



Joint Meeting in Coronary Revascularization
Busan, South Korea
Dec 12, 15:46 pm: Complex PCI Session

Left Main Interventions

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Interventional Cardiologist | “The Spencer B. King III Cath Lab”
Fmr. Instructor of Medicine | Emory University | Atlanta | GA | US
Fmr. CME/MOC Editor: *JACC CV Interventions*





CBS 2019, Nanjing, China

Left Main

Mean RVD = 5.0 mm
(Range: 3.5-6.5 mm)

Mean Length =
 10.5 ± 5.3 mm

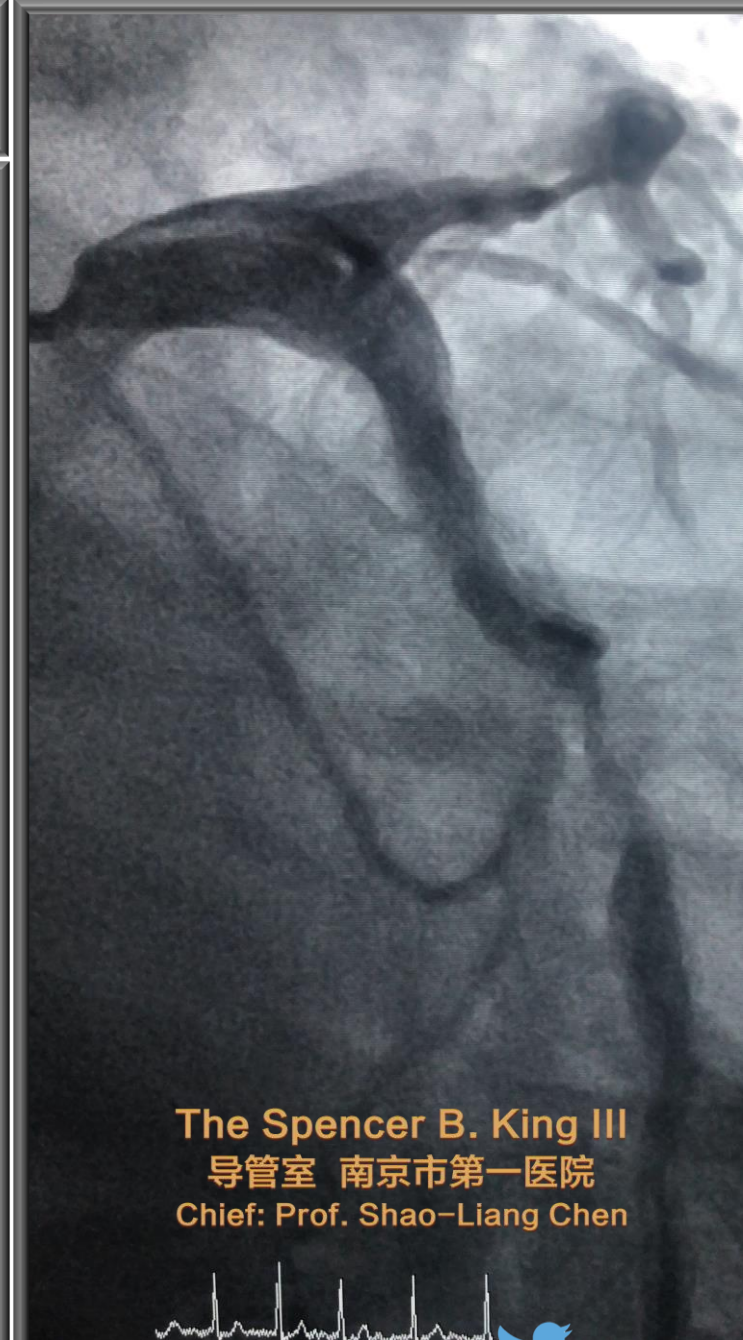
LAD

Bif angle:
70-80°

LCx

Oval and angled
ostium shape

Atherosclerosis w/ longitudinal
diffusion involving the lateral LM
extending into the 2 branches



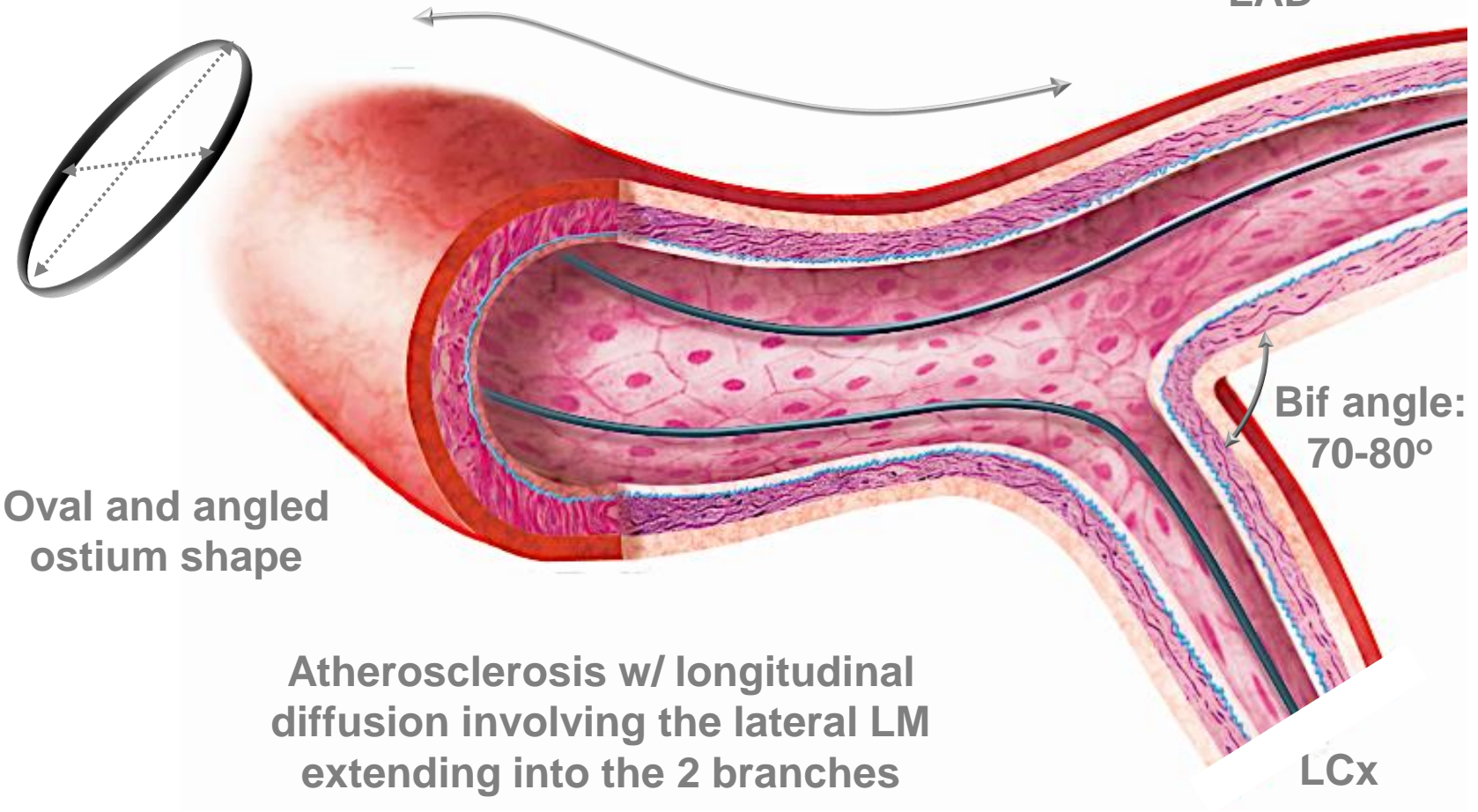
The Spencer B. King III
导管室 南京市第一医院
Chief: Prof. Shao-Liang Chen



