:481-5

JACC 2005;45:351-6

Circulation 2005;111:1383-9

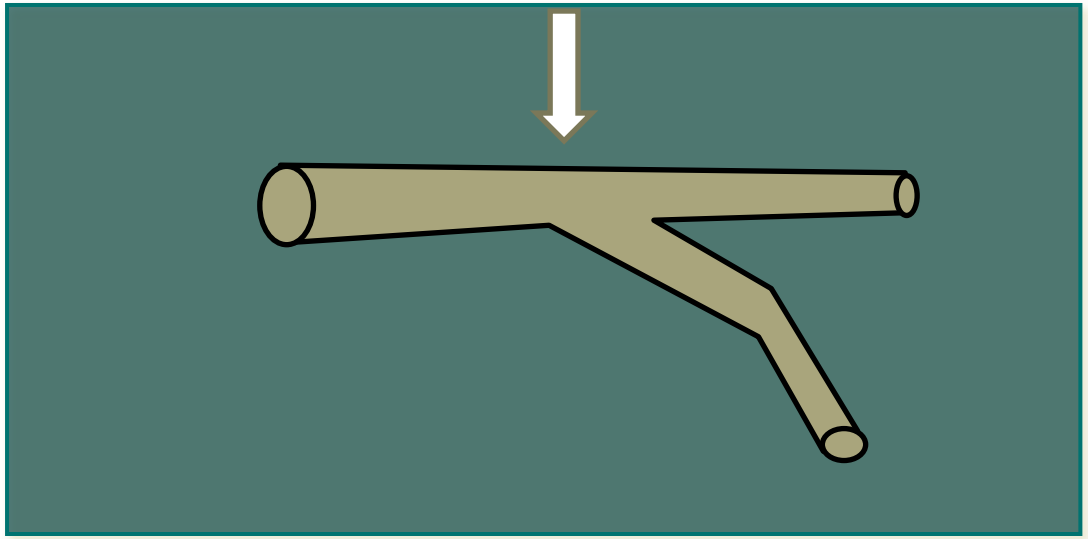
JACC 2006;47:870-7

Circulation 2006:113:2542-7

JACC 2006;47:864-70

LEFT MAIN CORONARY ARTERY DISEASE

Most LMCAD (40% to 94%) is located in the distal trunk portion and proximal segments coronary arteries are more affected.

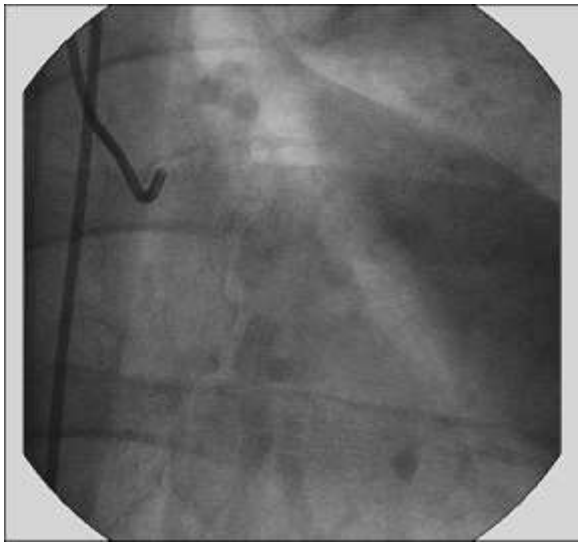


Am Heart J 2004;148:481-5
JACC 2005;45:351-6
Circulation 2005;111:1383-9
JACC 2006;47:870-7
Circulation 2006:113:2542-7
JACC 2006;47:864-70

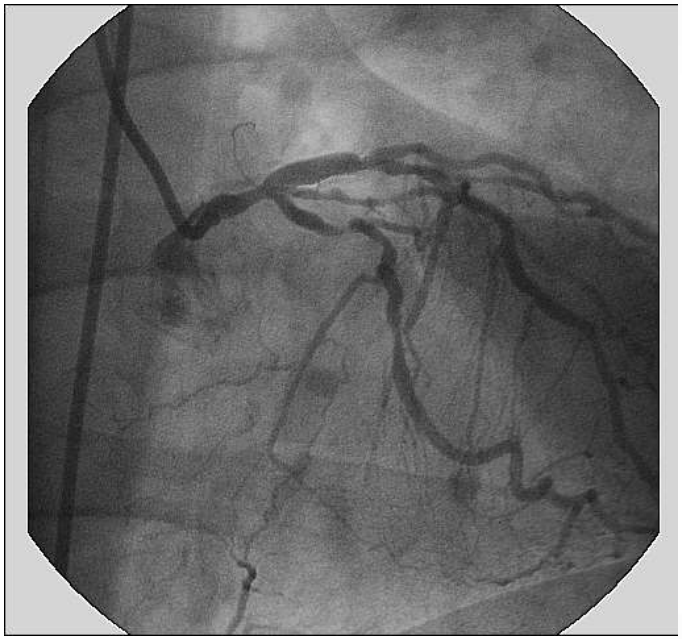
Approximately 50% of LMCAD present significant calcification

Catheter Cardiovasc Interv 2006;68:357-62

Calcium LMCAD



1/3 distal LMCAD + multivessel



1/3 medium LMCAD

LEFT MAIN CORONARY ARTERY DISEASE

Concept of Sucess

- Immediate
- Long-term follow-up requirement
- Real world

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EUROPEAN JOURNAL OF CARDIO-THORACIC SURGERY

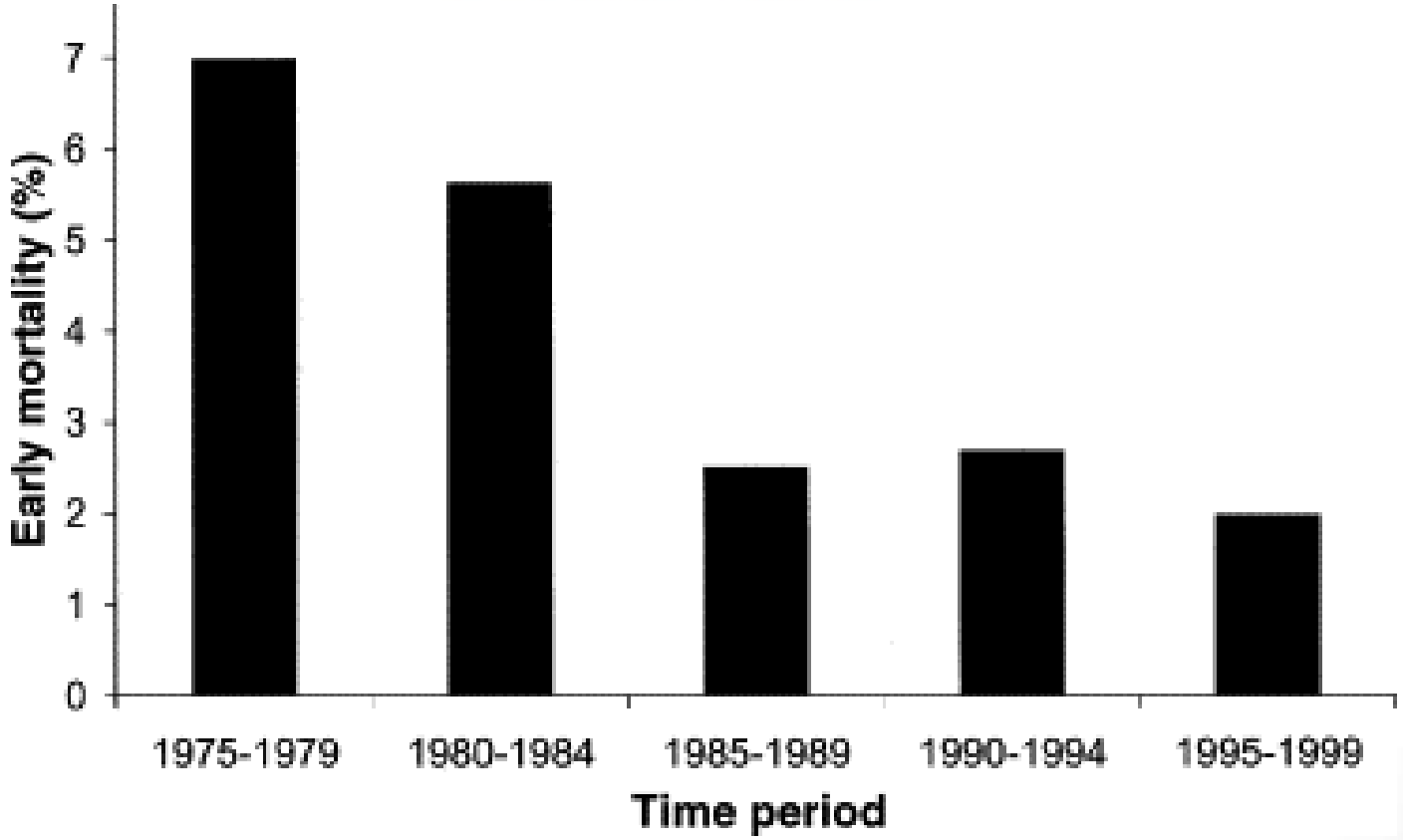
www.elsevier.com/locate/ejcts

Left main coronary artery stenosis no longer a risk factor for early and late death after coronary artery bypass surgery — an experience covering three decades

Anders Jönsson [a,*], Niklas Hammar [b,c], Tobias Nordquist [d], Torbjörn Ivert [a]

[a] *Department of Thoracic Surgery, Karolinska University Hospital, Stockholm, Sweden*
[b] *Department of Epidemiology; Institute of Environmental Medicine, Sweden*
[c] *Department of Epidemiology, AstraZeneca R&D, Mölndal, Sweden*
[d] *Department of Epidemiology, Stockholm Centre of Public Health, Stockholm, Sweden*

Received 21 March 2006; accepted 15 May 2006



Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17

ACC / AHA Guidelines 2006

- **CABG in LMCAD**

Class I r*ecommendation*

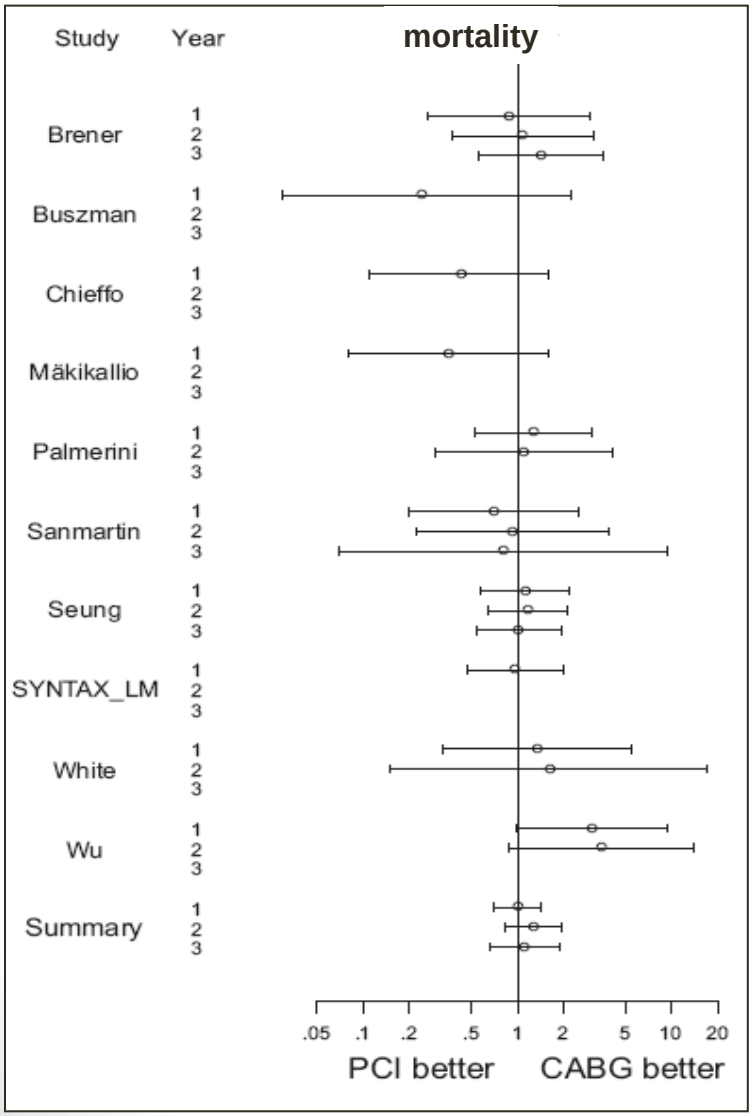
(procedure is beneficial, useful, effective.

- **CPI in LMCAD**

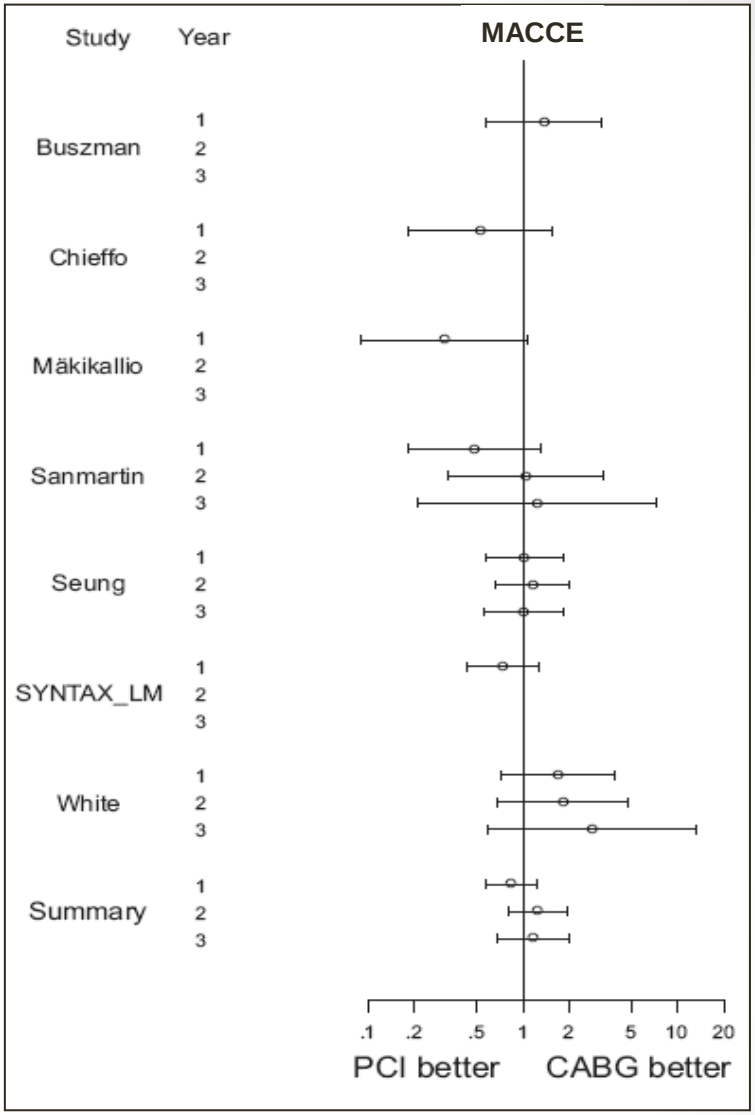
Class III – recommendation (procedure is not useful/effective, and in same cases may be harmful)

JACC 2006;47:216-35

A Meta-Analysis of 3,773 Patients Treated With Percutaneous Coronary Intervention or Surgery for Unprotected Left Main Coronary Artery Stenosis



Odds ratio
1y - 1.0
2y - 1.27
3y - 1.11

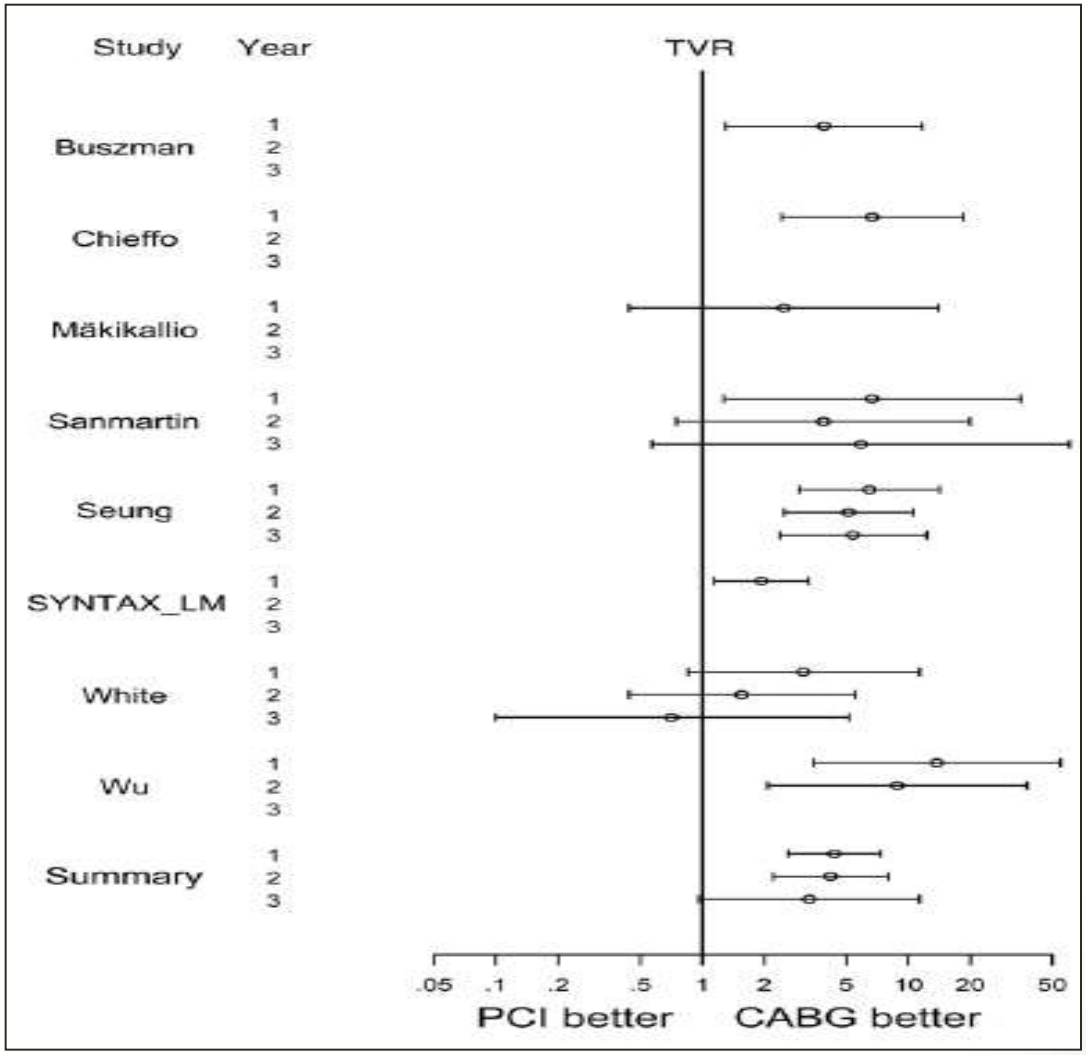


Odds ratio
1y – 0.84
2y – 1.25
3y – 1.16

Naik H et al. JACC Intv 2009;2:739-42

A Meta-Analysis of 3,773 Patients Treated With Percutaneous Coronary Intervention or Surgery for Unprotected Left Main Coronary Artery Stenosis

Target vessel Revascularization



Odds ratio
1y – 4.36
2y – 4.20
3y – 3.30

Naik H et al. JACC Intv 2009;2:739-42

A Meta-Analysis of 3,773 Patients Treated With Percutaneous Coronary Intervention or Surgery for Unprotected Left Main Coronary Artery Stenosis

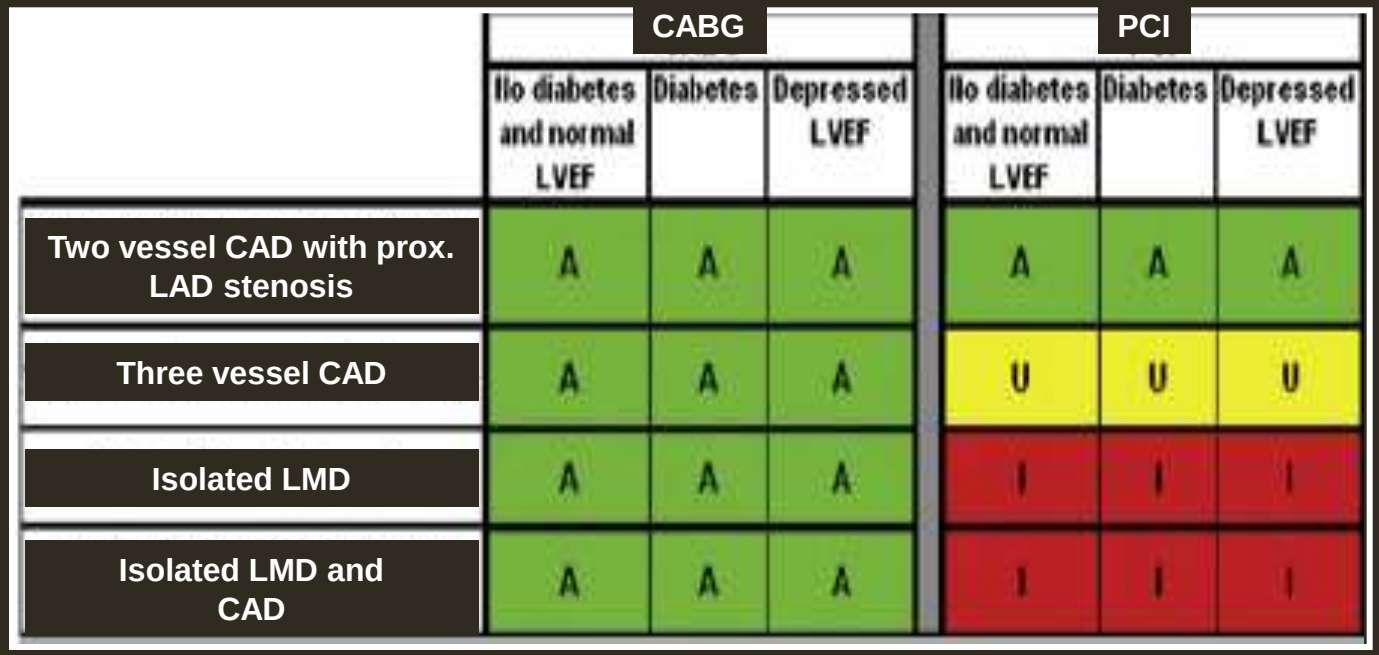
Hursh Naik, MD,* Anthony J. White, MBBS, PHD,* Tarun Chakravarty, MD,* James Forrester, MD,* Gregory Fontana, MD,* Saibal Kar, MD,* Prediman K. Shah, MD,* Robert E. Weiss, PHD,† Raj Makkar, MD*