Left Main

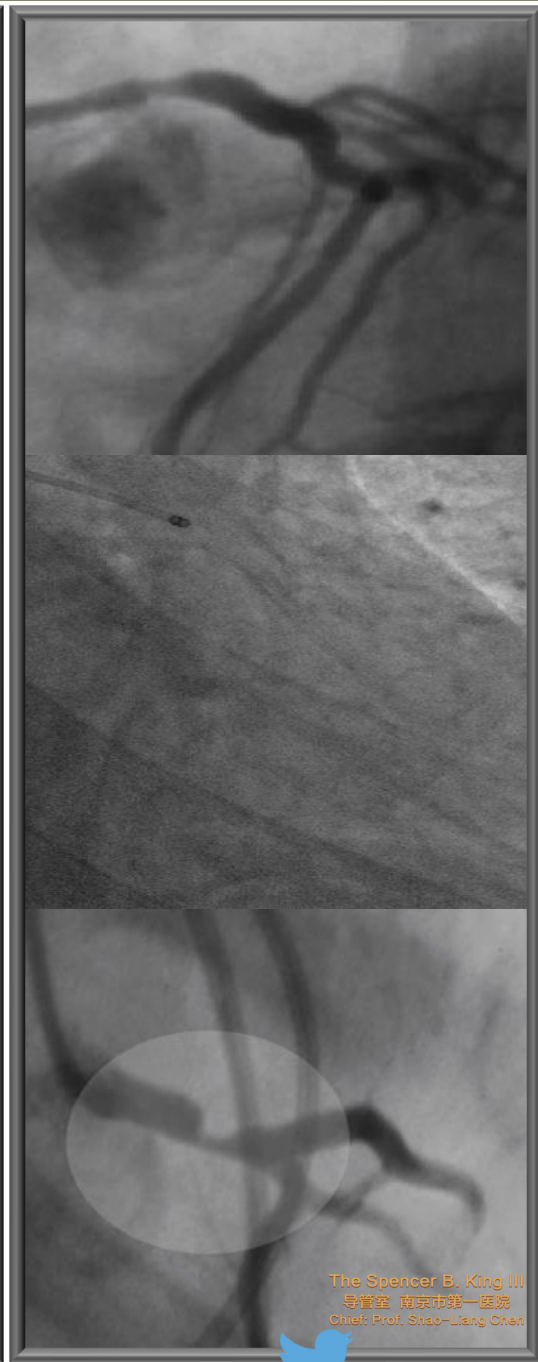
Mean RVD = 5.0 mm
(Range: 3.5-6.5 mm)

Mean Length =
 10.5 ± 5.3 mm



Ostium

Shaft Distal (80%)



Left Main: When to Intervene?

Mean RVD = 5.0 mm
(Range: 3.5-6.5 mm)

Mean Length =
 10.5 ± 5.3 mm

LAD



Ostium



**Angiographic DS > 50 %,
IVUS MLA < 4.5 mm² or FFR < 0.80**

Oval and angled
ostium shape

Atherosclerosis w/ longitudinal
diffusion involving the lateral LM
extending into the 2 branches

LCx

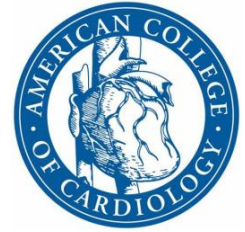


Shaft Disease





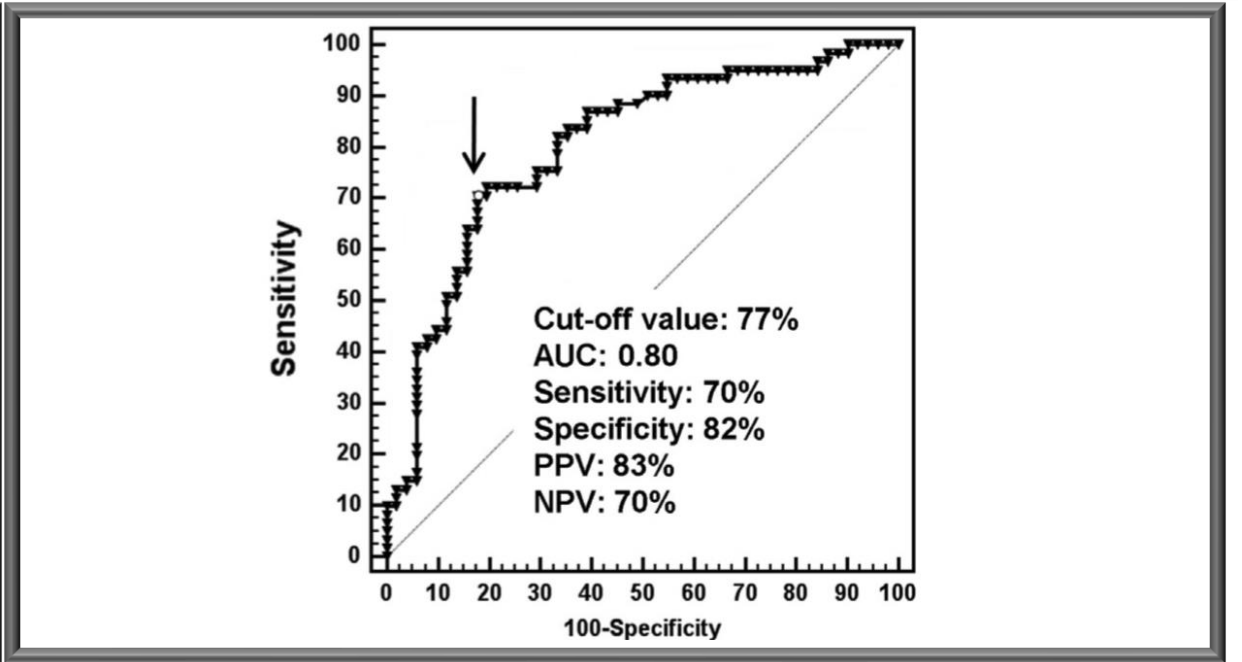
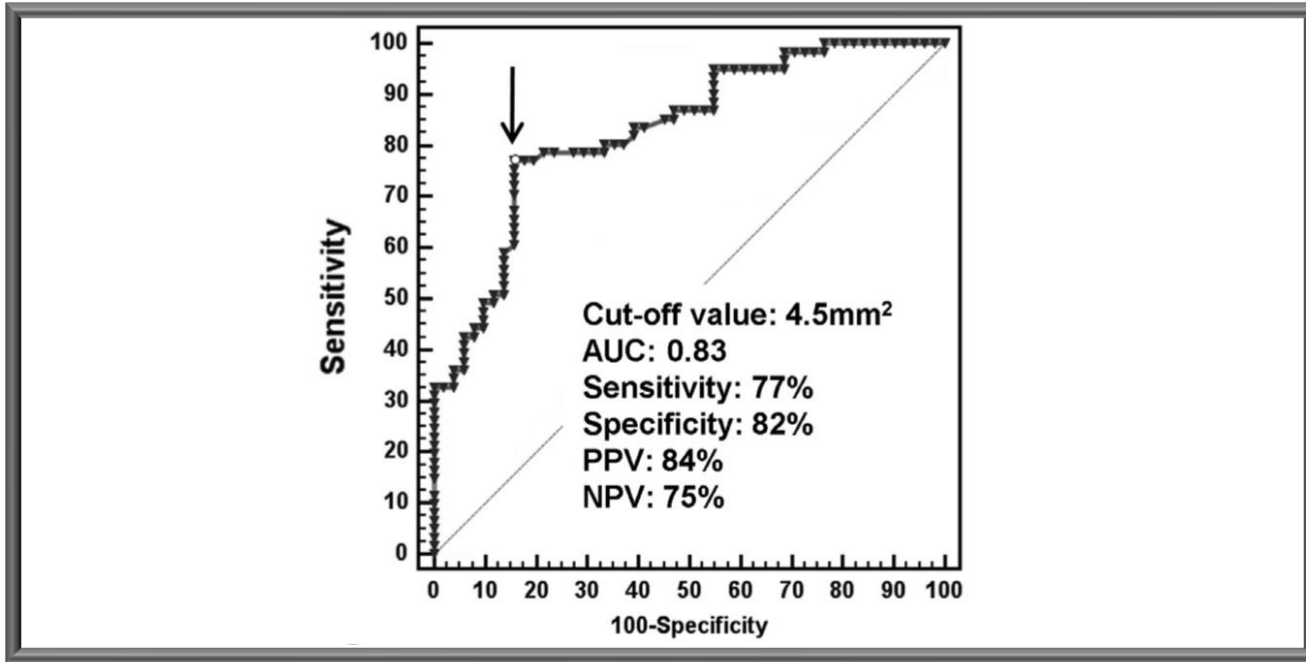
Intravascular Ultrasound-Derived Minimal Lumen Area Criteria for Functionally Significant Left Main Coronary Artery Stenosis



112 pts w/ ostial and shaft intermediate LM underwent IVUS and FFR

MLA = 4.5 mm²

PB = 75%



Park SJ, Ahn JM, Kang SJ et al. J Am Coll Cardiol Intv 2014;7:868–74

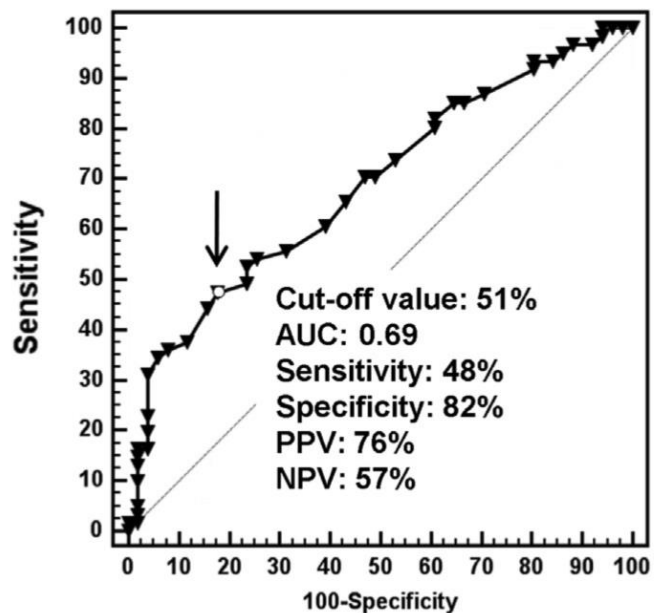


Intravascular Ultrasound-Derived Minimal Lumen Area Criteria for Functionally Significant Left Main Coronary Artery Stenosis