Los Angeles, California

Conclusions Our analysis reveals no difference in mortality or major adverse cardiovascular or cerebrovascular events, for up to 3 years, between PCI and CABG for the treatment of ULMCA stenosis. However, PCI patients had a significantly higher risk of target vessel revascularization. In selected patients with ULMCA stenosis, PCI is emerging as an acceptable option. (J Am Coll Cardiol Intv 2009;2:739–47) © 2009 by the American College of Cardiology Foundation

Naik H et al. JACC Intv 2009;2:739-42

Appropriateness Criteria for Coronary Revascularization



	CABG			PCI		
	No diabetes and normal LVEF	Diabetes	Depressed LVEF	No diabetes and normal LVEF	Diabetes	Depressed LVEF
Two vessel CAD with prox. LAD stenosis	A	A	A	A	A	A
Three vessel CAD	A	A	A	U	U	U
Isolated LMD	A	A	A	I	I	I
Isolated LMD and CAD	A	A	A	I	I	I

A=Appropriate

U=Uncertain

I=Inappropriate

Pattel MR et al ACCF/SCAI/STS/AATS/AHA/ASNC

JACC 2009;53:530-53

Circulation. 2009;119:1330-52

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doi:10.1016/j.jacc.2011.07.005

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease

A Meta-Analysis of Randomized Clinical Data

Davide Capodanno, MD,* Gregg W. Stone, MD,† Marie C. Morice, MD,‡ Theodore A. Bass, MD,§ Corrado Tamburino, MD, PhD*

Catania, Italy; New York, New York; Massy, France; and Jacksonville, Florida

Table 1 Studies Included in the Meta-Analysis

Study/First Author (Ref. #)	Year	Design	N	PCI, n	DES, %	CABG, n	LIMA to LAD, %	Primary Outcome
LEMANS (4)	2008	RCT	105	52	35	53	81	Cardiac death, MI, CVA, repeat revascularization, and/or acute/subacute in-stent thrombosis
SYNTAX Left Main (5)	2009	Pre-specified subanalysis from RCT	705	357	100	348	97	All-cause death, CVA, MI, and repeat revascularization
Boudriot et al. (8)	2010	RCT	201	100	100	101	99	All-cause death, MI, and repeat revascularization
PRECOMBAT (9)	2011	RCT	600	300	100	300	94	All-cause death, CVA, MI, and repeat revascularization

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

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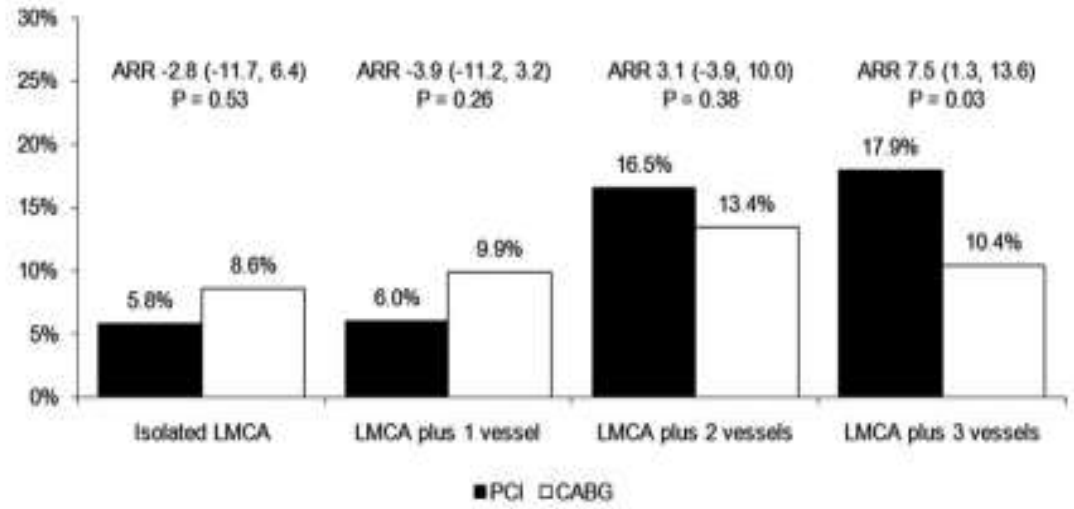

Figure 5 Differences in 1-Year MACCE Between PCI and CABG in the Pooled Analysis of the SYNTAX Left Main and PRECOMBAT Studies After Stratification by Burden of Coronary Artery Disease

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

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Interventional Cardiology

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Catania, Italy; New York, New York; Massy, France; and Jacksonville, Florida

Conclusions

From the available RCT data, no significant differences were present between PCI and CABG in patients with LMCA disease for the occurrence of 1-year MACCE and the component endpoints of death or MI. However, PCI was associated with higher rates of TVR but with fewer CVAs compared with CABG. Based on the present study, revision of the guidelines regarding left main PCI (1,2) is warranted, raising the level of evidence of current recommendations from B to A.

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

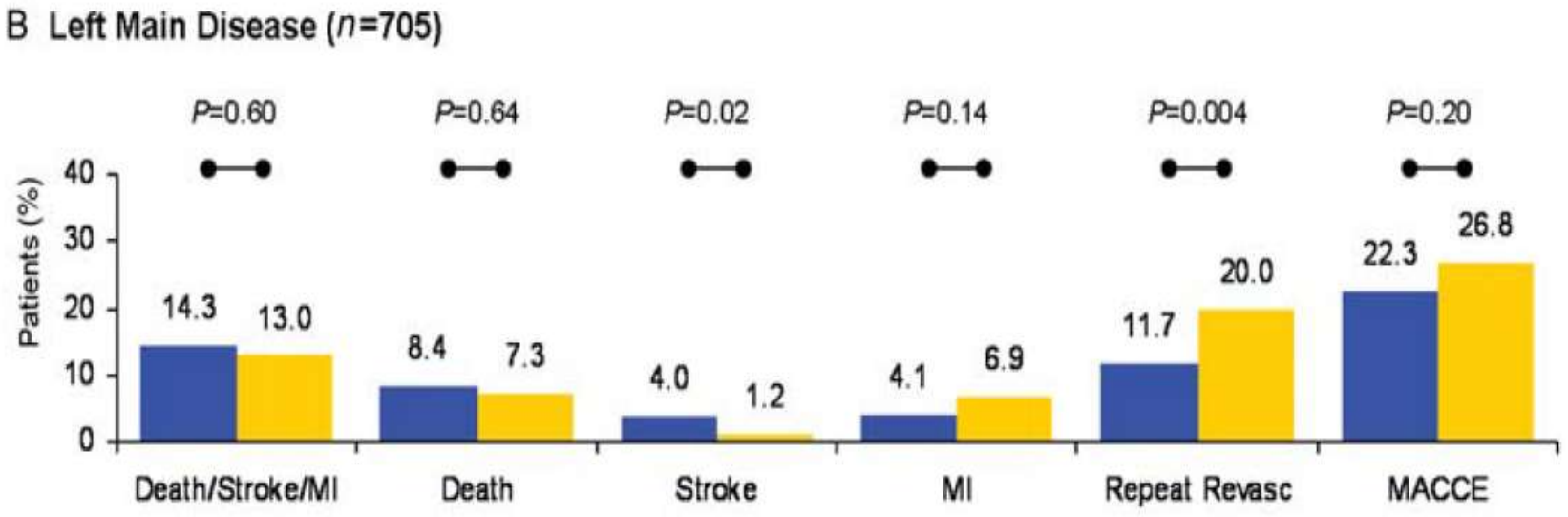
Comparison of coronary bypass surgery with drug-eluting stenting for the treatment of left main and/or three-vessel disease: 3-year follow-up of the SYNTAX trial

Arie Pieter Kappetein[1]*, Ted E. Feldman[2], Michael J. Mack[3], Marie-Claude Morice[4], David R. Holmes[5], Elisabeth Ståhle[6], Keith D. Dawkins[7], Friedrich W. Mohr[8], Patrick W. Serruys[1], and Antonio Colombo[9]

[1]Department of Thoracic Surgery, Erasmus Medical Centre, PO Box 2040, Room BD 569, 3000 CA Rotterdam, The Netherlands; [2]NorthShore University Health System, Evanston, IL, USA; [3]Baylor Healthcare System, Dallas, TX, USA; [4]Institut Cardiovasculaire Paris Sud, Massy, France; [5]Mayo Clinic, Rochester, MN, USA; [6]University Hospital Uppsala, Uppsala, Sweden; [7]Boston Scientific, Natick, MA, USA; [8]Herzzentrum Universität Leipzig, Leipzig, Germany; and [9]San Raffaele Scientific Institute, Milan, Italy

Received 2 March 2011; revised 29 May 2011; accepted 8 June 2011; online publish-ahead-of-print 22 June 2011

Left Main Disease (n=705)



Kappetein AP et al. EHJ 2011;32:2125-34

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Received 2 March 2011; revised 29 May 2011; accepted 8 June 2011; online publish-ahead-of-print 22 June 2011

"***At 3 years, MACCE was significantly higher in PCI-*** compared with CABG-treated patients. In patients with less complex disease ***(low SYNTAX scores for 3VD or low/intermediate terciles for LM patients), PCI is an acceptable*** revascularization, although longer follow-up is needed to evaluate these two revascularization strategies."

Kappetein AP et al. EHJ 2011;32:2125-34

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

Marie-Claude Morice, MD; Patrick W. Serruys, MD, PhD; A. Pieter Kappetein, MD, PhD; Ted E. Feldman, MD; Elisabeth Ståhle, MD; Antonio Colombo, MD; Michael J. Mack, MD; David R. Holmes, MD; James W. Choi, MD; Witold Ruzyllo, MD; Grzegorz Religa, MD; Jian Huang, MD, MS; Kristine Roy, PhD; Keith D. Dawkins, MD; Friedrich Mohr, MD, PhD

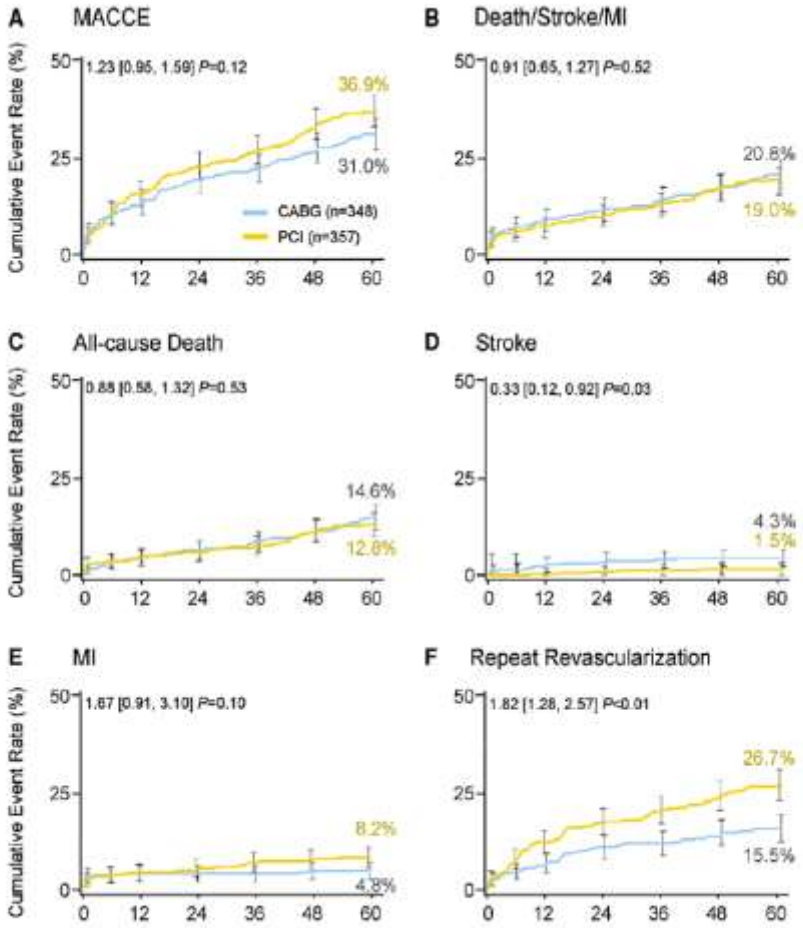

Figure 2. Five-year incidence of cardiac events in left main coronary artery (LM) patients. Hazard ratio and 95% confidence intervals are from the Cox partial likelihood method. Event rates are Kaplan-Meier estimates with a log-rank *P* value.

Morice MC et al.
Circulation 2014;129:2388-2394

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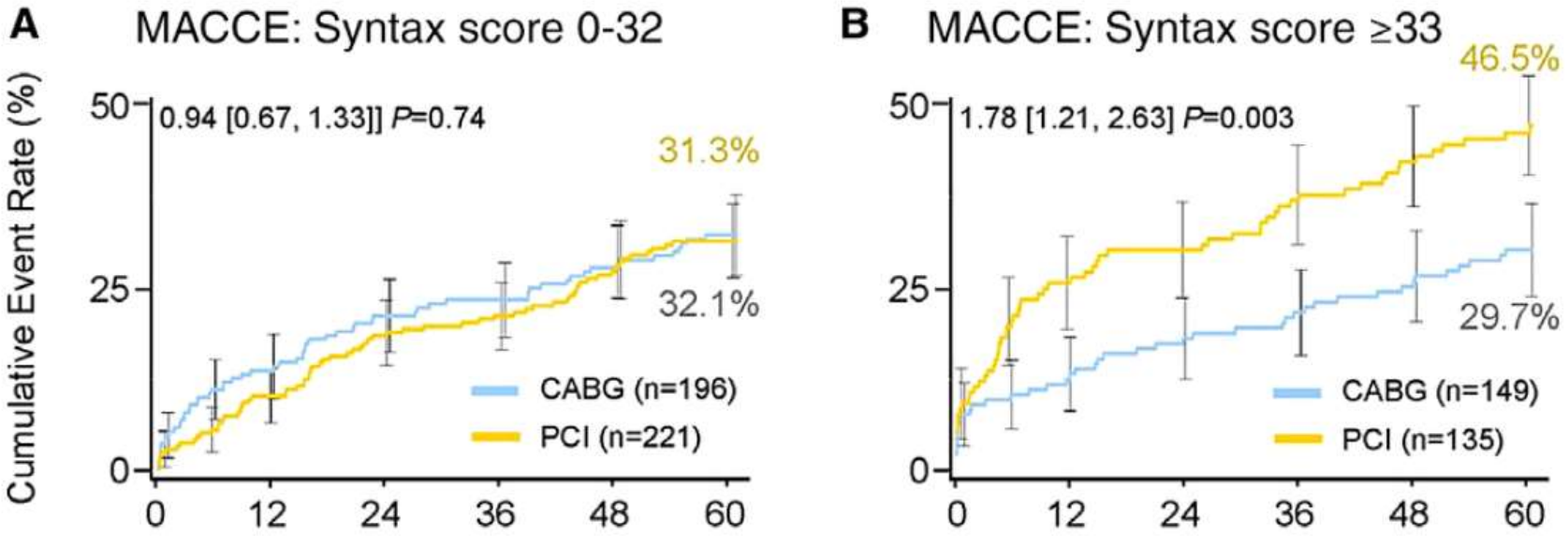

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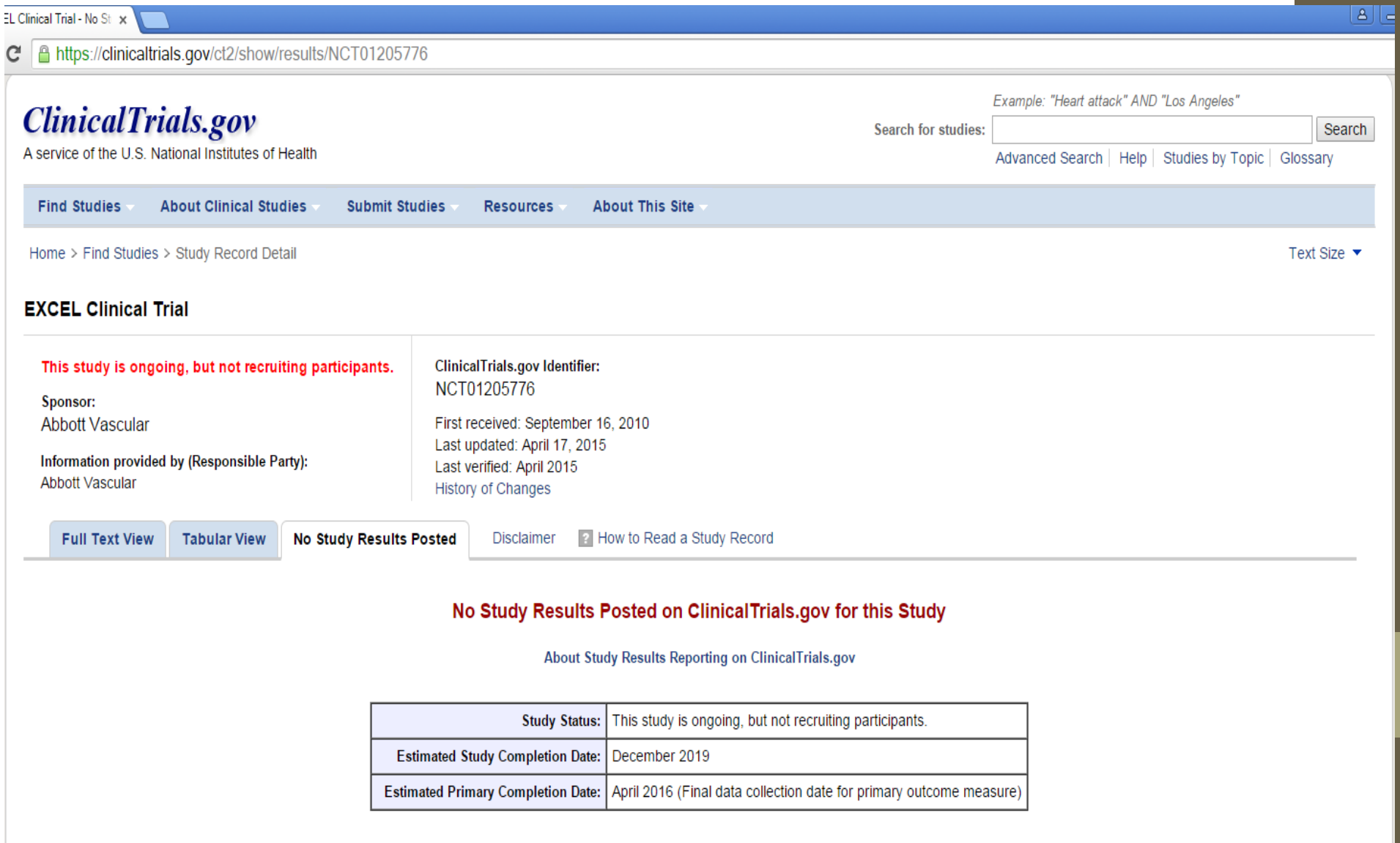
Conclusions

The SYNTAX trial is currently the largest randomized, controlled trial comparing PCI with CABG in complex coronary disease with a prespecified and powered LM subgroup. CABG has been the gold standard for revascularization of the LM vessel; however, this hypothesis-generating subanalysis of the SYNTAX trial suggests that PCI can provide equivalent longterm (to 5 years) death/stroke or MI to CABG, in particular in the subset of LM subjects with SYNTAX scores <33.

Morice MC et al. Circulation 2014;129:2388-2394

Evaluation of XIENCE PRIME™ Everolimus Eluting Stent System (EECSS) or XIENCE V® EECSS or XIENCE Xpedition™ EECSS or XIENCE PRO EECSS Versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization - EXCEL Clinical Trial



Coronary Artery Bypass Grafting Vs Drug Eluting Stent Percutaneous Coronary Angioplasty in the Treatment of Unprotected Left Main Stenosis (NOBLE Study – Nordic-Baltic-British Left Main Revascularization)

Coronary Artery Bypass Grafting Vs Drug Eluting Stent Percutaneous Coronary Angioplasty in the Treatment of Unprotected Left Main Stenosis (LeftMain/NOBLE)

This study is ongoing, but not recruiting participants.