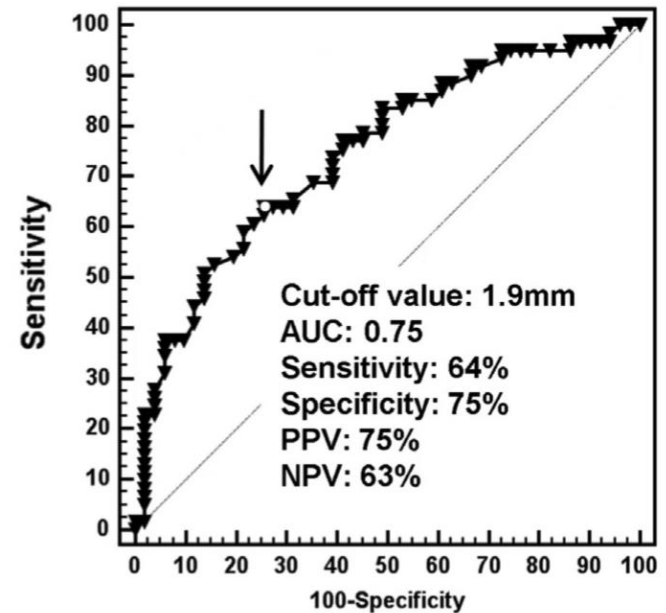


112 pts w/ ostial and shaft intermediate LM underwent IVUS and FFR

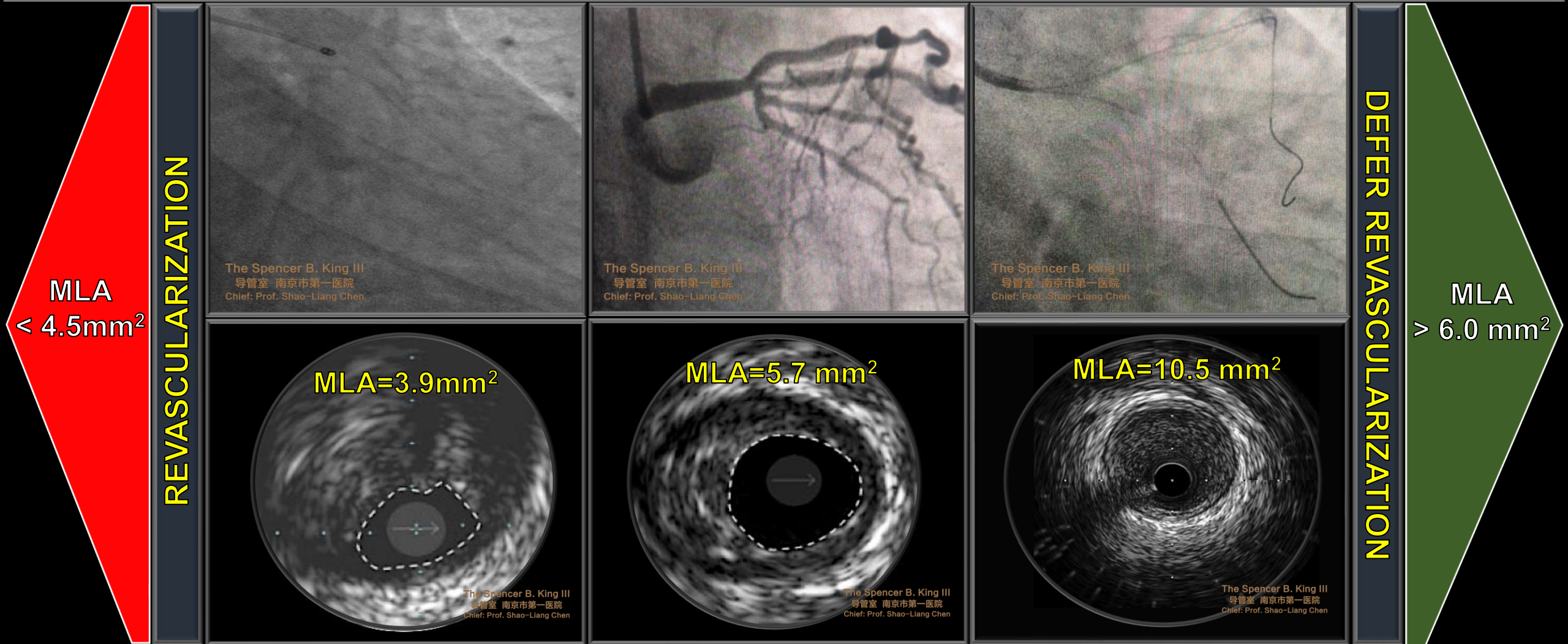
DS = 50%



MLD = 1.9 mm



Clinical use of intracoronary imaging. Part 2: acute coronary syndromes, ambiguous coronary angiography findings, and guiding interventional decision.