Sponsor:
Evald Hoej Christiansen

Information provided by (Responsible Party):
Evald Hoej Christiansen, Aarhus University Hospital Skejby

ClinicalTrials.gov Identifier:
NCT01496651

First received: December 19, 2011
Last updated: January 30, 2015
Last verified: January 2015
History of Changes

No Study Results Posted on ClinicalTrials.gov for this Study

About Study Results Reporting on ClinicalTrials.gov

Study Status:	This study is ongoing, but not recruiting participants.
Estimated Study Completion Date:	December 2018
Primary Completion Date:	January 2015 (Final data collection date for primary outcome measure)

ESC/EACTS Guidelines on myocardial revascularization

Subset of CAD by anatomy	Favours CABG	Favours PCI	Ref. [a]
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]

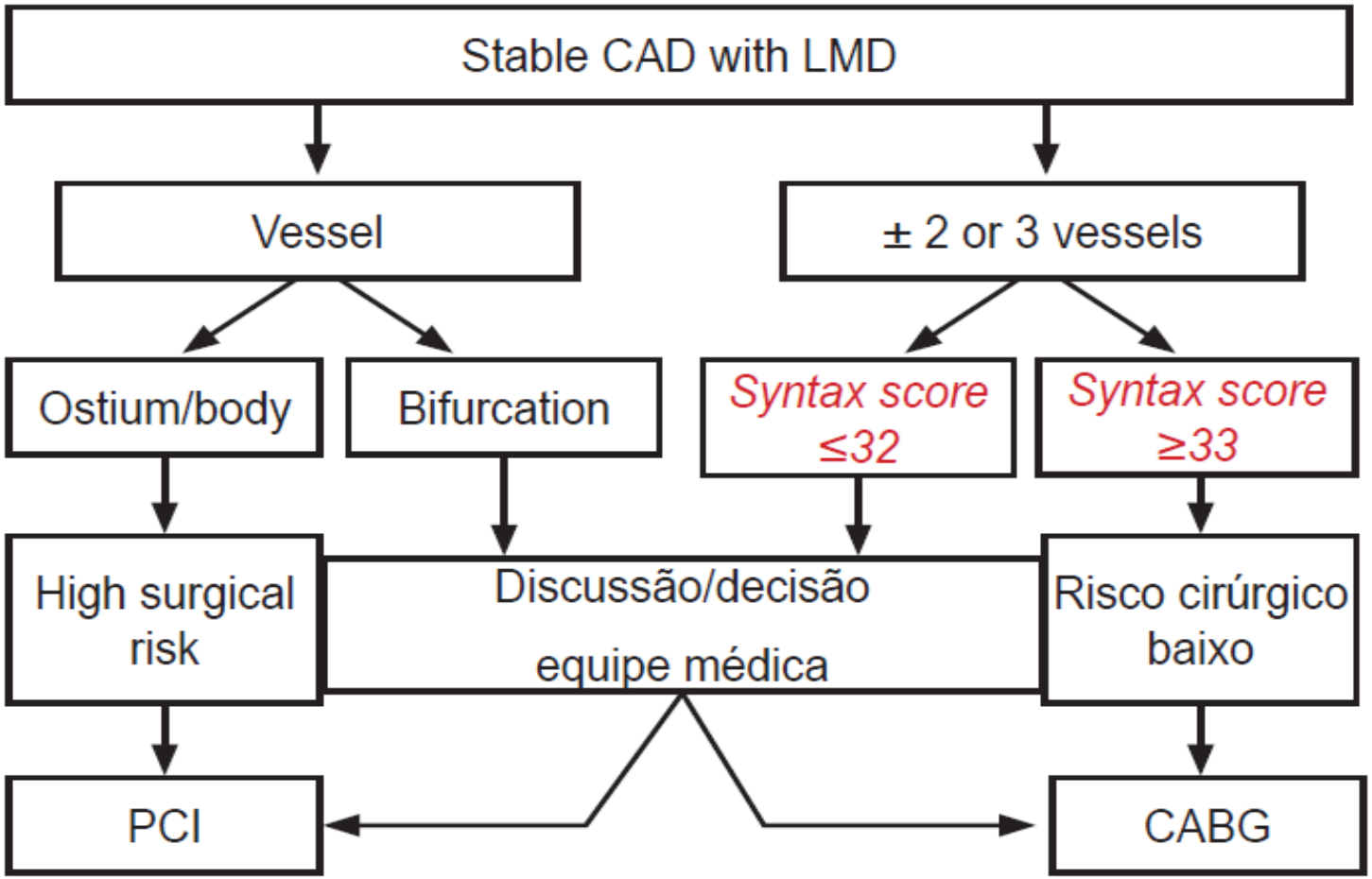
Eur J Cardiothorac Surg 2010;38:S1-S52

Recommendations according to extent of CAD	CABG		PCI		
	Class[a]	Level[b]	Class[a]	Level[b]	Ref[c]
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B	17,134,170
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B	17
Left main disease with a SYNTAX score >32.	I	B	III	B	17

Eur J Cardiothoracic Surgery 2014: 1–102

Guideline for Stable Coronary Artery Disease

Arq Bras Cardiol 2014; 103(2Suppl.2): 1-59



CONCLUSIONS

- The revascularization concept of LMCAD presented changes in the last years
- Coronary artery bypass graft is the "gold standard" for LMCAD and multivessel disease.
- In more recent studies angioplasty can be considered as an acceptable method in low or intermediate anatomical complex cases or in high surgical risk pts.
- Heart Team discussion is recommended.
- In few months new controlled and randomized trials should be announced.

Gracias!

Appropriateness of coronary revascularization for patients without acute coronary syndromes

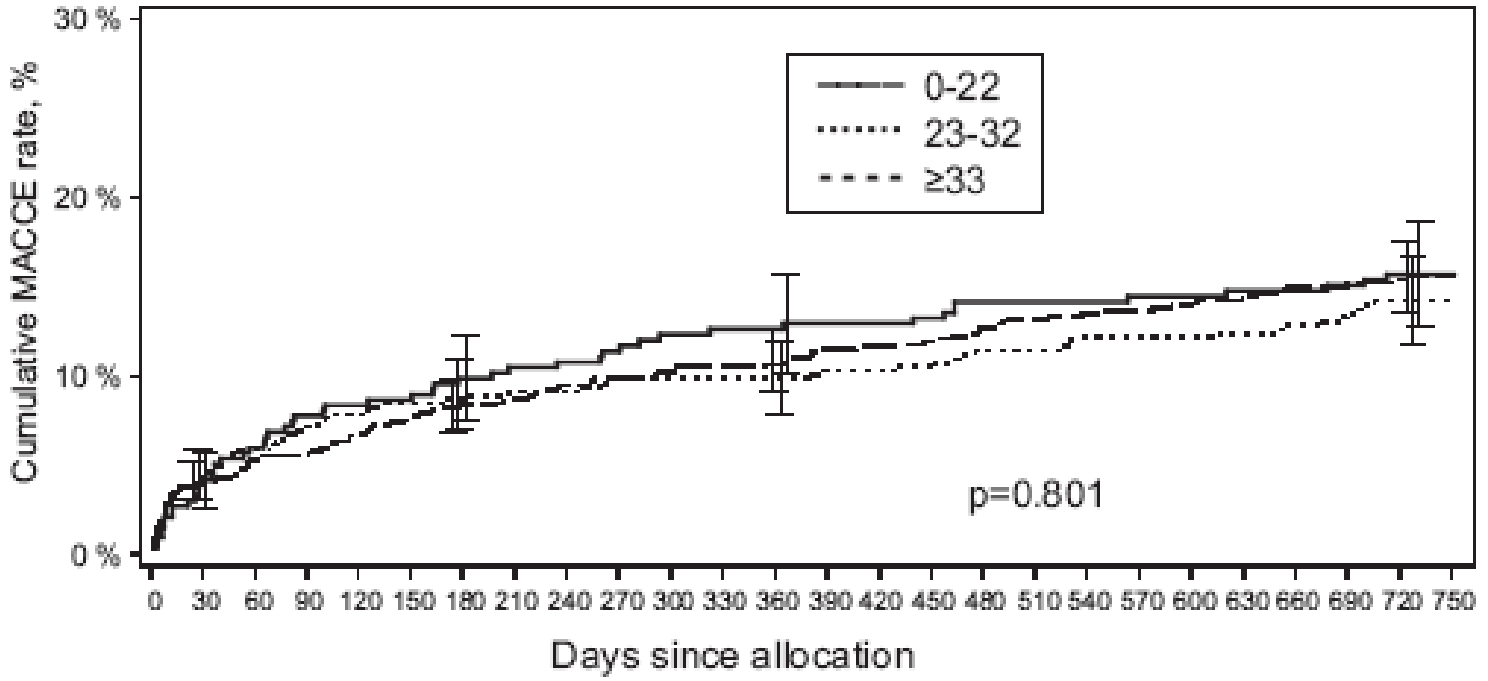
Table 1 Rating Cases as Appropriate for Revascularization According to ACC/AHA Appropriate Use Criteria Patients*

Case Description	Procedure Performed	
	CABG	PCI
Total cases reported	14,519	81,407
Eligible cases—no ACS, no previous CABG (% of all cases reported that are eligible)	10,460 (72.04)	33,970 (41.73)
Eligible cases where rating cannot be determined	2,292	9,425
Cases rated for appropriateness of revascularization	8,168	24,545
Revascularization (CABG or PCI) is		
Appropriate	7,372	8,856
	90.25%	36.08%
Inappropriate	91	3,508
	1.11%	14.29%
Uncertain	705	12,181
	8.63%	49.63%

Hannan EL, et al. J Am Coll Cardiol. 2012 ;59(21):1870-6.

Complex coronary anatomy in coronary artery bypass graft surgery: impact of complex coronary anatomy in modern bypass surgery? Lessons learned from the SYNTAX trial after two years

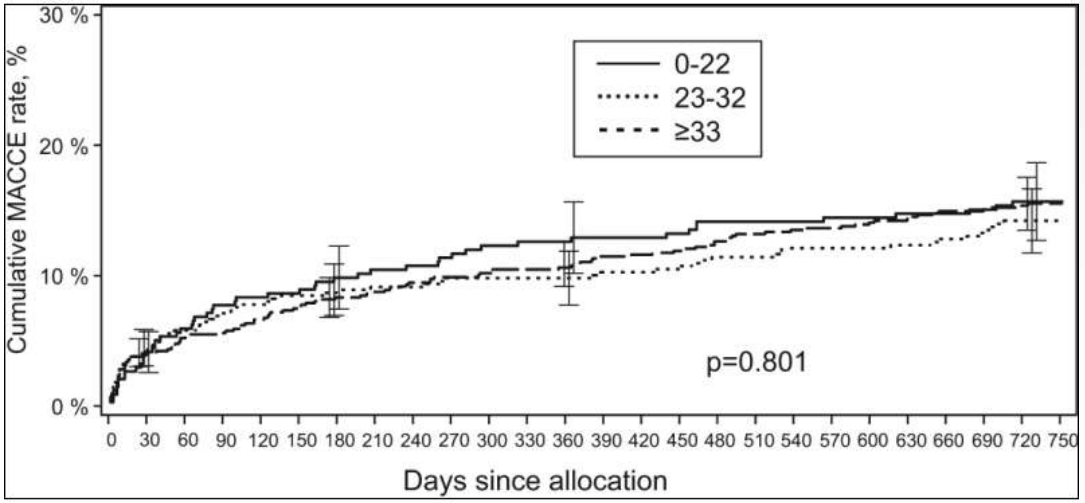
MACCE in CABG patients increased not with high raw SYNTAX scores



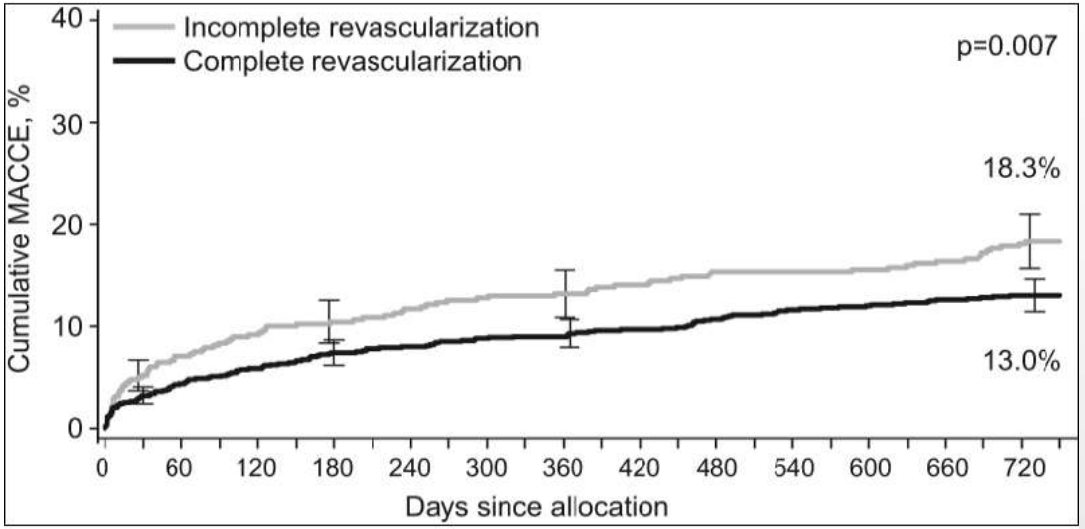
Mohr FW, et al. J Thorac Cardiovasc Surg. 2011;141(1):130-40.

Impact of complex coronary anatomy in modern bypass surgery? Lessons learned from the SYNTAX trial

Eventos CV não alteram com o aumento do Syntax Score



Eventos CV aumentam com a RM incompleta



Mohr FW, et al. J Thoracic Cardiovasc Surg 2011;141(1):130-40

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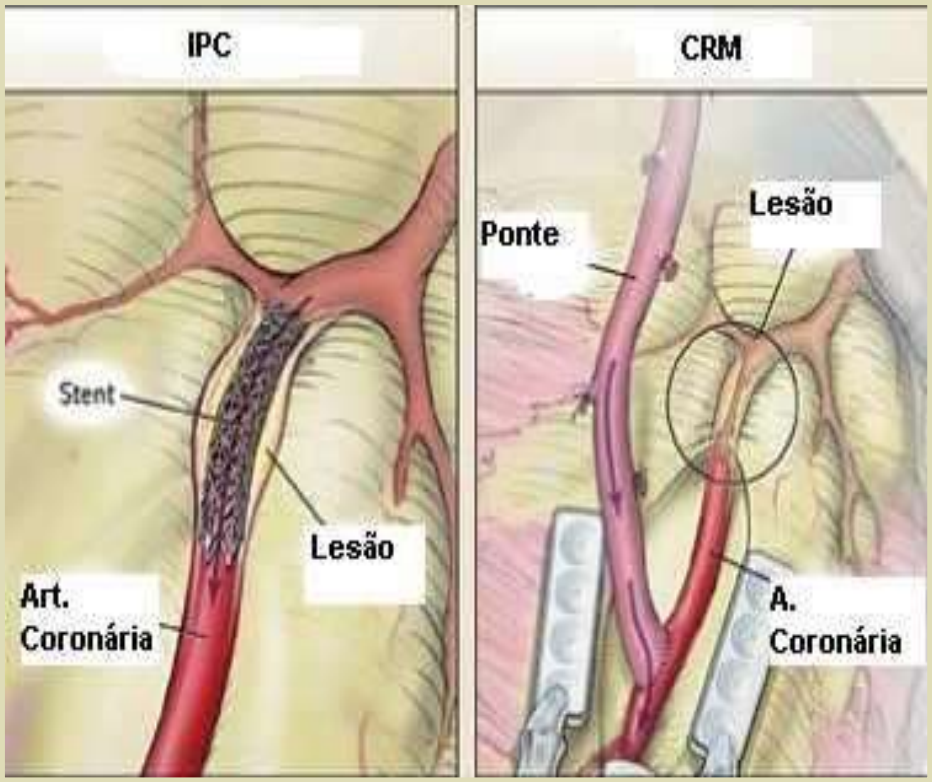
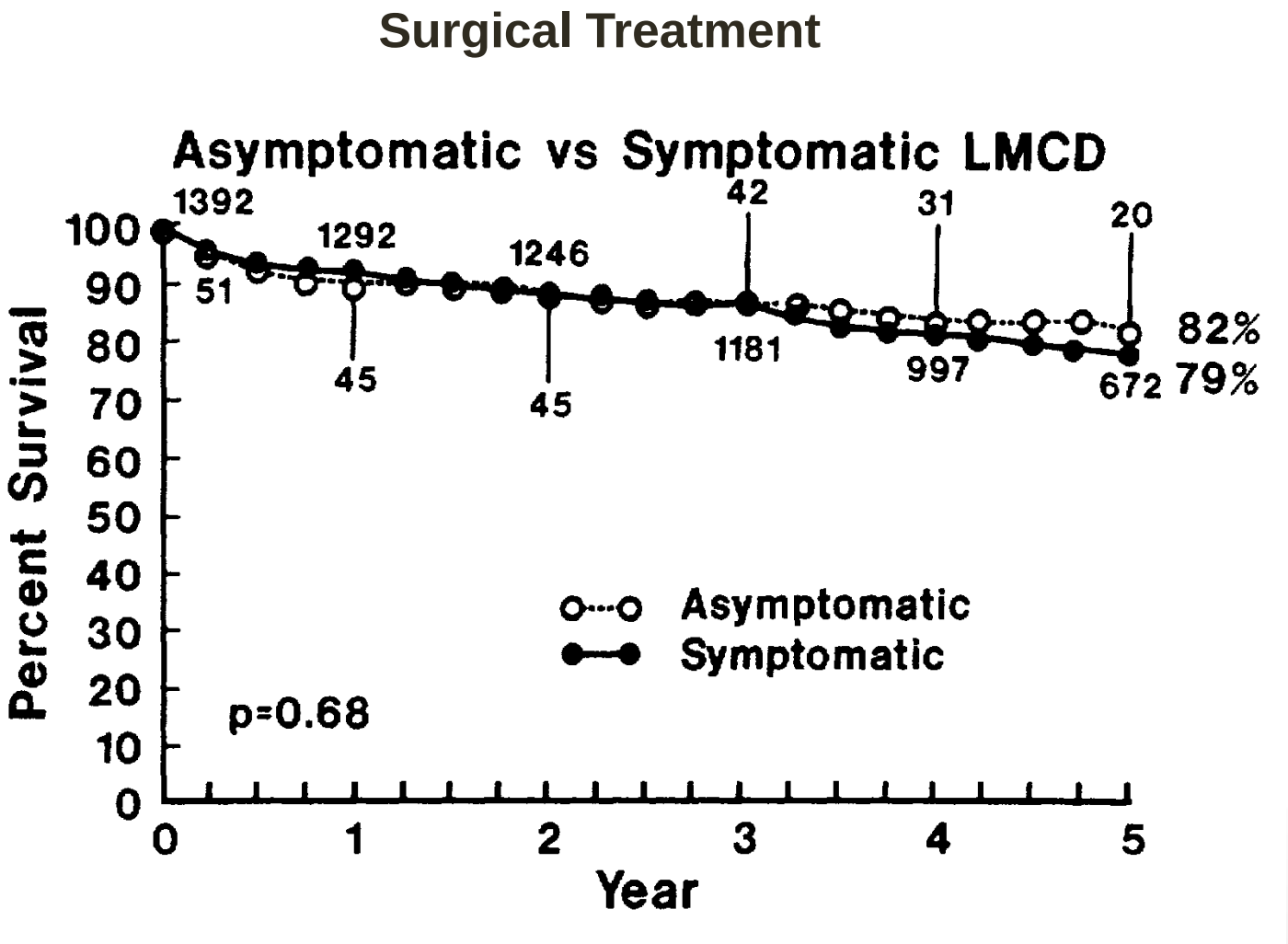
Methods of Coronary Revascularization - Things May Not Be as They Seem [Editorial]



Gersh BJ, Frye R. NEJM, 2005; 352(21):2235-37

Asymptomatic Left Main Coronary Artery Disease in the Coronary Artery Surgery Study (CASS) Registry