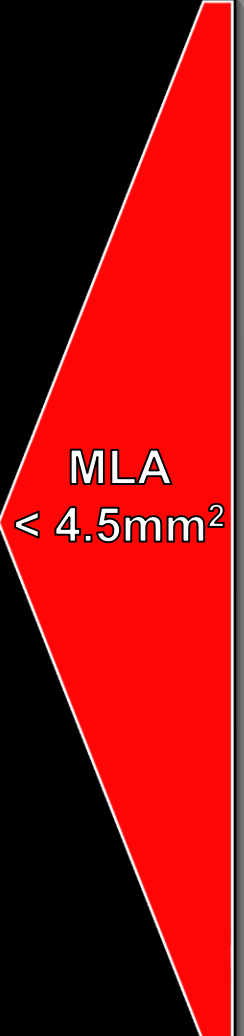
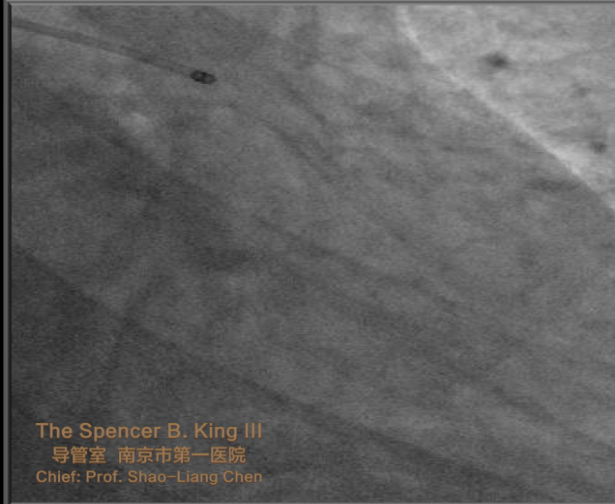
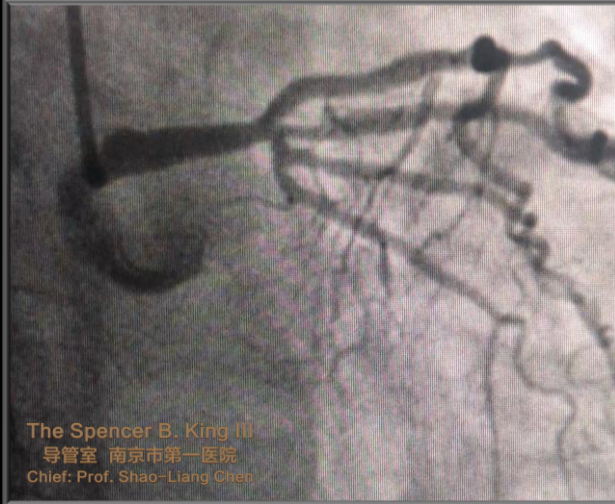
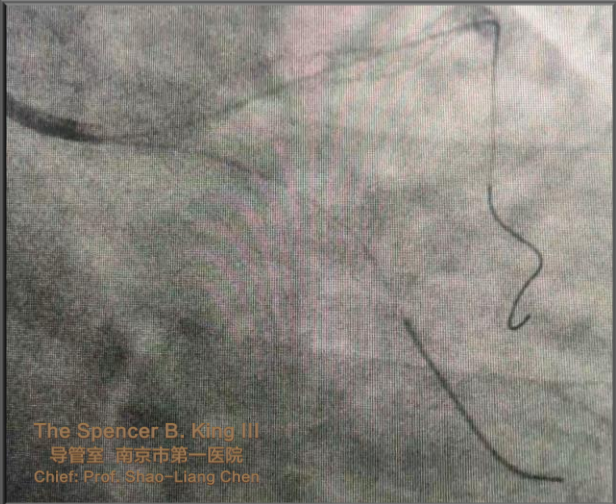
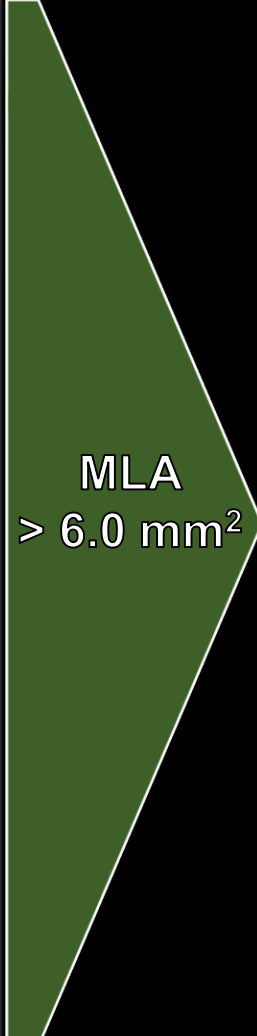
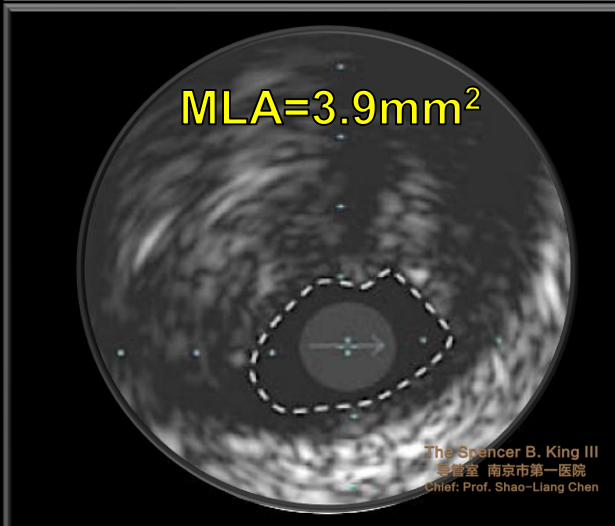
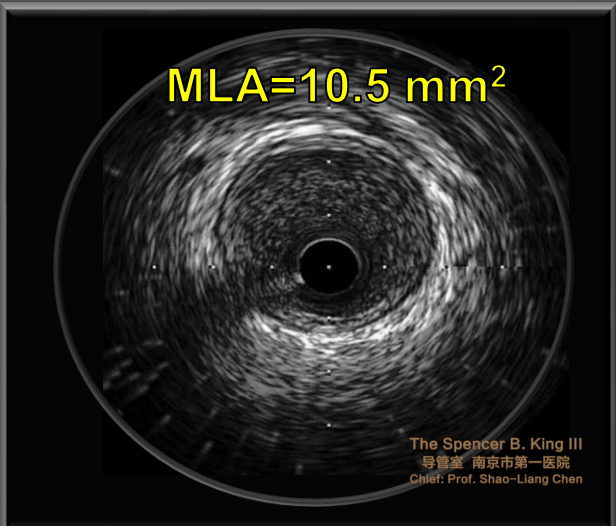
MLA
< 4.5mm²