Taylor HA et al. Circulation 1989;79(6):1171-9

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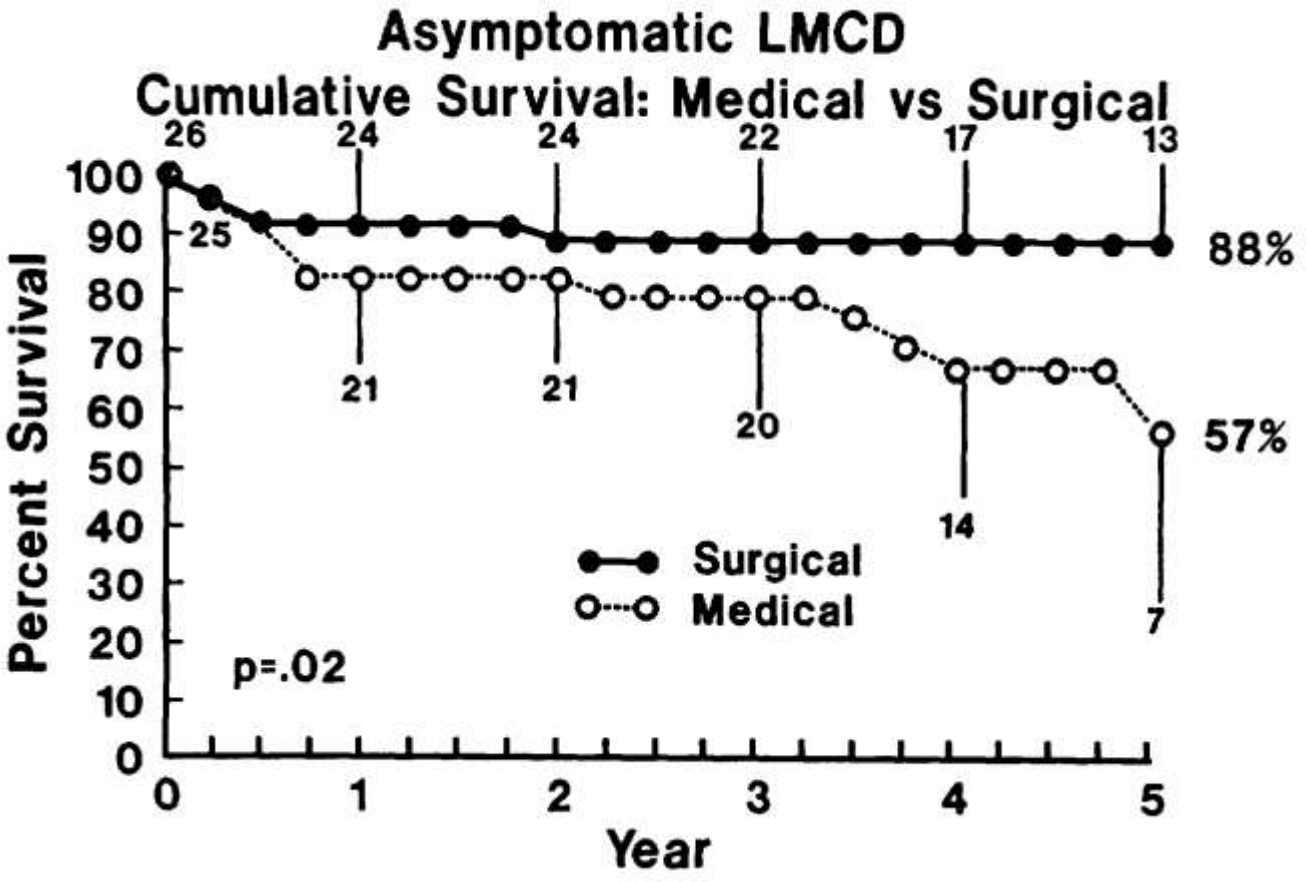
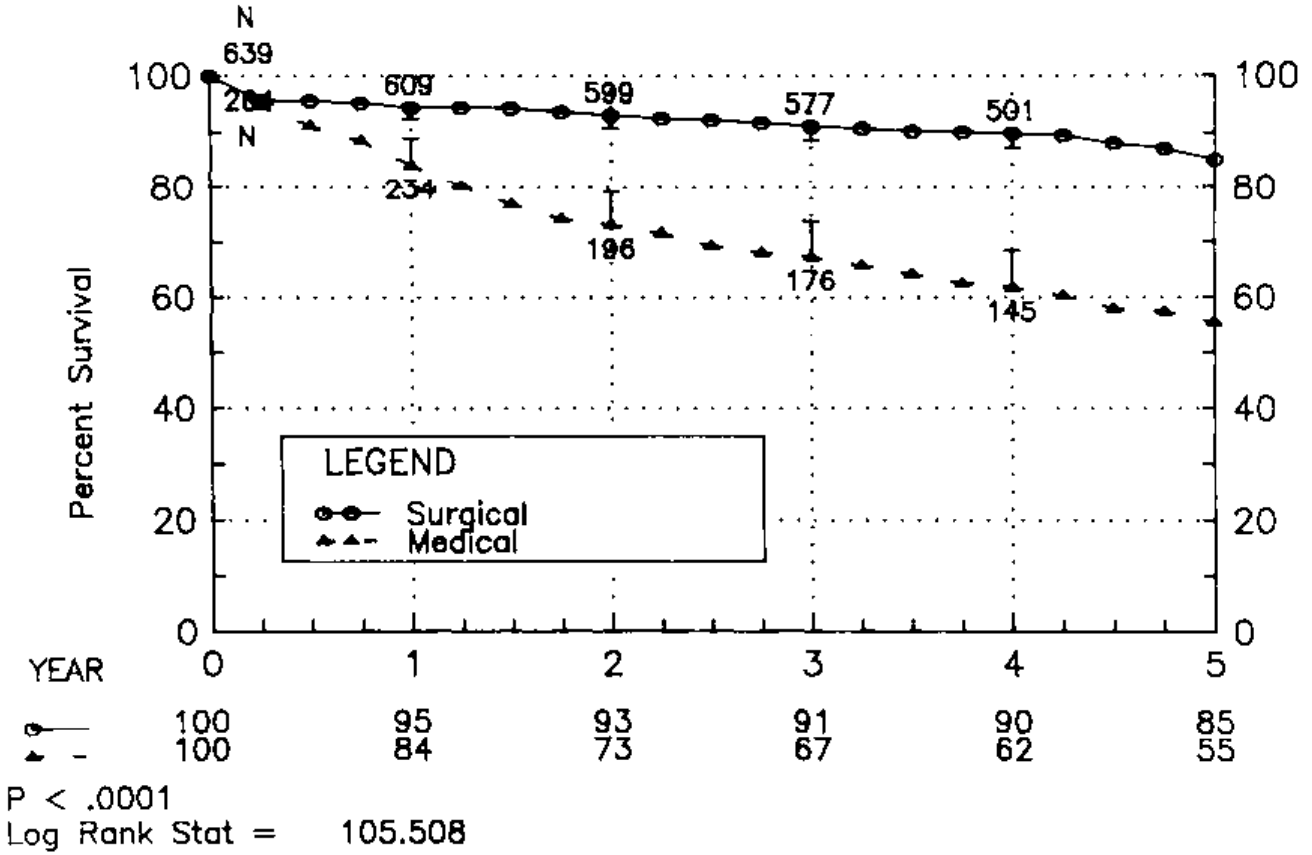


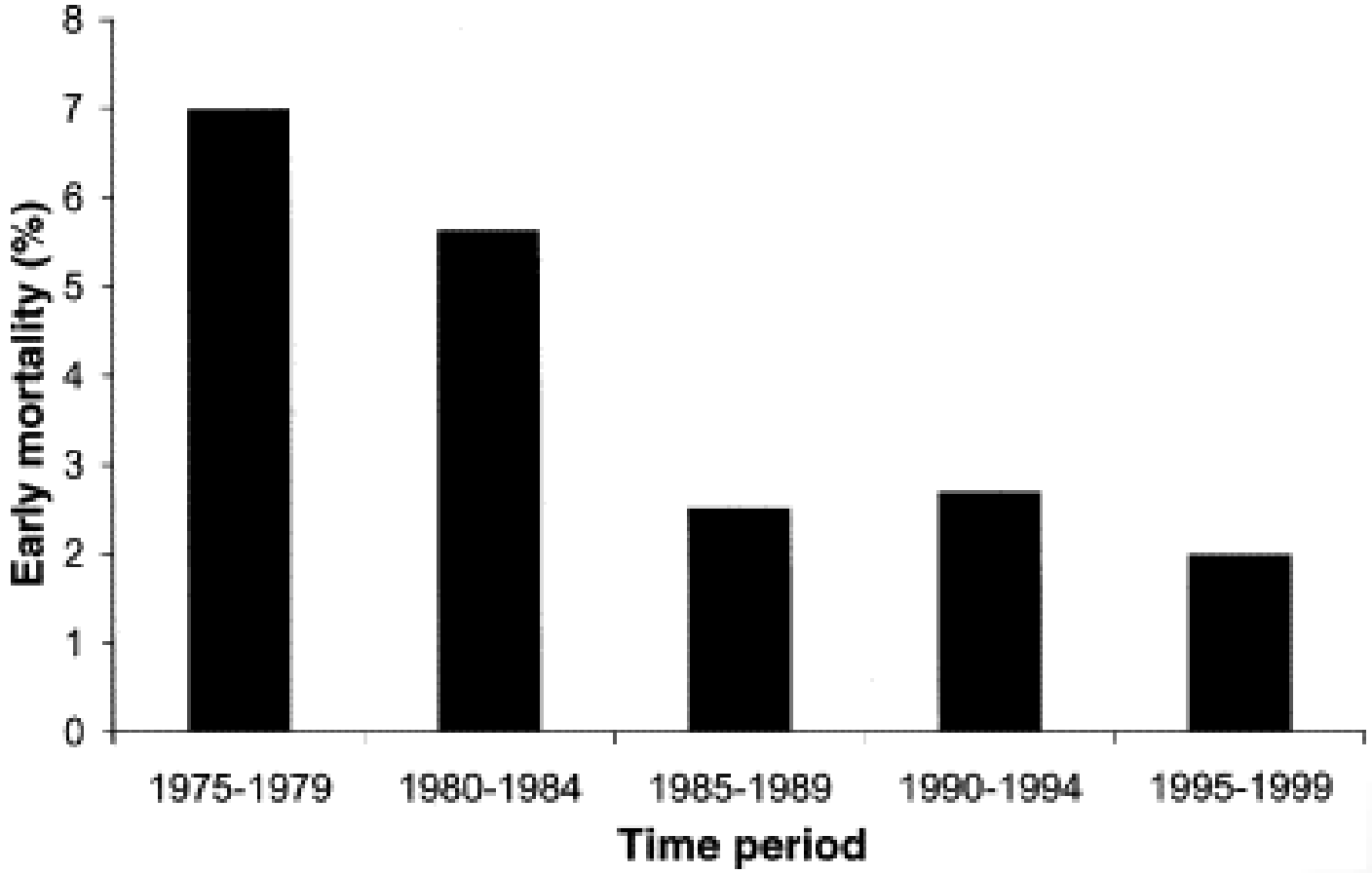
Taylor HA et al. Circulation 1989;79(6):1171-9

The role of coronary bypass surgery for “left main equivalent” coronary disease: The Coronary Artery Surgery Stydy Registry



Chaitman BR et al. Circulation 1986;74(Suppl):III17-25

Left main coronary artery stenosis no longer a risk factor for early and late death after CABG — an experience covering three decades



Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17

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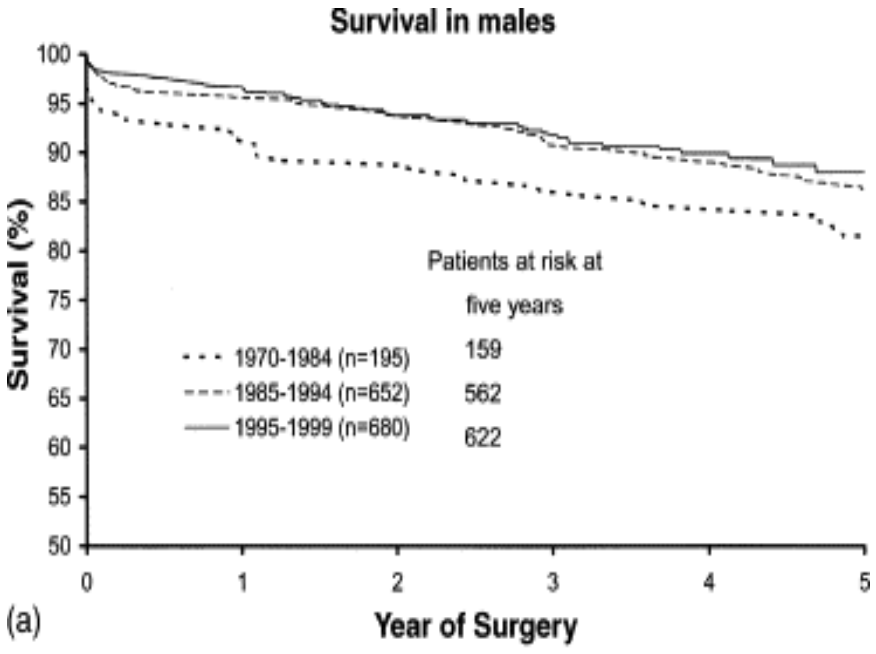

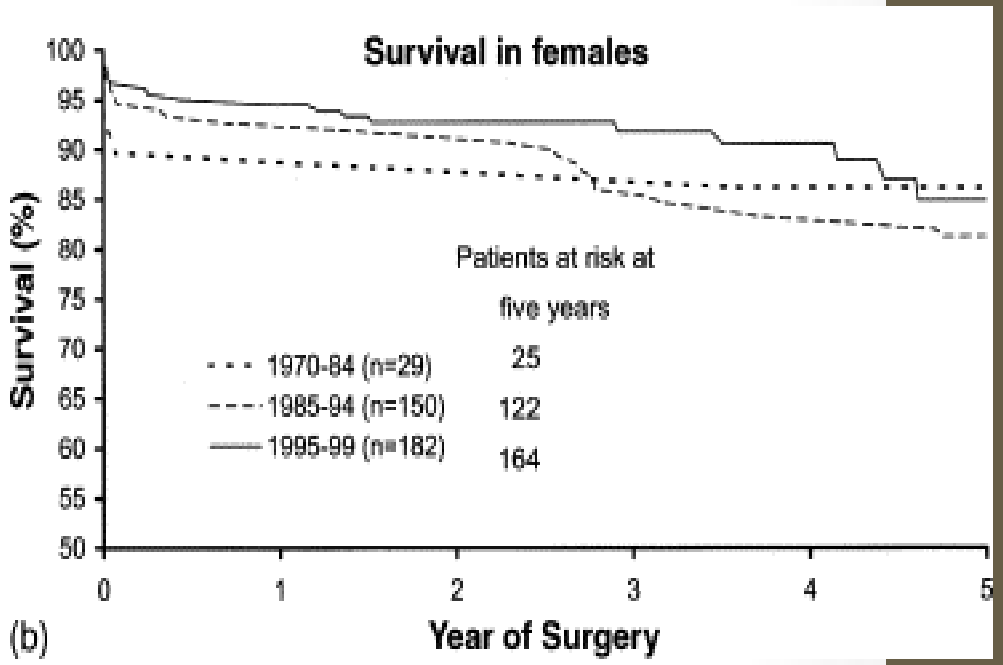

Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17

Left main coronary artery stenosis no longer a risk factor for early and late death after CABG — an experience covering three decades

Follow-up 30 days

Year of surgery	Left main coronary artery obstruction: Yes		Left main coronary artery obstruction: No		OR (95% CI)	OR (95% CI)
All patients	pat.	Deaths, *n* (%)	pat.	Deaths, *n* (%)		
1970–1999	1888	51 (2.7)	8759	178 (2.0)	1.2 (0.8–1.6)	1.1 (0.8–1.6)
1970–1984	224	13 (5.8)	1797	27 (1.5)	3.5 (1.8–6.9)	3.7 (1.8–7.6)
1985–1994	802	21 (2.6)	3857	84 (2.2)	1.0 (0.6–1.6)	1.0 (0.6–1.6)
1995–1999	862	17 (2.0)	3105	67 (2.2)	0.8 (0.5–1.5)	0.8 (0.5–1.5

Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17

Left main coronary artery stenosis no longer a risk factor for early and late death after CABG — an experience covering three decades

Follow-up 5 years

All patients	Left main coronary artery obstruction: Yes pat.	Yes Deaths, *n* (%)	No pat.	No Deaths, *n* (%)	OR (95% CI)	OR (95% CI)
1970–1999	1837	183 (10.0)	8581	697 (8.1)	1.3 (1.0–1.5)	1.3 (1.1–1.6)
1970–1984	211	27 (12.8)	1770	148 (8.4)	1.5 (1.0–2.2)	1.7 (1.1–2.5)
1985–1994	781	97 (12.4)	3773	349 (9.2)	1.2 (0.9–1.5)	1.2 (1.0–1.5)
1995–1999	845	59 (7.0)	3038	200 (6.6)	1.0 (0.8–1.4)	1.1 (0.8–1.5)

Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17

Revascularization for Unprotected Left Main Stem Coronary Artery Stenosis Stenting or Surgery

Author (Year)	Year of Surgery	n	Mortality (%)			
			Hospital	30-Day	1-Year	2-Year
Jonsson et al. (2006)	1970 to 1999	1,888	2.7	—	—	—
Lu et al. (2006) (2005)	1997 to 2003	1,197	2.8	3	5	6
Keogh and Kinsman (2003)	2003	5,003	3	—	—	—
Dewey et al. (2006) (2001)	1998 to 1999	728	—	4.2	—	—
Yeatman et al. (2006) (2001)	1996 to 2000	387	2.4	—	—	5
Ellis et al. (2006) (1998)	1990 to 1995	1,585	2.3	—	—	—
Weighted average	—	10,788	2.8	—	—	—

Taggart, DP et al. JACC 2008;51(9):885-92

Revascularization for Unprotected Left Main Stem Coronary Artery Stenosis Stenting or Surgery

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Revascularization for Unprotected Left Main Stem Coronary Artery Stenosis Stenting or Surgery

Eight Studies of PCI Using BMS in LMS

Author	Sites	n	% Eligible	Stent	In-Hospital to 30-Day		1- to 2-Year FU	
					Mortality	Revasc.	Mortality	Revasc.
Keeley et al.	1	54	—	100%	5%	20%	31%	15%
Silvestri et al.	1	47	—	100%	9%	—	11%	15%
Silvestri et al.	1	93	—	100%	0%	—	3%	21%
Tan et al.: all	25	279	—	85%	14%	—	24%	34%
Tan et al.:	25	89	—	85%	3.4%	—	3.4%	31%
Black et al.	1	92	—	100%	4%	—	6.5%	16%
Takagi et al.	1	63	—	58%	0%	10%	16%	31%
Park et al.	4	270	—	100%	0%	4%	7%	29%
Brueren et al	1	71	—	64%	1%	4%	10%	25%
Kelley et al.	3	97	—	100%	9%	—	28%	20%
Weighted average		38		1,155	6%	3%	17%	29%

Taggart, DP et al. JACC 2008;51(9):885-92

Revascularization for Unprotected Left Main Stem Coronary Artery Stenosis Stenting or Surgery

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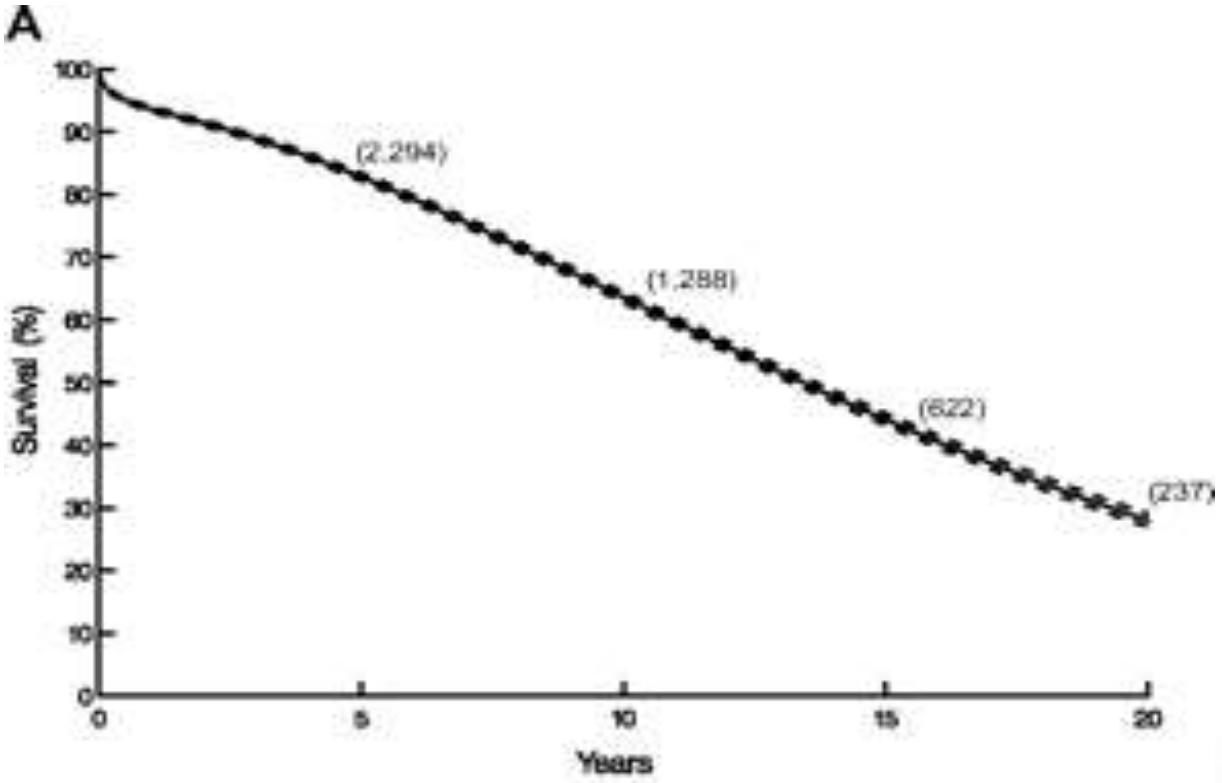
Taggart, DP et al. JACC 2008;51(9):885-92

A Benchmark for Evaluating Innovative Treatment of Left Main Coronary Disease

1971 - 1998 , First 1,000 primary CABG pats. (26,927)

Left main trunk stenosis (n=3803)

Survival after primary isolated coronary artery bypass grafting for all patients

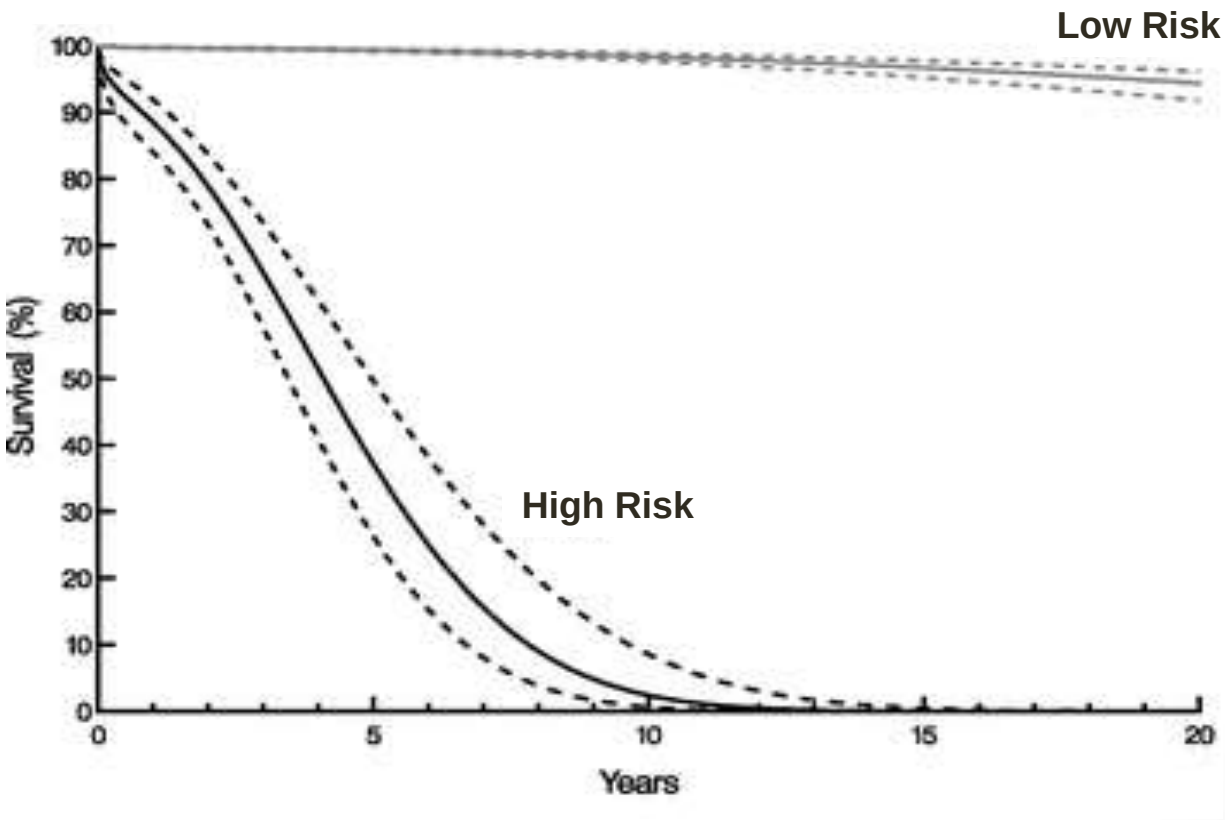


Sabik JF, et al. Circulation 2007;116:232-39

A Benchmark for Evaluating Innovative Treatment of Left Main Coronary Disease

Survival after primary isolated CABG for LMT stenosis:

high- and low-risk patients (n=3803)



Sabik JF, et al. Circulation 2007;116:232-39

Comparison of Percutaneous Versus Surgical Revascularization of Severe Unprotected Left Main Coronary Stenosis in Matched Patients

N= 97 vs.190 (period 1997 -2006)

In conclusion, patients who underwent percutaneous revascularization of severe LMCA stenosis appeared to have 3-year survival equivalent to those who underwent CABG - 80% vs. 85% (p = 0.14).

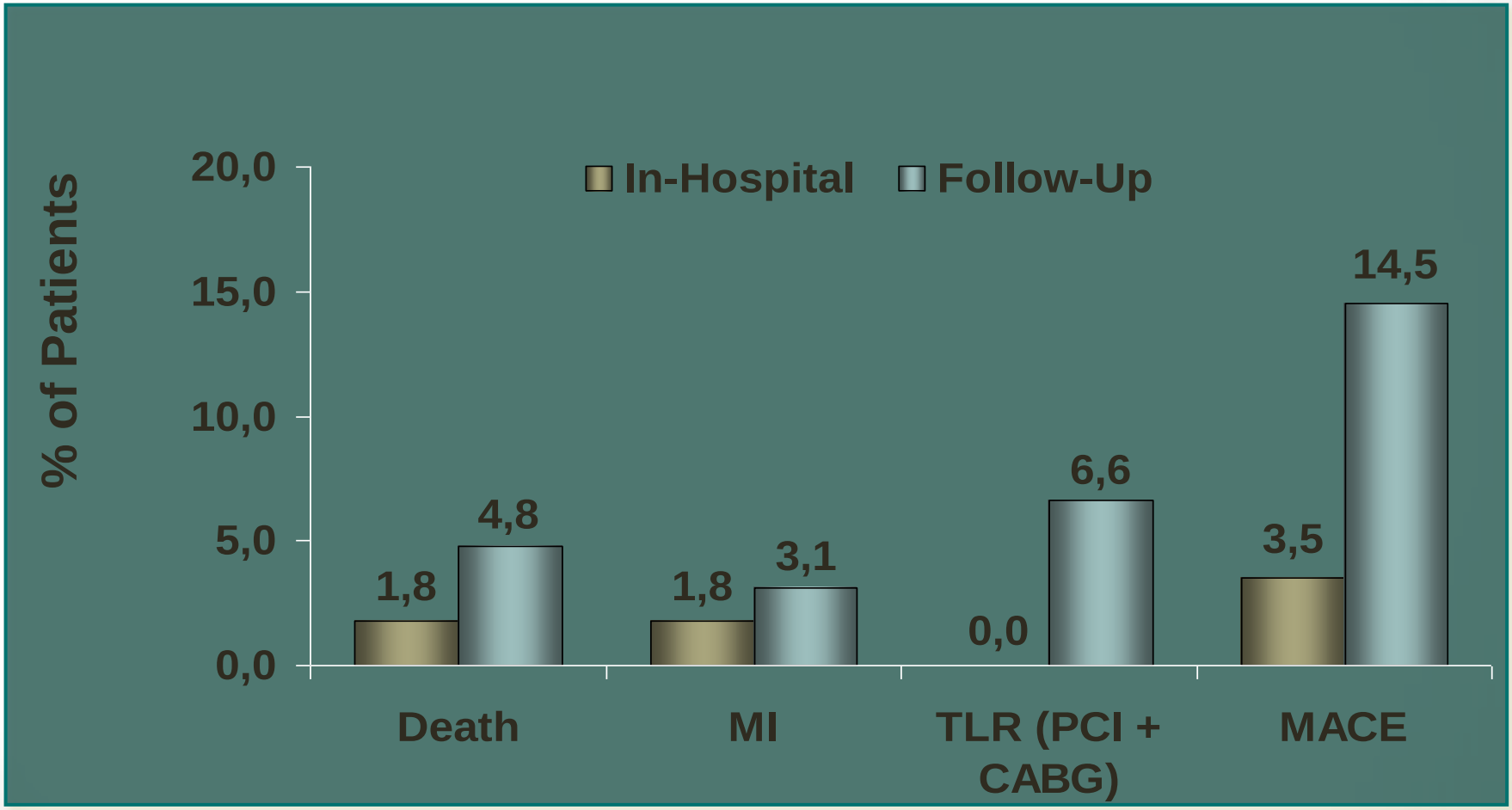
Diabetes mellitus and advanced co-morbidity were the principal determinants of survival - (hazard rate 1.96, p = 0.004)

These findings support the need for randomized trials with adequate follow-up to compare the 2 approaches.

Brener SJ, et al. Am J Cardiol 2008;101(2):169 -72

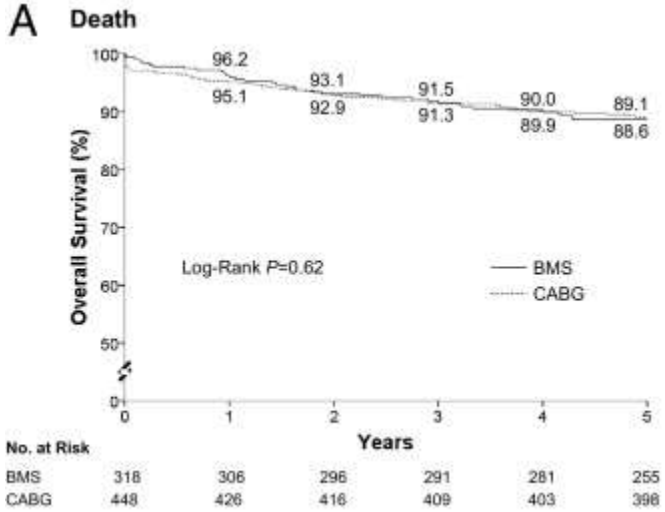
SES Left Main Registry

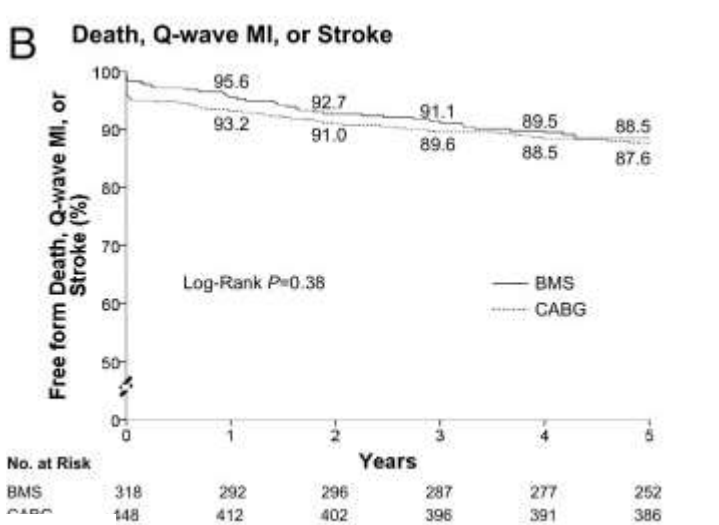
N=294

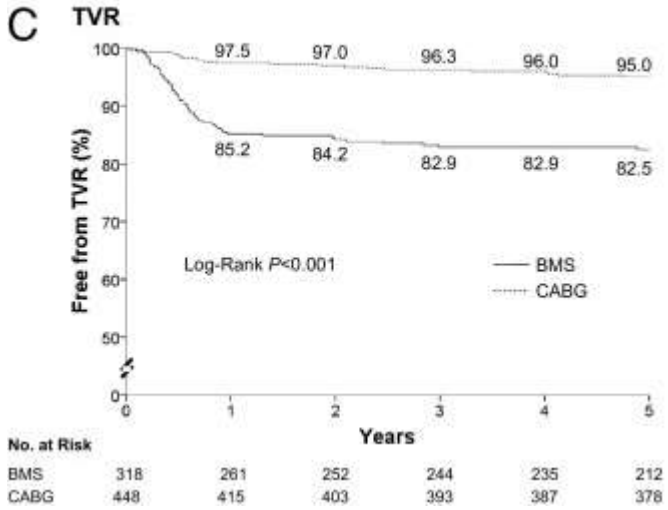


Fajadet, J.Cardiovascular Conference at Snowmass, 2006

Long-Term Safety and Efficacy of Stenting Versus Coronary Artery Bypass Grafting for Unprotected Left Main Coronary Artery Disease: 5-Year Results From the MAIN-COMPARE (Revascularization for Unprotected Left Main Coronary Artery Stenosis: Comparison of Percutaneous Coronary Angioplasty Versus Surgical Revascularization) Registry







Park DW et al.
JACC 2010;56:117-124

Current percutaneous coronary intervention and coronary artery bypass grafting practices for three-vessel and left main coronary artery disease. Insights from the SYNTAX run-in phase

Overall results

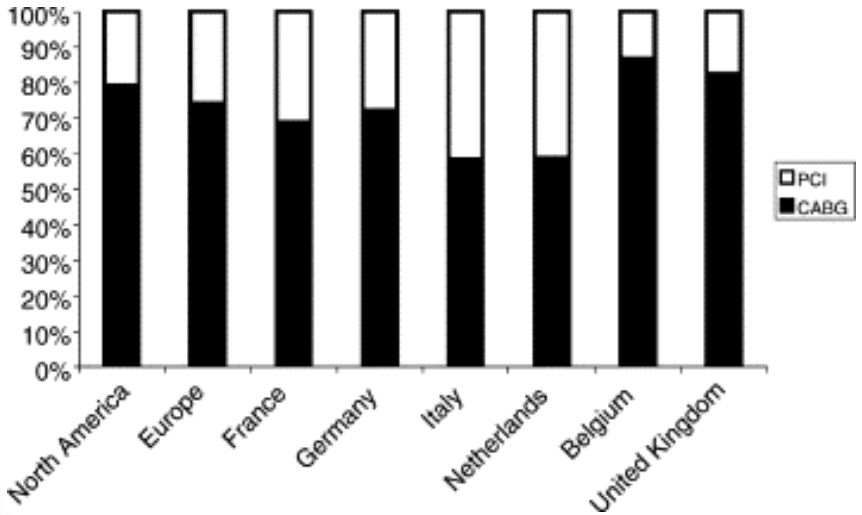
	PCI (*N* = 3177)	CABG (*N* = 8895)	Total (*N* = 12,072)
Number of sites	104	103	
Patients/site	30.5	86.4	
Three-vessel disease	2317 (27%)	6215 (73%)	8532
Three-vessel disease/site	22.3	60.3	
Total left main disease	860 (24%)	2680 (76%)	3540
Left main disease/site	8.3	26.0	

Kappetein AP, et al. Eur Cardio-thorac Surg 2006;29:486-91

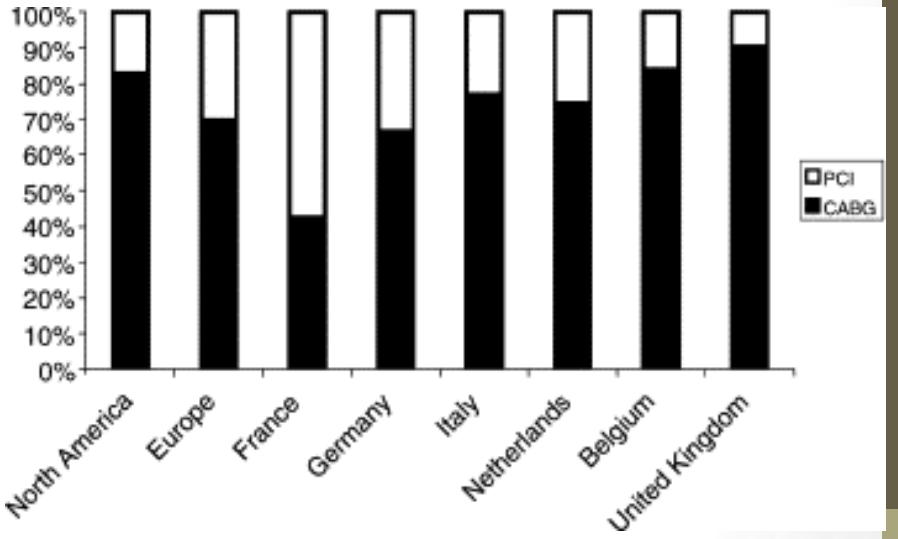
Current percutaneous coronary intervention and coronary artery bypass grafting practices for three-vessel and left main coronary artery disease. Insights from the SYNTAX run-in phase

Procedure by region or country

Three-vessel disease



Left main disease



Kappetein AP, et al. Eur Cardio-thorac Surg 2006;29:486-91

Main results from SYNTAX randomized trial
Mean Follow-up: 1 year

End points	CABG (%)	DES (%)	p
MACCE	12.4	17.8	0.002
Death	3.5	4.4	0.37
Stroke *	2.2	0.6	0.003
MI	3.3	4.8	0.11
Revascularization	5.9	13.5	<0.001
Graft occlusion or Stent thrombosis	3.4	3.3	0.89

* **"Stoke rate were analyzed on an ITT basis and almost half of the strokes in the CABG arm actually occurred prior to surgery" (F. Mohr).**

Serruys PW et al. NEJM 2009;360(10):961-72

Three Year Sintax Results

Cumulative event rates to three years

Cumulative event rate	CABG (%)	Taxus (%)	p
MACCE *	20.2	28.0	<0.001
Death, stroke, MI	12.0	14.1	0.21
All-cause death	6.7	8.6	0.13
Stroke **	3.4	2.0	0.07
MI ***	3.6	7.1	0.002
Repeat revascularization	10.7	19.7	<0.001

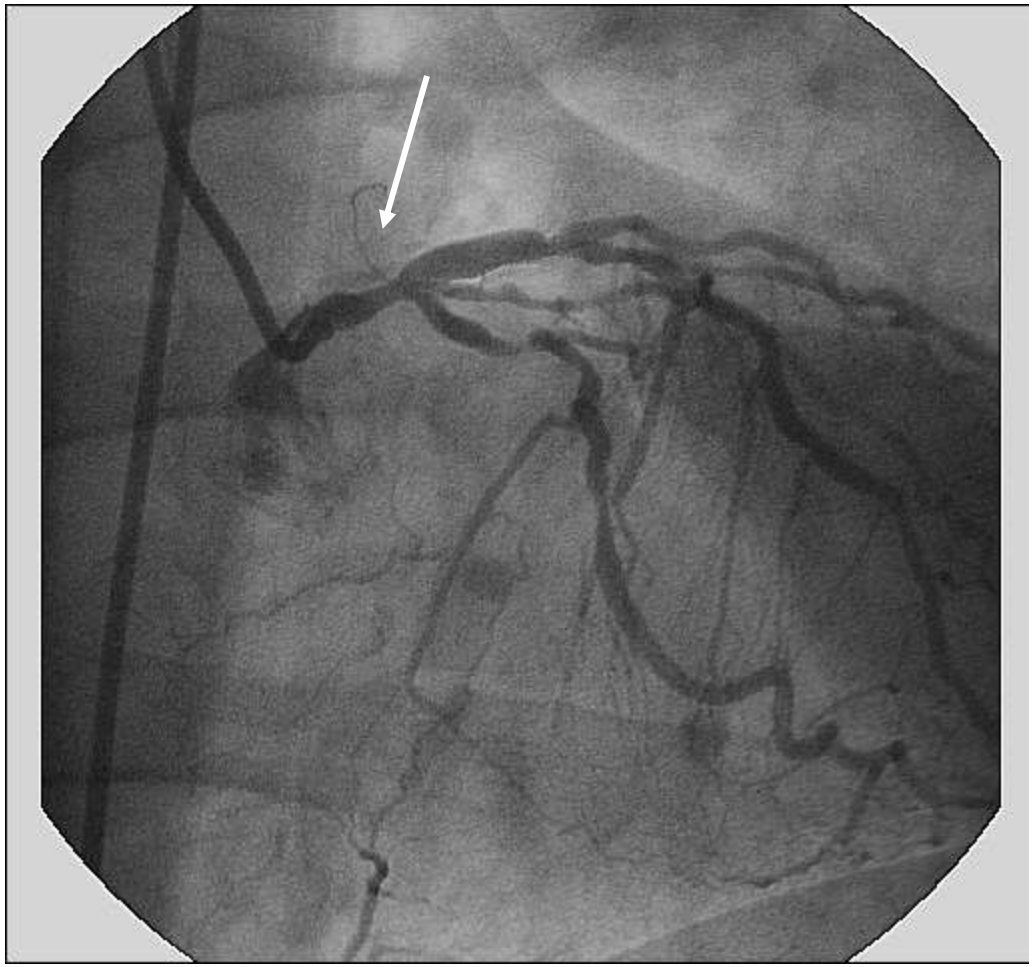
* In intermediate-risk patients (23-32), the three-year MACCE results show that the event curves have continued to separate, reaching 27.4% for DES-treated patients and 18.9% for the CABG-treated patients, a difference that now reaches statistical significance (p=0.02).

** Stroke rate between one and two years 0.6% vs 0.7% and between two and three years 0.5% vs 0.6%

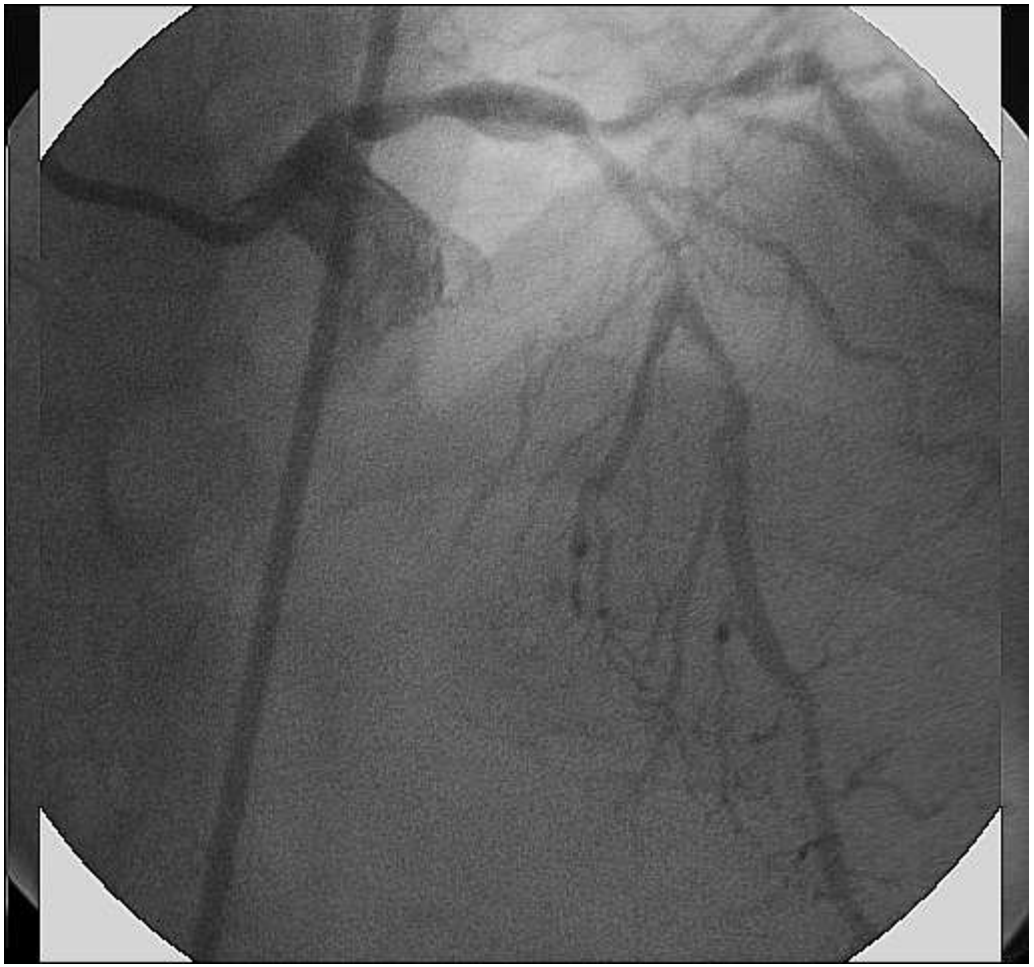
*** Stent thrombosis (4.5%) vs. Symptomatic graft occlusion (3.5%), p=ns