REVASCULARIZATION

DEFER REVASCULARIZATION

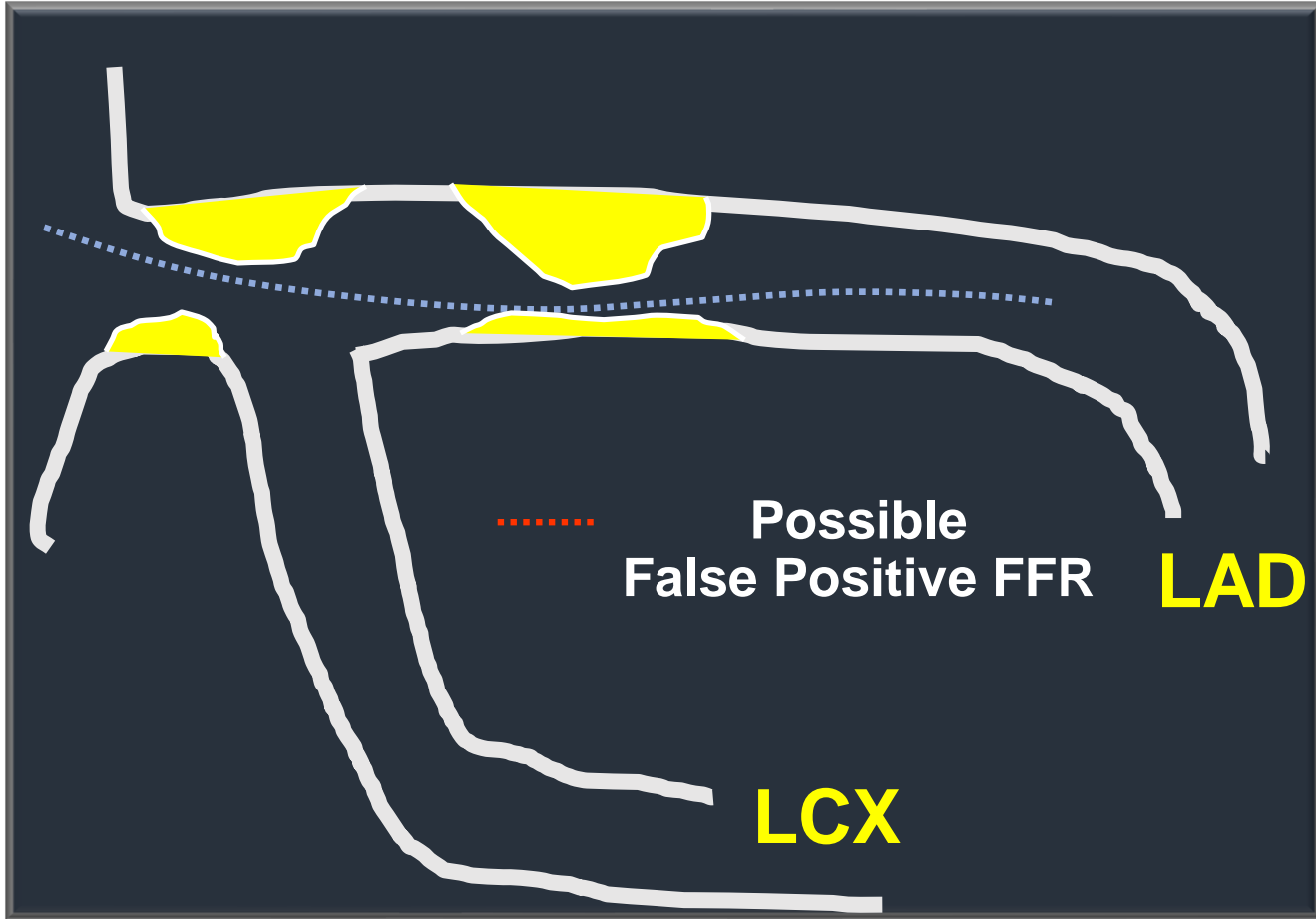
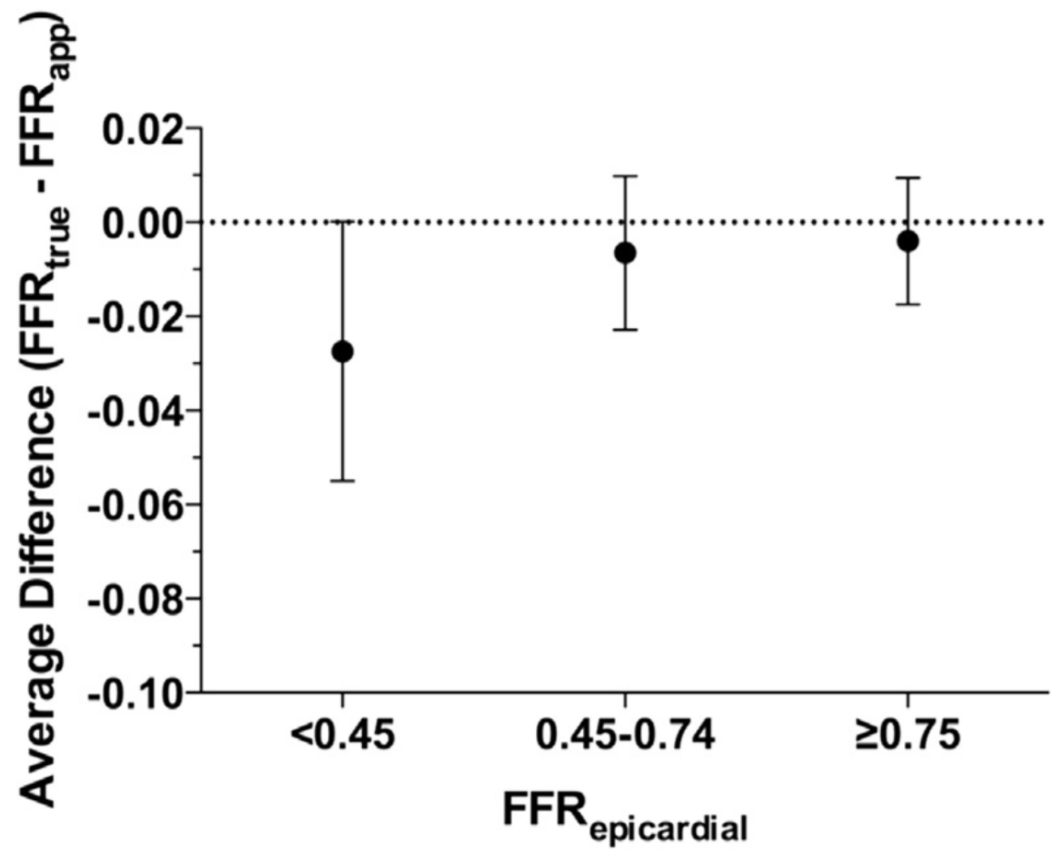
MLA
> 6.0 mm²

Clinical use of intracoronary imaging. Part 2: acute coronary syndromes, ambiguous coronary angiography findings, and guiding interventional decision.

 <p>MLA < 4.5mm²</p>	<p>REVASCULARIZATION</p>	 <p>The Spencer B. King III 导管室 南京市第一医院 Chief: Prof. Shao-Liang Chen</p>	 <p>The Spencer B. King III 导管室 南京市第一医院 Chief: Prof. Shao-Liang Chen</p>	 <p>The Spencer B. King III 导管室 南京市第一医院 Chief: Prof. Shao-Liang Chen</p>	<p>DEFER REVASCULARIZATION</p>  <p>MLA > 6.0 mm²</p>
	 <p>MLA=3.9mm²</p> <p>The Spencer B. King III 导管室 南京市第一医院 Chief: Prof. Shao-Liang Chen</p>	<p>4.5 mm² < MLA < 6.0 mm²</p> <p>Physiologic Assessment Consideration</p>	 <p>MLA=10.5 mm²</p> <p>The Spencer B. King III 导管室 南京市第一医院 Chief: Prof. Shao-Liang Chen</p>		



The Impact of Downstream Coronary Stenosis on Fractional Flow Reserve Assessment of Intermediate Left Main Coronary Artery Disease



Fearon W, Yong A, Lenders G et al. JAmColl Cardiol Intv 2015;8:398-403



Joint Meeting in Coronary Revascularization
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Left Main Interventions

The Evidence



Left Main Interventions: Evidence

SYNTAX 10Y - PW Serruys

The SYnergy between percutaneous coronary intervention w/ TAXus and cardiac surgery 10 year outcomes

PRECOMBAT 1Y, 5Y – SJ Park

Bypass Surgery Versus Angioplasty Using Sirolimus-Eluting Stent in Patients With Left Main Coronary Artery Disease

EXCEL 5Y – GW Stone

Everolimus-Eluting Stents or Bypass Surgery for LM Coronary Artery Disease

NOBLE 5Y – E Christiansen

Bioresorbable polymer DES vs coronary artery CABG in the treatment of UPLM

Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial



David J F M Thuijs, A Pieter Kappetein, Patrick W Serruys, Friedrich-Wilhelm Mohr, Marie-Claude Morice, Michael J Mack, David R Holmes Jr, Nick Curzen, Piraze Davierwala, Thilo Noack, Milan Mlojevic, Keith D Dawkins, Bruno R da Costa, Peter Juni, Stuart J Head, for the SYNTAX Extended Survival Investigators*

Summary Background The Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) trial was a non-inferiority trial that compared percutaneous coronary intervention (PCI) using first-generation paclitaxel-eluting stents with coronary artery bypass grafting (CABG) in patients with de-novo three-vessel and left main coronary artery disease, and reported results up to 5 years. We now report 10-year all-cause death results.