Kappetein AP et al. EHJ 2011;32:2125-34

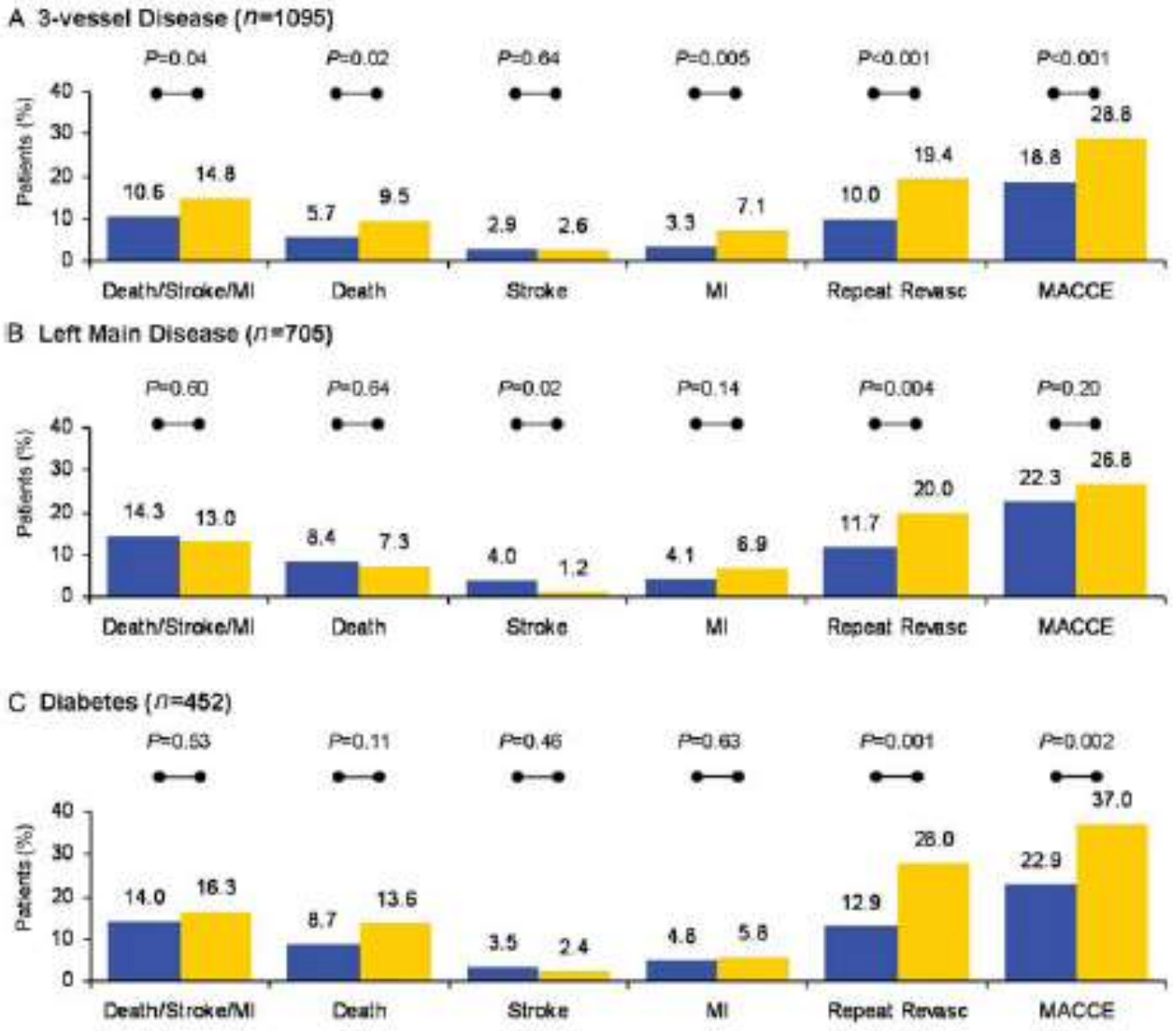
1/3 distal TCE + multiarterial



1/3 médio do TCE



SYNTAX trial - 3-year follow-up



Kappetein AP et al. EHJ 2011;32:2125-34

Eighteen-year follow-up in the Veterans Affairs Cooperative Study of Coronary Artery Bypass Surgery for stable angina. The VA Coronary Artery Bypass Surgery Cooperative Study Group.

TABLE 5. Cumulative Survival Rates by the Censored Method

	7 Years		11 Years		15 Years		18 Years	
Group	M	S	M	S	M	S	M	S
All patients	0.70	0.78	0.57	0.58	0.45	0.40	0.26	0.29
Left main	0.59	0.87	0.41	0.59	0.21	0.39	0.21	0.26
Non–left main	0.73	0.77	0.59	0.58	0.47	0.41	0.26	0.30

M, medical; S, surgical; ang., angiographic.

VA study group. Circulation 1992;86(1):121-30

Effect of CABG on survival: overview of 10-year results from randomised trials by the CABG Trialists Collaboration.

For patients with Left Main Artery Disease
(Veterans Administration and European studies)

Mortality reduction with CABG:

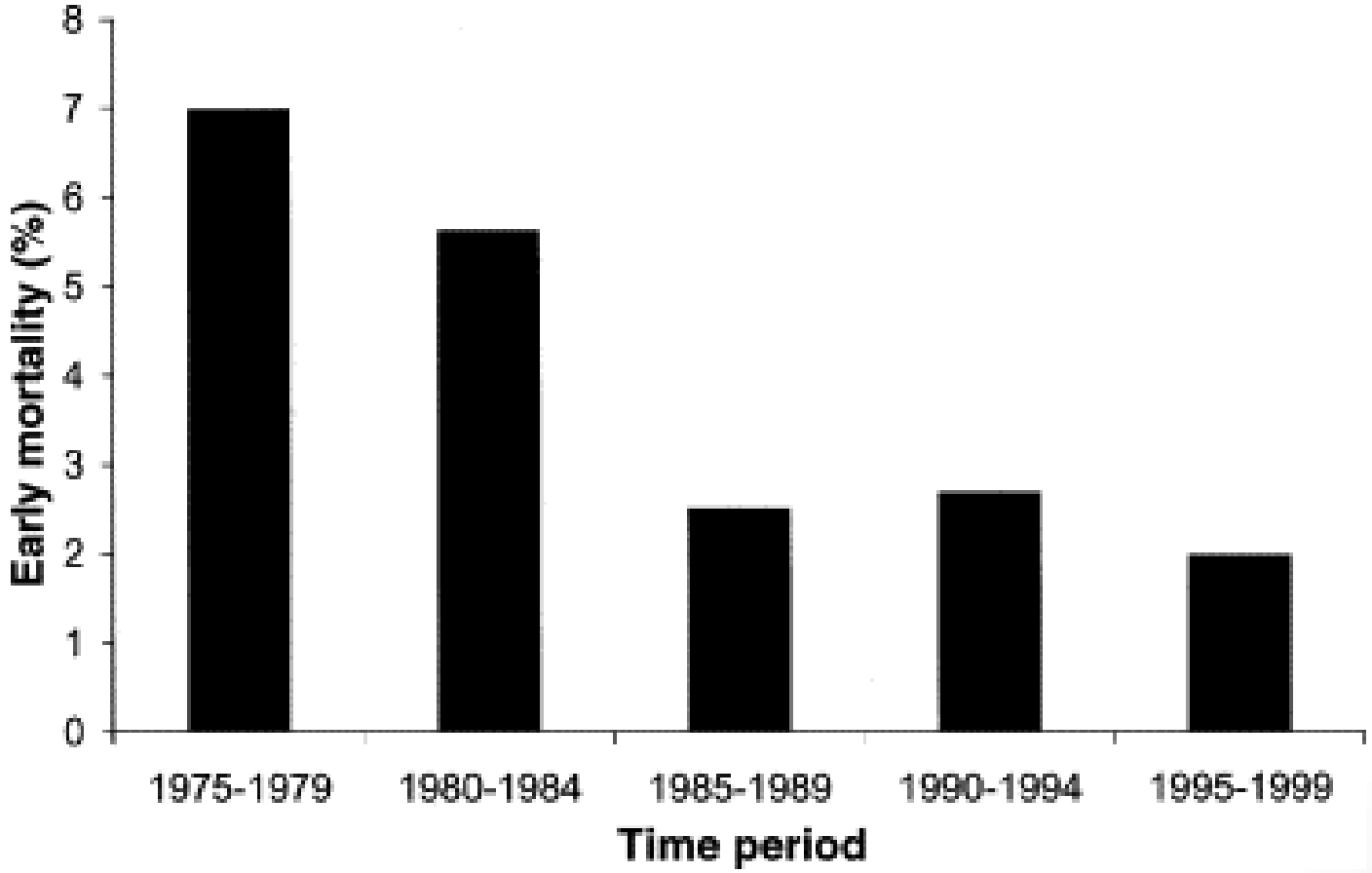
At 5 years 68% (95% CI 30-85), p = 0.004

At 10 years 33% (30% increase to 65% reduction), p = 0.24

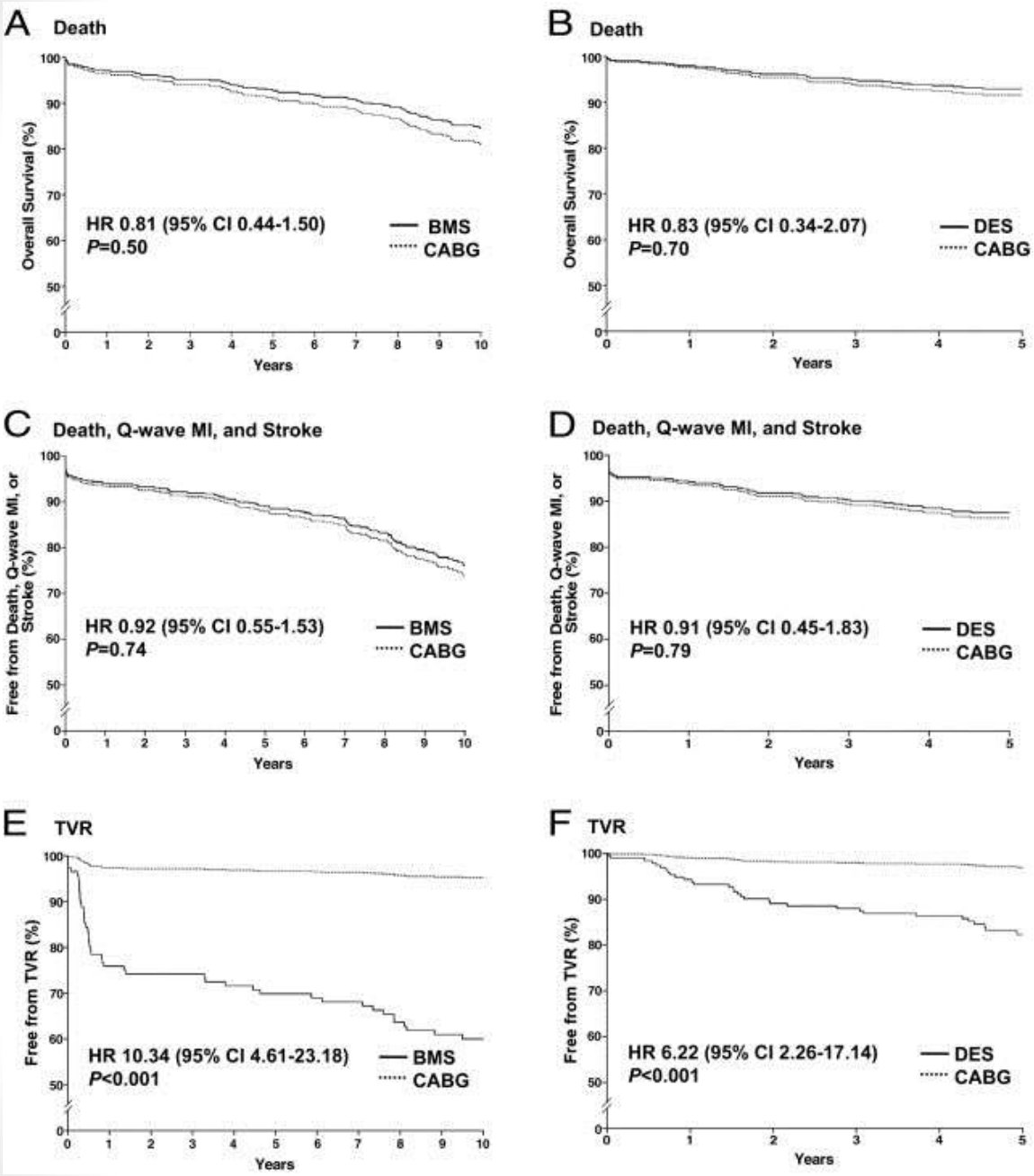
*** Mortality was also significantly lower with CABG among patients with three-vessel disease at 5 years (42%; p =0.001) and 10 years (24%; p = 0.02.)**

Yusuf, S et al. Lancet 1994;344(2):563-70

Left main coronary artery stenosis no longer a risk factor for early and late death after CABG — an experience covering three decades



Jönsson, A et al. Eur J Cardio-Thorac Surg 2006;30(2):311-17



Long-term outcomes after stenting versus coronary artery bypass grafting for unprotected left main coronary artery disease: 10-year results of bare-metal stents and 5-year results of drug-eluting stents from the ASAN-MAIN (ASAN Medical Center-Left MAIN Revascularization) Registry.

Park DW et al.
JACC 2010;56:1366-75

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease : A Meta-Analysis of Randomized Clinical Data

Table 1 Studies Included in the Meta-Analysis

Study/First Author (Ref. #)	Year	Design	N	PCI, n	DES, %	CABG, n	LIMA to LAD, %	Primary Outcome
LEMANS (4)	2008	RCT	105	52	35	53	81	Cardiac death, MI, CVA, repeat revascularization, and/or acute/subacute in-stent thrombosis
SYNTAX Left Main (5)	2009	Pre-specified subanalysis from RCT	705	357	100	348	97	All-cause death, CVA, MI, and repeat revascularization
Boudriot et al. (8)	2010	RCT	201	100	100	101	99	All-cause death, MI, and repeat revascularization
PRECOMBAT (9)	2011	RCT	600	300	100	300	94	All-cause death, CVA, MI, and repeat revascularization

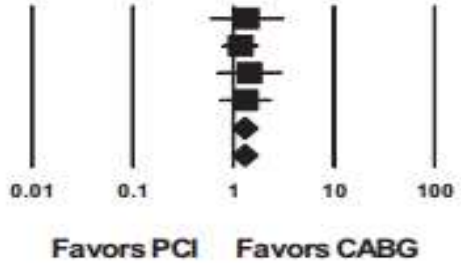
Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease : A Meta-Analysis of Randomized Clinical Data

Major Adverse Cardiac and Cerebrovascular Events

Model	Study name	Odds ratio	Lower limit	Upper limit	p-Value	Events / Total PCI	Events / Total CABG
	LEMANS	1.368	0.579	3.229	0.475	16 / 52	13 / 53
	SYNTAX left main	1.181	0.774	1.801	0.440	56 / 355	46 / 336
	Boudriot et al.	1.458	0.686	3.098	0.327	19 / 100	14 / 101
	PRECOMBAT	1.328	0.725	2.436	0.359	26 / 300	20 / 300
Fixed	Pooled estimate	1.276	0.950	1.715	0.106		
Random	Pooled estimate	1.276	0.950	1.715	0.106		

I^2 = 0%



Death, Myocardial Infarction or Stroke

Model	Study name	Odds ratio	Lower limit	Upper limit	p-Value	Events / Total PCI	Events / Total CABG
	SYNTAX left main	0.745	0.430	1.291	0.294	25 / 355	31 / 336
	PRECOMBAT	0.828	0.352	1.946	0.664	10 / 300	12 / 300
Fixed	Pooled estimate	0.769	0.484	1.220	0.264		
Random	Pooled estimate	0.769	0.484	1.220	0.264		

I^2 = 0%

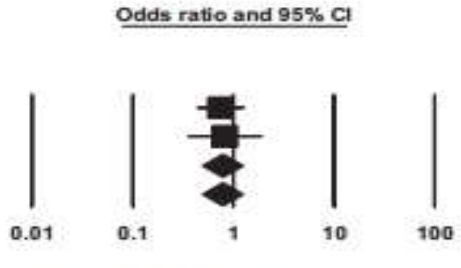


Figure 2 Effect of PCI on MACCE and the Composite of Death, MI, or Stroke

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease : A Meta-Analysis of Randomized Clinical Data

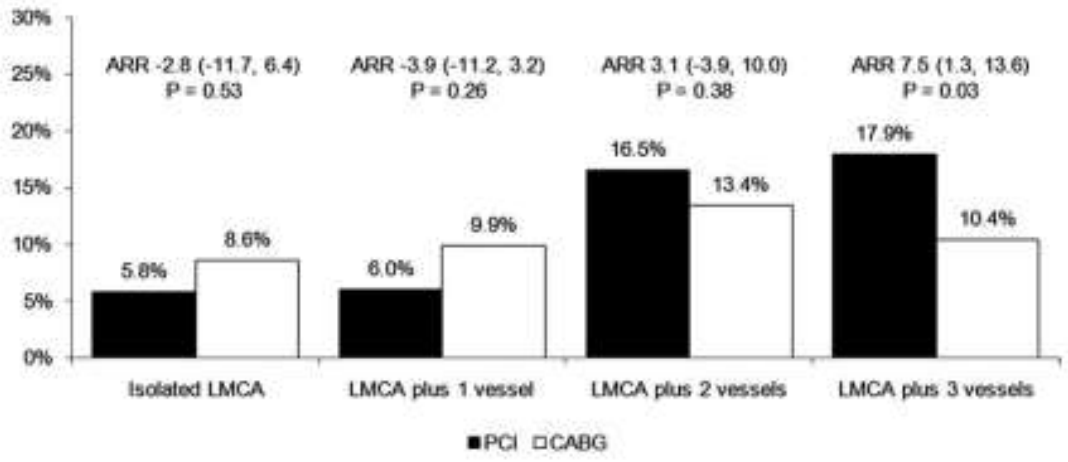


Figure 5 Differences in 1-Year MACCE Between PCI and CABG in the Pooled Analysis of the SYNTAX Left Main and PRECOMBAT Studies After Stratification by Burden of Coronary Artery Disease

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease : A Meta-Analysis of Randomized Clinical Data

Conclusions

From the available RCT data, no significant differences were present between PCI and CABG in patients with LMCA disease for the occurrence of 1-year MACCE and the component endpoints of death or MI. However, PCI was associated with higher rates of TVR but with fewer CVAs compared with CABG. Based on the present study, revision of the guidelines regarding left main PCI (1,2) is warranted, raising the level of evidence of current recommendations from B to A.

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

European Heart Journal

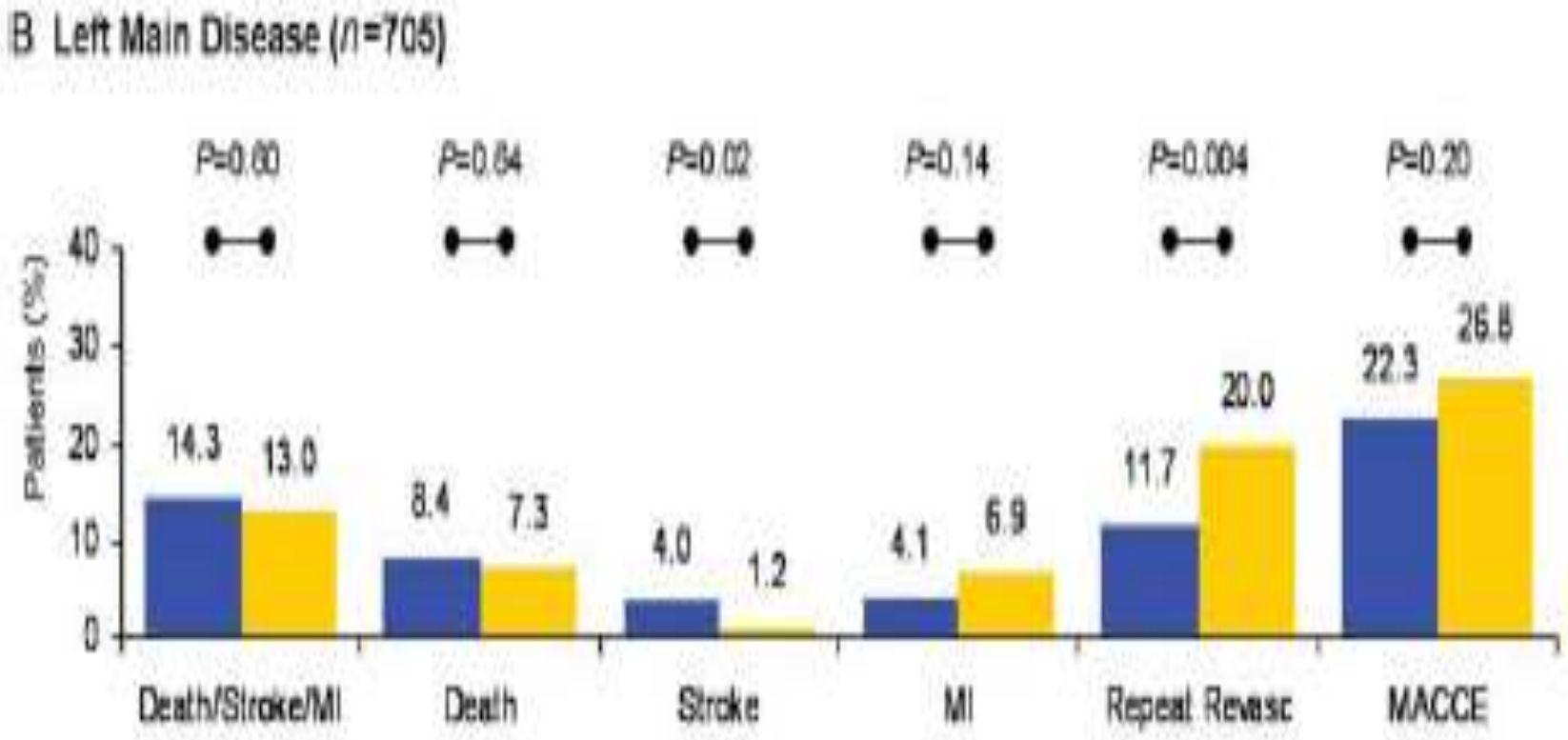
Comparison of coronary bypass surgery with drug-eluting stenting for the treatment of left main and/or three-vessel disease: 3-year follow-up of the SYNTAX trial

"***At 3 years, MACCE was significantly higher in PCI-*** compared with CABG-treated patients. In patients with less complex disease ***(low SYNTAX scores for 3VD or low/intermediate terciles for LM patients), PCI is an acceptable*** revascularization, although longer follow-up is needed to evaluate these two revascularization strategies."