Methods The SYNTAX Extended Survival (SYNTAXES) study is an investigator-driven extension of follow-up of a multicentre, randomised controlled trial done in 85 hospitals across 18 North American and European countries. Patients with de-novo three-vessel and left main coronary artery disease were randomly assigned (1:1) to the PCI group or CABG group. Patients with a history of PCI or CABG, acute myocardial infarction, or an indication for concomitant cardiac surgery were excluded. The primary endpoint of the SYNTAXES study was 10-year all-cause death, which was assessed according to the intention-to-treat principle. Prespecified subgroup analyses were performed according to the presence or absence of left main coronary artery disease and diabetes, and according to coronary complexity defined by core laboratory SYNTAX score tertiles. This study is registered with ClinicalTrials.gov, NCT03417050.

Findings From March, 2005, to April, 2007, 1800 patients were randomly assigned to the PCI (n=903) or CABG (n=897) group. Vital status information at 10 years was complete for 841 (93%) patients in the PCI group and 848 (95%) patients in the CABG group. At 10 years, 244 (27%) patients had died after PCI and 211 (24%) after CABG (hazard ratio 1.17 [95% CI 0.97–1.41], p=0.092). Among patients with three-vessel disease, 151 (28%) of 546 had died after PCI versus 113 (21%) of 549 after CABG (hazard ratio 1.41 [95% CI 1.10–1.80]), and among patients with left main coronary artery disease, 93 (26%) of 357 had died after PCI versus 98 (28%) of 348 after CABG (0.90 [0.68–1.20], p=0.0004–0.019). There was no treatment-by-subgroup interaction with diabetes (p_{interaction}=0.66) and no linear trend across SYNTAX score tertiles (p_{linear}=0.30).

Interpretation At 10 years, no significant difference existed in all-cause death between PCI using first-generation paclitaxel-eluting stents and CABG. However, CABG provided a significant survival benefit in patients with three-vessel disease, but not in patients with left main coronary artery disease.

Funding German Foundation of Heart Research (SYNTAXES study, 5–10-year follow-up) and Boston Scientific Corporation (SYNTAX study, 0–5-year follow-up).

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Introduction Several randomised trials^{1–4} have compared coronary artery bypass grafting (CABG) versus percutaneous coronary intervention (PCI) with simple balloon angioplasty, bare metal stents, or drug-eluting stents for the treatment of multivessel or left main coronary artery disease, but no significant differences in survival were demonstrated. Results from a pooled analysis of individual patient data⁵ from 11 trials and 11 518 patients suggested that all-cause death was significantly lower after CABG versus PCI at 5-year follow-up (9.2% vs 11.2%; hazard ratio [HR] 1.20

[95% CI 1.06–1.37], p=0.0038). However, the mean age of the patient population was 65 years, and thus the overall life expectancy of most patients exceeded this follow-up time. Longer-term follow-up beyond 5 years is required to determine the relative effectiveness of PCI versus CABG. The Synergy between PCI with Taxus and Cardiac Surgery (SYNTAX) trial compared PCI with paclitaxel-eluting stents versus CABG in 1800 patients with de-novo three-vessel disease and left main coronary artery disease, and reported similar survival among patients in the PCI and CABG groups after 5 years of

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See Online/Comment

[http://dx.doi.org/10.1016/S0140-6736\(19\)31997-X](http://dx.doi.org/10.1016/S0140-6736(19)31997-X)

*Investigators are listed in the appendix

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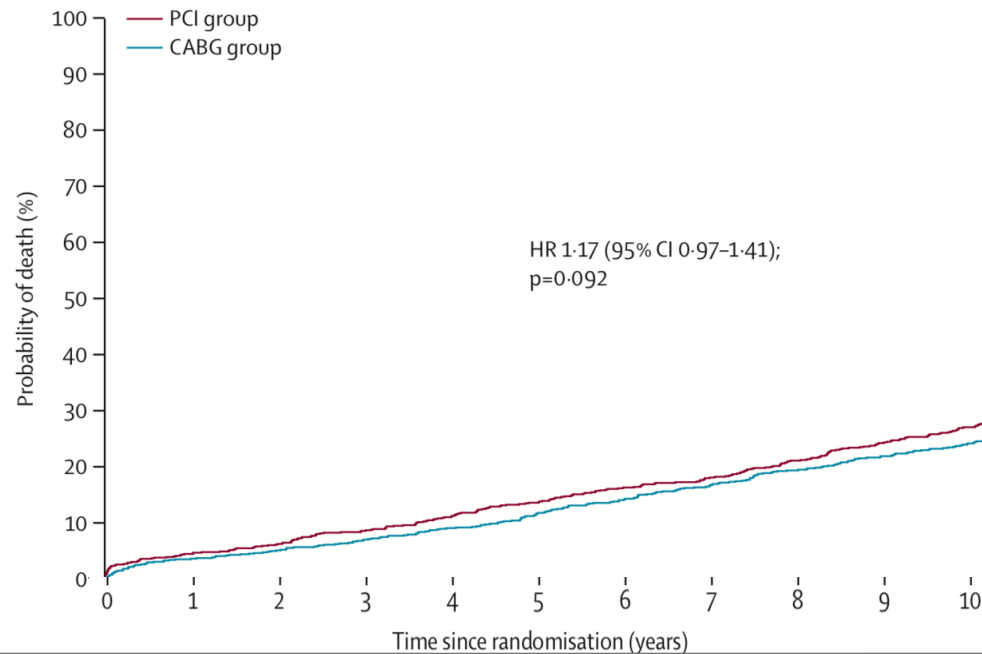
THE LANCET



"Frequent birth complications are expected to become the leading cause of child mortality in China."

Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial

1800 pts with de-novo 3V & LM were randomized (1:1) to PCI or CABG. The primary endpoint was 10Y all-cause Death.