Kappetein AP et al. EHJ 2011;32:2125-34

SYNTAX trial
3-year follow-up

Left Main Disease (n=705)



Kappetein AP et al. EHJ 2011;32:2125-34

Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three-vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial

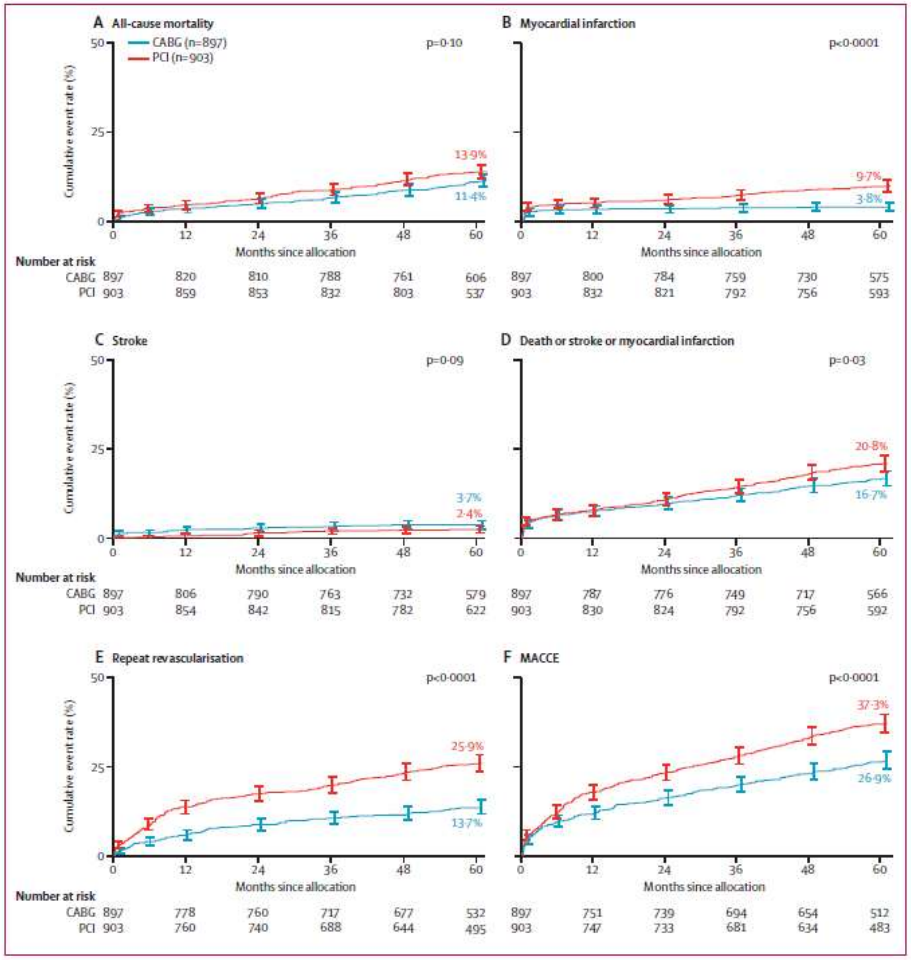


Figure 2: Kaplan-Meier cumulative event curves at 5 years' follow-up

Mohr FW et al. Lancet 2013; 381: 629–38

Coronary artery bypass graft surgery versus percutaneous coronary intervention in patients with three-vessel disease and left main coronary disease: 5-year follow-up of the randomised, clinical SYNTAX trial

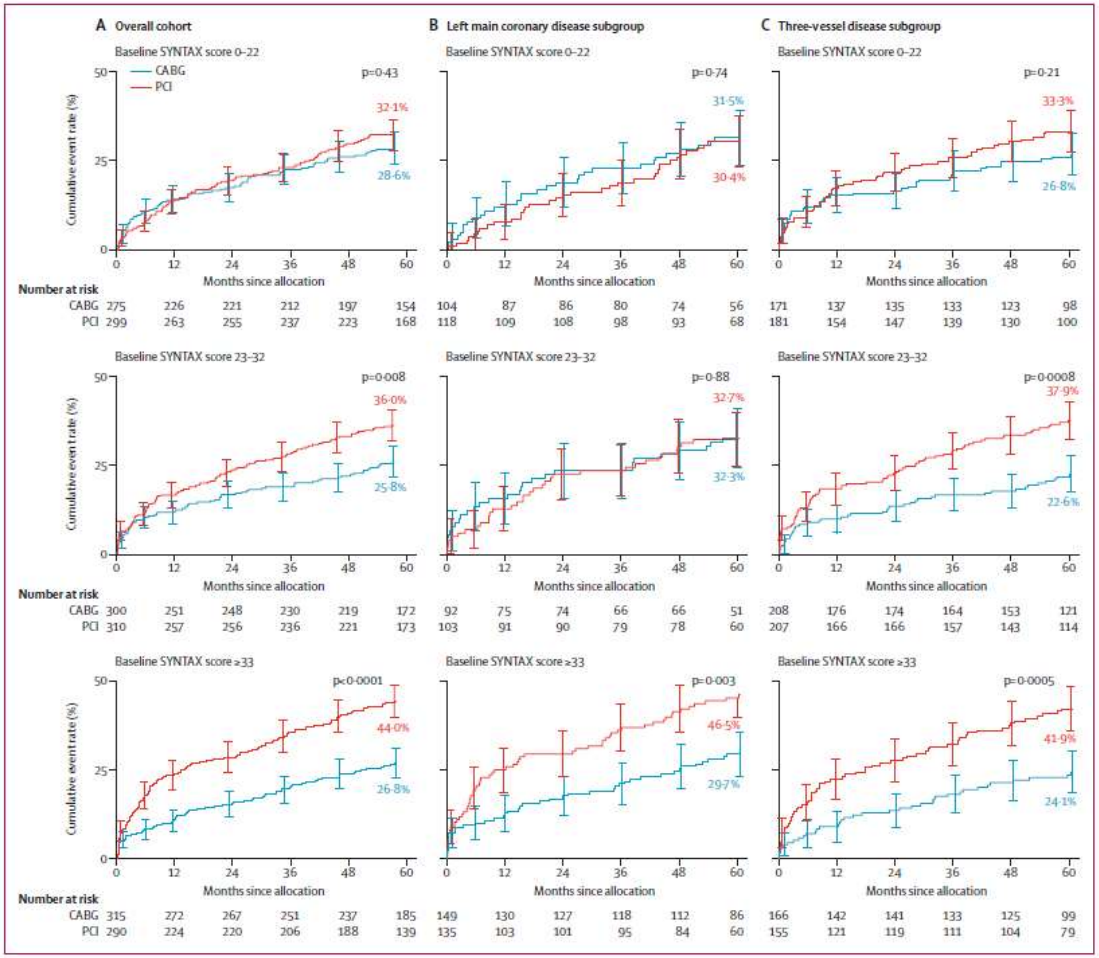


Figure 3: Kaplan-Meier cumulative event curves for MACCE by baseline SYNTAX score tercile

Mohr FW et al. Lancet 2013; 381: 629–38

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

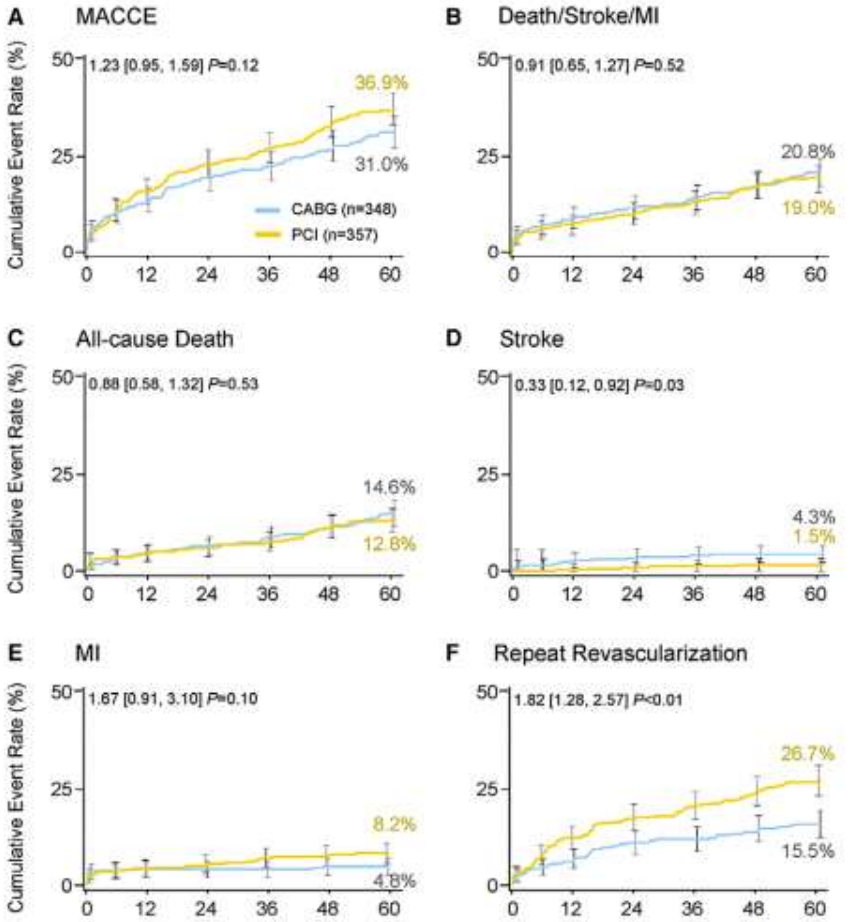


Figure 2. Five-year incidence of cardiac events in left main coronary artery (LM) patients. Hazard ratio and 95% confidence intervals are from the Cox partial likelihood method. Event rates are Kaplan-Meier estimates with a log-rank *P* value.

Morice MC et al. Circulation 2014;129:2388-2394

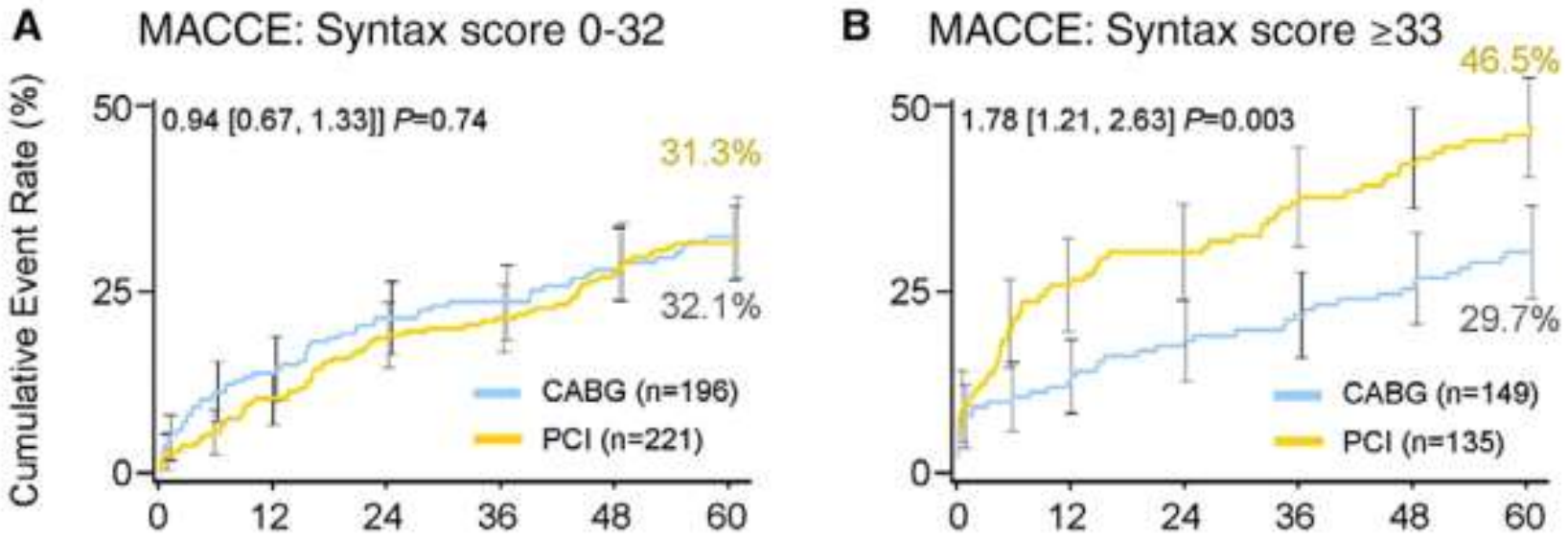
Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

Table 1. Components of MACCE and Stent Thrombosis Incidence Rates at 5 Years in Left Main Patients

Event	PCI (n=357)	CABG (n=348)	Hazard Ratio PCI vs CABG (95 CI)	*P* Value
MACCE	36.9 (130)	31.0 (103)	1.23 (0.95-1.59)	0.12
All death/stroke/MI	19.0 (67)	20.8 (69)	0.91 (0.65-1.27)	0.57
All death	12.8 (45)	14.6 (48)	0.88 (0.58-1.32)	0.53
Cardiac death	8.6 (30)	7.2 (23)	1.23 (0.71-2.11)	0.46
Stroke	1.5 (5)	4.3 (14)	0.33 (0.12-0.92)	0.03
MI	8.2 (28)	4.8 (16)	1.67 (0.91-3.10)	0.10
Revascularization	26.7 (90)	15.5 (49)	1.82 (1.28-2.57)	<0.001
PCI	21.6 (73)	13.8 (43)	1.67 (1.15-2.43)	0.007
CABG	7.9 (26)	1.7 (6)	4.16 (1.71-10.10)	<0.001
Stent thrombosis/graft occlusion	5.1 (17)	4.4 (14)	1.15 (0.57-2.33)	0.70

Morice MC et al. Circulation 2014;129:2388-2394

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial



Morice MC et al. Circulation 2014;129:2388-2394

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

Table 2. Components of MACCE Rates at 5 Years in Left Main Patients Stratified by SYNTAX Score Tertile

Variable	PCI	CABG	Hazard Ratio PCI vs CABG (95% CI)	*P* Value
SYNTAX score 0–32	n=221	n=196		
MACCE	31.3 (68)	32.1 (60)	0.94 (0.67-1.33)	0.74
All death/stroke/MI	14.8 (32)	19.8 (37)	0.71 (0.44-1.14)	0.16
All death	7.9 (17)	15.1 (28)	0.50 (0.27-0.91)	0.02
Cardiac death	4.2 (9)	8.3 (15)	0.50 (0.22-1.14)	0.09
Stroke	1.4 (3)	3.9 (7)	0.35 (0.09-1.35)	0.11
MI	6.1 (13)	3.8 (7)	1.58 (0.63-3.95)	0.33
Revascularization	22.6 (48)	18.6 (33)	1.23 (0.79-1.91)	0.36
PCI	19.3 (41)	17.1 (30)	1.15 (0.72-1.83)	0.57
CABG	6.2 (13)	1.5 (3)	3.68 (1.05-12.91)	0.03
SYNTAX score ≥33	N=135	N=149		
MACCE	46.5 (62)	29.7 (43)	1.78 (1.21-2.63)	0.003
All death/stroke/MI	26.1 (35)	22.1 (32)	1.23 (0.76-1.98)	0.40
All death	20.9 (28)	14.1 (20)	1.59 (0.90-2.83)	0.11
Cardiac death	15.8 (21)	5.9 (8)	2.98 (1.32-6.73)	0.006
Stroke	1.6 (2)	4.9 (7)	0.32 (0.07-1.54)	0.13
MI	11.7 (15)	6.1 (9)	1.88 (0.82-4.30)	0.13
Revascularization	34.1 (42)	11.6 (16)	3.30 (1.86-5.88)	<0.001
PCI	25.6 (32)	9.5 (13)	3.07 (1.61-5.85)	<0.001
CABG	11.2 (13)	2.0 (3)	5.01 (1.43-17.57)	0.005

Morice MC et al. Circulation 2014;129:2388-2394

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

Conclusions

The SYNTAX trial is currently the largest randomized, controlled trial comparing PCI with CABG in complex coronary disease with a prespecified and powered LM subgroup. CABG has been the gold standard for revascularization of the LM vessel; however, this hypothesis-generating subanalysis of the SYNTAX trial suggests that PCI can provide equivalent longterm (to 5 years) death/stroke or MI to CABG, in particular in the subset of LM subjects with SYNTAX scores <33.

Morice MC et al. Circulation 2014;129:2388-2394

Conclusions

- **Cirurgia de Revascularização continua “gold standard ” para lesão de TCE e multiarteral.**
- **Trabalhos mais recentes passaram a considerar a angioplastia para casos de menor ou intermediária complexidade anatômica ou risco cirúrgico alto.**
- **Discussões com Heart Team são recomendadas.**
- **Trabalhos controlados e randomizados devem ter resultados divulgados em poucos meses.**

Guideline for Stable Coronary Artery Disease

Arq Bras Cardiol 2014; 103(2Suppl.2): 1-59

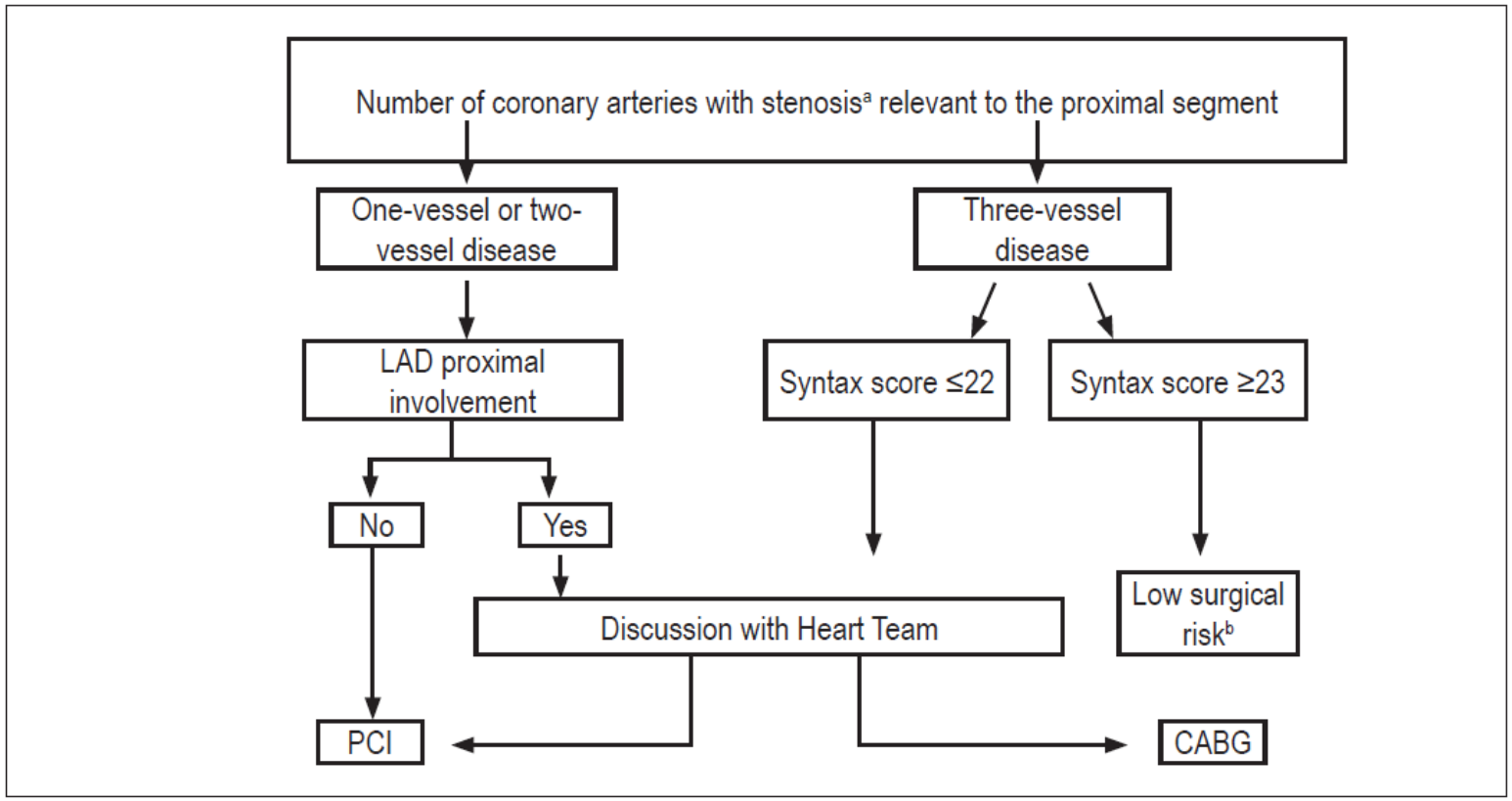


Figure 3 – *PCI or CABG in stable coronary atherosclerosis without involvement of LMD. a ≥ 50% stenosis and evidence of ischemia, lesion > 90%, by two physicians or fractional flow reserve of 0.80; b CABG is the preferred option in most patients, unless they present comorbidities or particularities that merit discussion with the Heart Team. According to local practice (time constraints and workload, for example), direct transfer to CABG may be permitted for low-risk patients, when formal discussion in a multidisciplinary team is not required.*

Percutaneous Coronary Intervention Versus Coronary Artery Bypass Graft Surgery in Left Main Coronary Artery Disease

A Meta-Analysis of Randomized Clinical Data

Davide Capodanno, MD,* Gregg W. Stone, MD,† Marie C. Morice, MD,‡ Theodore A. Bass, MD,§ Corrado Tamburino, MD, PhD*

Catania, Italy; New York, New York; Massy, France; and Jacksonville, Florida

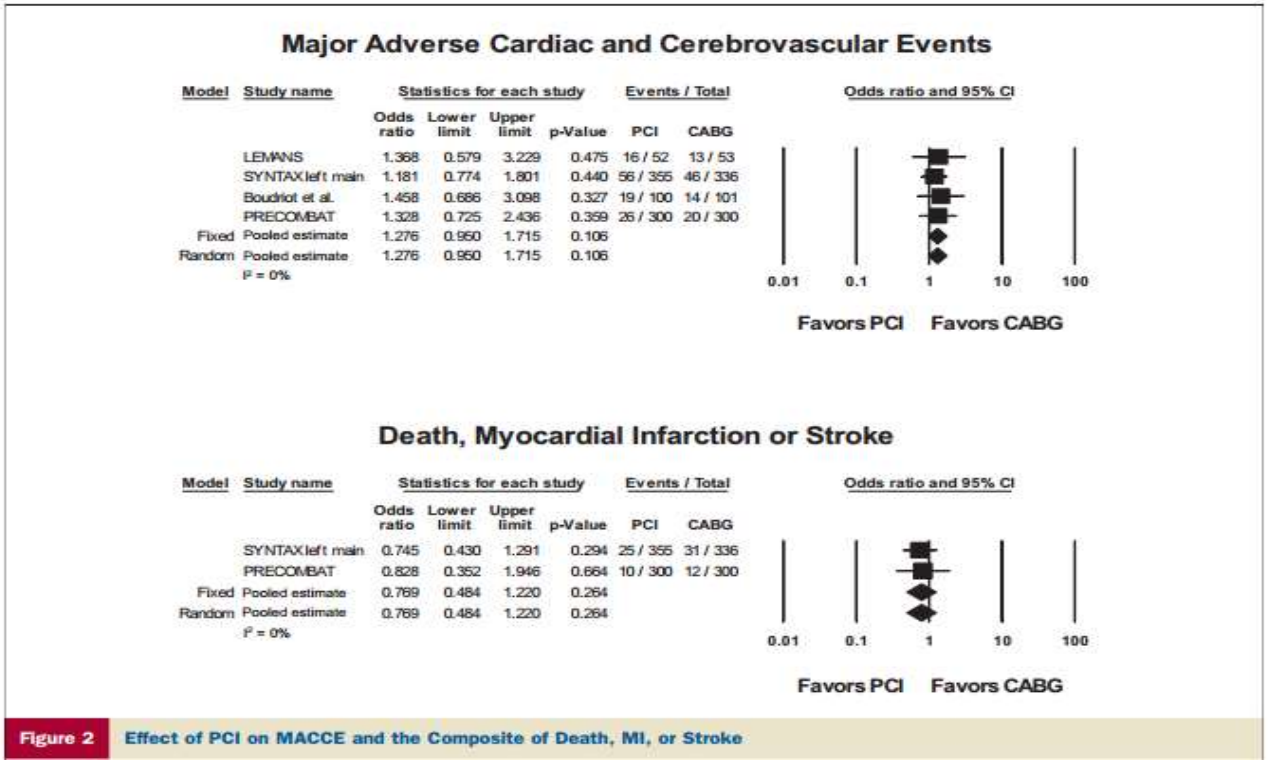


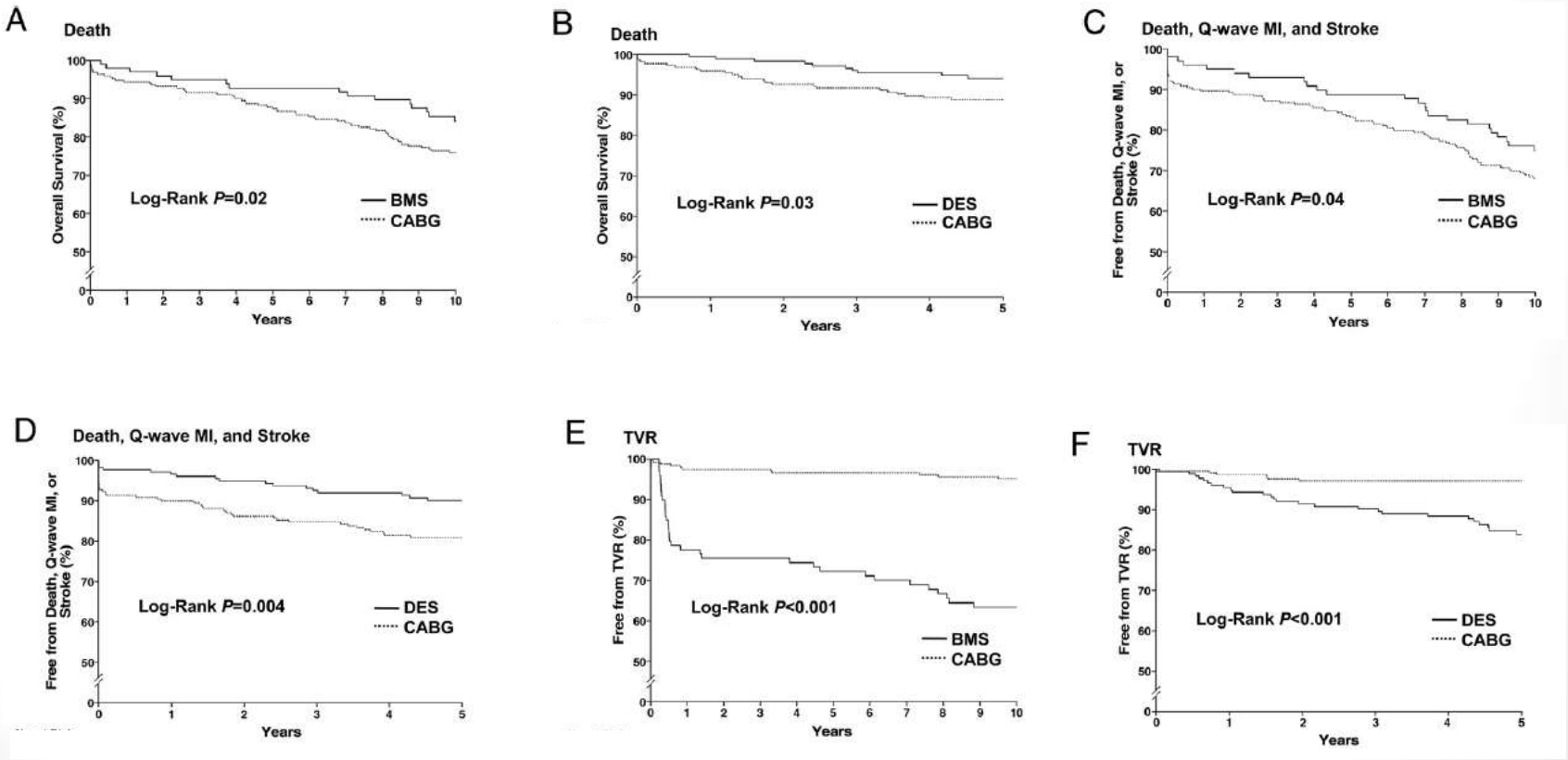
Figure 2 Effect of PCI on MACCE and the Composite of Death, MI, or Stroke

Capodanno D et al. J Am Coll Cardiol 2011;58:1426–32

Long-Term Outcomes After Stenting Versus Coronary Artery Bypass Grafting for Unprotected Left Main Coronary Artery Disease

10-Year Results of Bare-Metal Stents and 5-Year Results of Drug-Eluting Stents From the ASAN–MAIN (ASAN Medical Center–Left MAIN Revascularization) Registry

Duk-Woo Park, MD,* Young-Hak Kim, MD,* Sung-Cheol Yun, PHD,‡ Jong-Young Lee, MD,* Won-Jang Kim, MD,* Soo-Jin Kang, MD,* Seung-Whan Lee, MD,* Cheol-Whan Lee, MD,* Jae-Joong Kim, MD,* Suk-Jung Choo, MD,† Cheol-Hyun Chung, MD,† Jae-Won Lee, MD,† Seong-Wook Park, MD,* Seung-Jung Park, MD*



Park DW et al.
JACC 2010;56:1366-75

SYNTAX randomized trial - 12 months

	MACCE	
CAD (n)	CABG (%)	DES (%)
Left Main (612)	13.7	16.8
- LM only (61)	8.5	7.1
- LM + 1VD (95)	13.2	7.8
- L M + 2VD (212)	14.4	19.8
- L M + 3VD (246)	15.4	19.3
3 VD (1188)	11.5	19.2

Serruys PW et al. NEJM 2009;360(10):961-72

Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the Synergy Between Percutaneous Coronary Intervention With Taxus and Cardiac Surgery Trial

Marie-Claude Morice, MD; Patrick W. Serruys, MD, PhD; A. Pieter Kappetein, MD, PhD; Ted E. Feldman, MD; Elisabeth Ståhle, MD; Antonio Colombo, MD; Michael J. Mack, MD; David R. Holmes, MD; James W. Choi, MD; Witold Ruzyllo, MD; Grzegorz Religa, MD; Jian Huang, MD, MS; Kristine Roy, PhD; Keith D. Dawkins, MD; Friedrich Mohr, MD, PhD

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Morice MC et al. Circulation 2014;129:2388-2394

2011 ACCF/AHA guideline

Revascularization to Improve Survival vs Medical Therapy

3-vessel disease with or without proximal LAD artery disease*		
CABG	I	B
	IIa—It is reasonable to choose CABG over PCI in patients with complex 3-vessel CAD (eg, SYNTAX >22) who are good candidates for CABG	B
PCI	IIb—Of uncertain benefit	B
2-vessel disease with proximal LAD artery disease*		
CABG	I	B
PCI	IIb—Of uncertain benefit	B
2-vessel disease without proximal LAD artery disease*		
CABG	IIa—With extensive ischemia	B
	IIb—Of uncertain benefit without extensive ischemia	C
PCI	IIb—Of uncertain benefit	B
1-vessel proximal LAD artery disease		
CABG	IIa—With LIMA for long-term benefit	B
PCI	IIb—of uncertain benefit	B
1-vessel disease without proximal LAD artery involvement		
CABG	III: Harm	B
PCI	III: Harm	B
LV dysfunction		
CABG	IIa—EF 35% to 50%	B
CABG	IIb—EF <35% without significant left main CAD	B
PCI	Insufficient data	

J Thorac Cardiovasc Surg. 2012;143(1):4-34

2014 ESC/EACTS Guidelines on myocardial revascularization

Recommendation for the type of revascularization (CABG or PCI) in patients with SCAD with suitable coronary anatomy for both procedures and low predicted surgical mortality

Recommendations according to extent of CAD	CABG		PCI		
	Class[a]	Level[b]	Class[a]	Level[b]	Ref[c]
One or two-vessel disease without proximal LAD stenosis.	IIb	C	I	C	
One-vessel disease with proximal LAD stenosis.	I	A	I	A	107,108,160, 161,178,179
Two-vessel disease with proximal LAD stenosis.	I	B	I	C	108,135,137
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B	17,134,170
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B	17
Left main disease with a SYNTAX score >32.	I	B	III	B	17
Three-vessel disease with a SYNTAX score ≤ 22.	I	A	I	B	17,157,175,176
Three-vessel disease with a SYNTAX score 23–32.	I	A	III	B	17,157,175,176
Three-vessel disease with a SYNTAX score >32.	I	A	III	B	17,157,175,176

European Journal of Cardio-Thoracic Surgery (2014) 1–102

SYNTAX Study: TAXUS Drug-Eluting Stent Versus Coronary Artery Bypass Surgery for the Treatment of Narrowed Arteries

This study is currently recruiting patients.
Verified by Boston Scientific Corporation February 2007

SYNTAX is a novel, randomized trial with nested registries comparing PCI with paclitaxel-eluting TAXUS stents to CABG for 3VD and LM patients to evaluate the best treatment for these patients with complex coronary disease.

Study chairs or principal investigators

Patrick W. Serruys, MD, PhD, Principal Investigator, Erasmus University Medical Center Rotterdam

Friedrich W Mohr, MD, Principal Investigator, University of Leipzig

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 MARCH 5, 2009 VOL. 360 NO. 10

Percutaneous Coronary Intervention versus Coronary-Artery Bypass Grafting for Severe Coronary Artery Disease

Patrick W. Serruys, M.D., Ph.D., Marie-Claude Morice, M.D., A. Pieter Kappetein, M.D., Ph.D., Antonio Colombo, M.D., David R. Holmes, M.D., Michael J. Mack, M.D., Elisabeth Ståhle, M.D., Ted E. Feldman, M.D., Marcel van den Brand, M.D., Eric J. Bass, B.A., Nic Van Dyck, R.N., Katrin Leadley, M.D., Keith D. Dawkins, M.D., and Friedrich W. Mohr, M.D., Ph.D., for the SYNTAX Investigators*

	MACCE	
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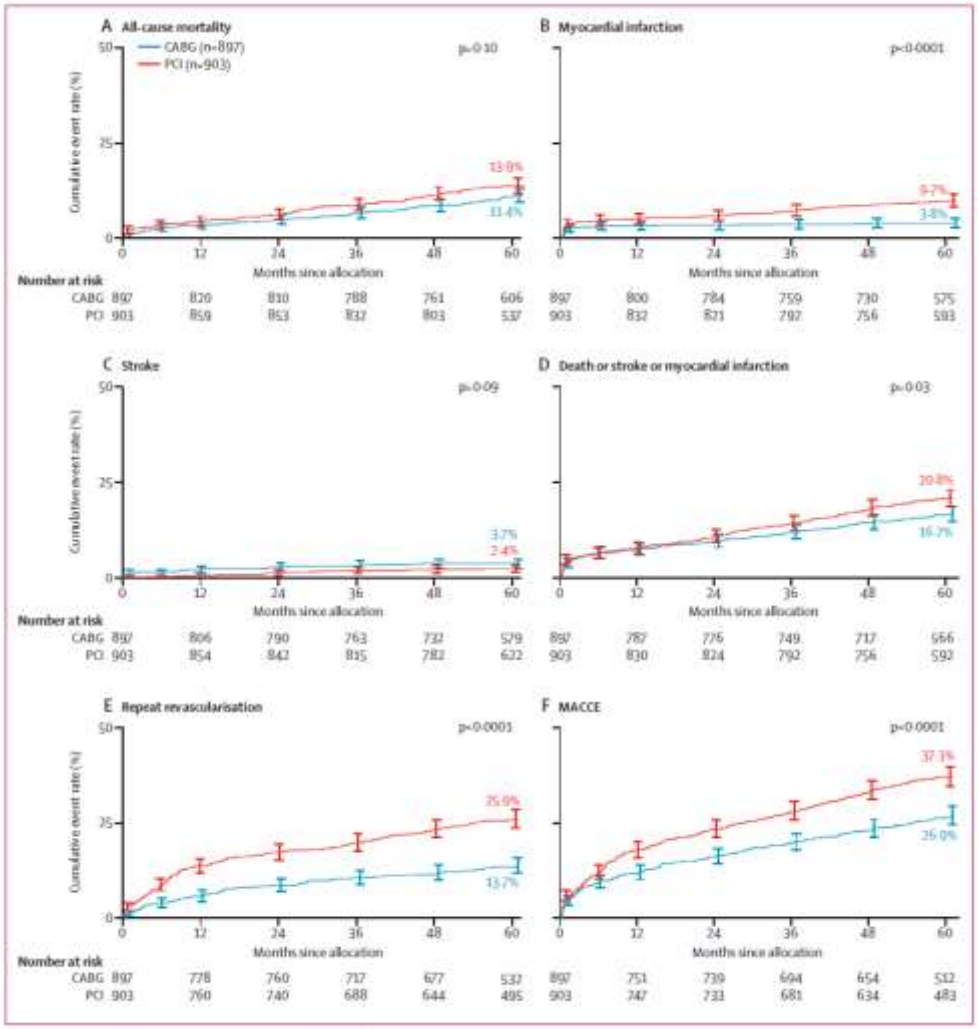

Figure 2: Kaplan-Meier cumulative event curves at 5 years' follow-up

Mohr FW et al.
Lancet 2013; 381: 629–38

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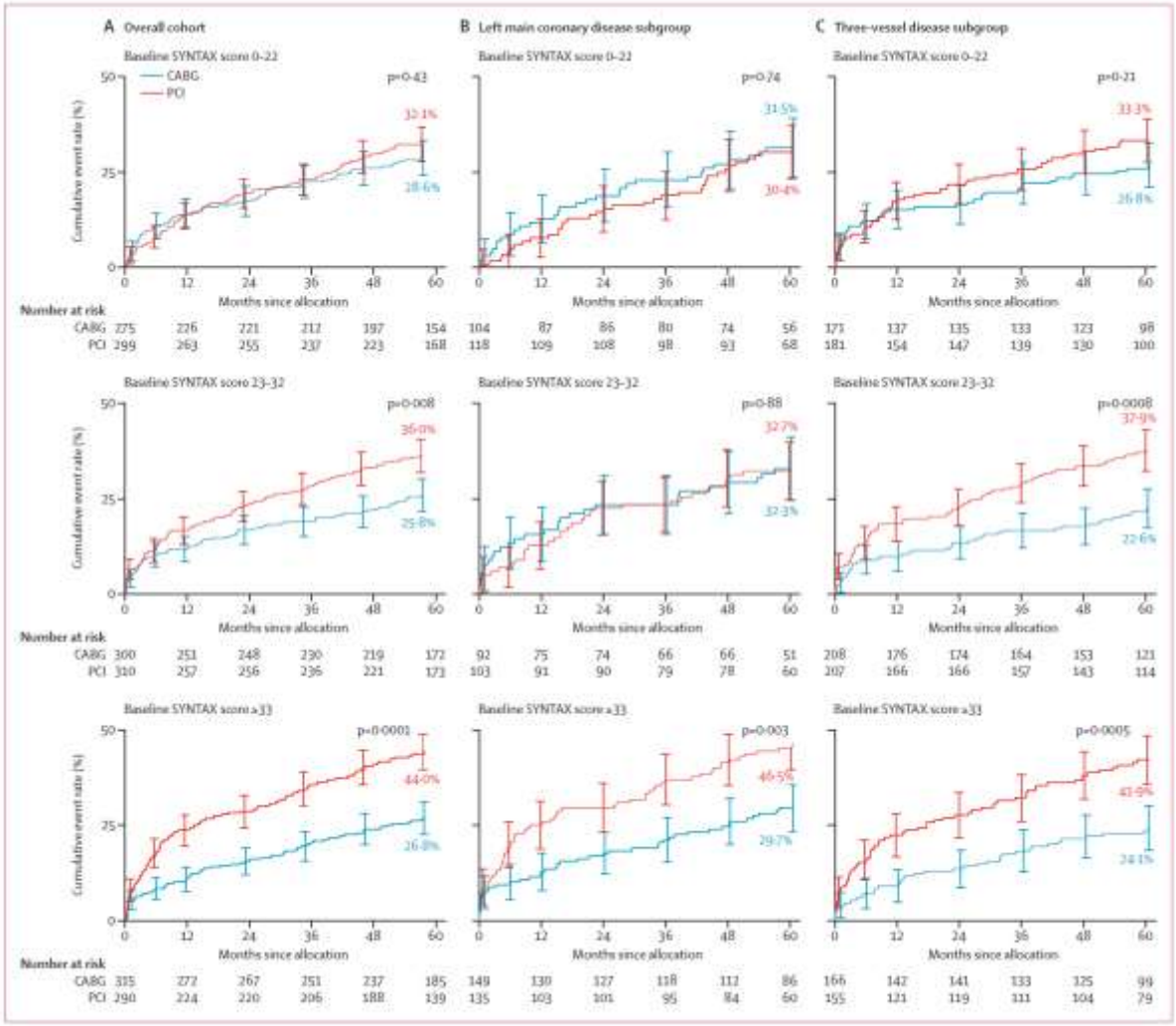

Figure 3: Kaplan-Meier cumulative event curves for MACCE by baseline SYNTAX score tercile

Mohr FW et al.
Lancet 2013; 381: 629–38

2011 ACCF/AHA guideline

Revascularization to Improve Survival vs Medical Therapy

Anatomic Setting	COR	LOE
UPLM or complex CAD		
CABG and PCI	I—Heart Team approach recommended	C
CABG and PCI	IIa—Calculation of the STS and SYNTAX scores	B
UPLM*		
CABG	I	B
PCI	IIa—For SIHD when *both* of the following are present: • Anatomic conditions associated with a low risk of PCI procedural complications and a high likelihood of good long-term outcome (eg, a low SYNTAX score of ≤22, ostial or trunk left main CAD) • Clinical characteristics that predict a significantly increased risk of adverse surgical outcomes (eg, 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: • Anatomic conditions associated with a low to intermediate risk of PCI procedural complications and intermediate to high likelihood of good long-term outcome (eg, low–intermediate SYNTAX score of <33, bifurcation left main CAD) • Clinical characteristics that predict an increased risk of adverse surgical outcomes (eg, 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 and for PCI and who are good candidates for CABG	B
3-vessel disease with or without proximal LAD artery disease*		
CABG	I	B
	IIa—It is reasonable to choose CABG over PCI in patients with complex 3-vessel CAD (eg, SYNTAX >22) who are good candidates for CABG	B
PCI	IIb—Of uncertain benefit	B

J Thorac Cardiovasc Surg. 2012;143(1):4-34.