Thuis D, Kappetein P, Serruys PW et al. Lancet 2019



@billgogas

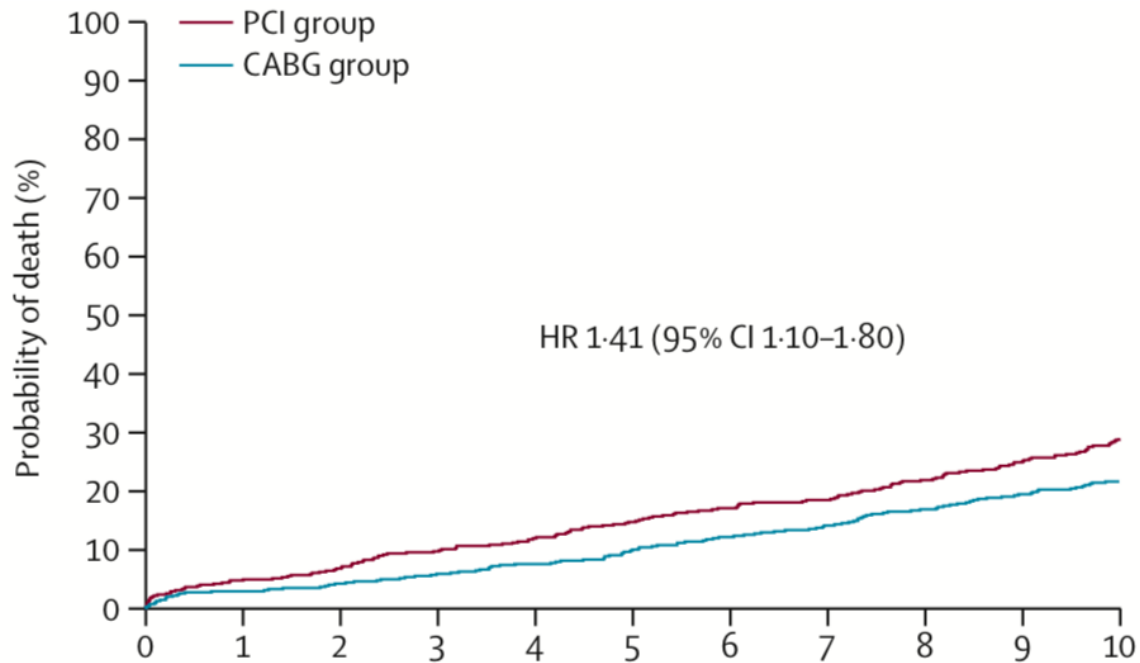
THE LANCET



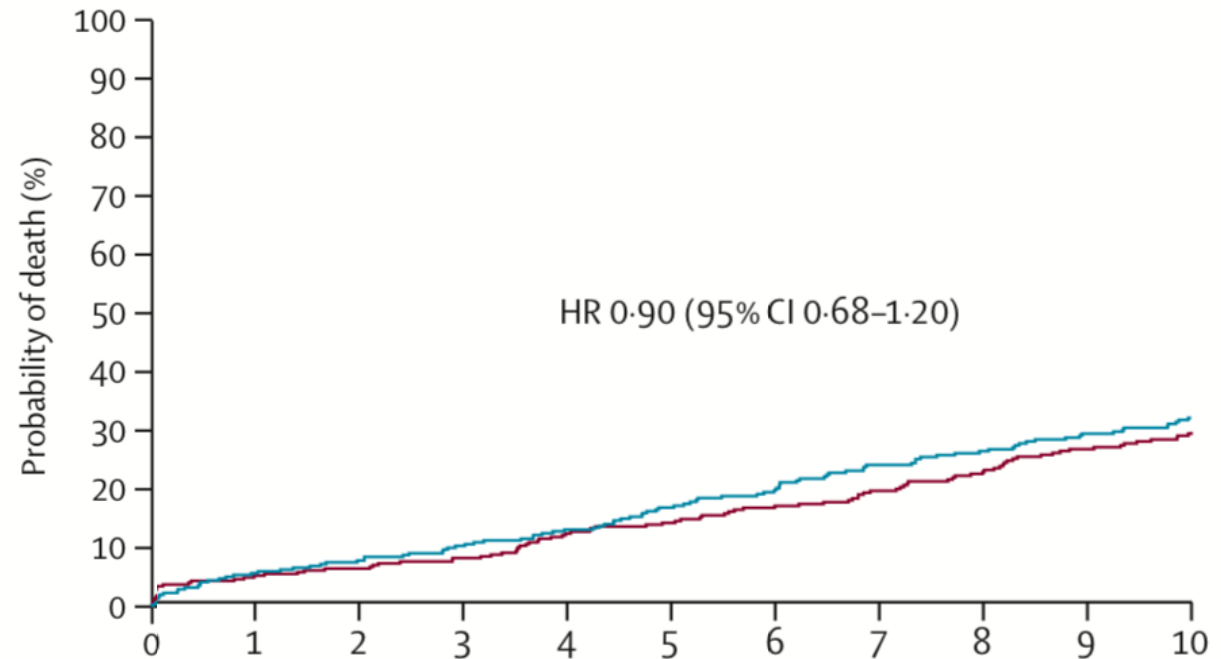
"Premature birth complications are expected to become the leading cause of child mortality in China."

Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial

3VD



LM



Thuis D, Kappetein P, Serruys PW et al. Lancet 2019

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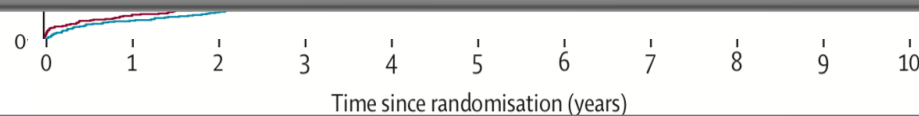
"Frequent birth complications are expected to become the leading cause of child mortality in China."

Percutaneous coronary intervention versus coronary artery bypass grafting in patients with three-vessel or left main coronary artery disease: 10-year follow-up of the multicentre randomised controlled SYNTAX trial

1800 pts with de-novo 3V & LM were randomized (1:1) to PCI or CABG. The primary endpoint was 10Y all-cause Death

Conclusion

At 10Y, **no** significant difference existed in **all-cause Death** between PCI using **1st gen PES & CABG**. However, **CABG** provided a **significant survival benefit in patients w/ 3VD**, but not in patients with LM



Thuis D, Kappetein P, Serruys PW et al. Lancet 2019



Left Main Interventions: Evidence

SYNTAX 10Y

The SYnergy between percutaneous coronary intervention w/ TAXus and cardiac surgery 10 year outcomes

PRECOMBAT 1Y

Bypass Surgery Versus Angioplasty Using Sirolimus-Eluting Stent in Patients With Left Main Coronary Artery Disease

EXCEL 5Y

Everolimus-Eluting Stents or Bypass Surgery for LM Coronary Artery Disease

NOBLE 5Y

Bioresorbable polymer DES vs coronary artery CABG in the treatment of UPLM

THE NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease

Seung-Jung Park, M.D., Young-Hak Kim, M.D., Duk-Woo Park, M.D., Sung-Cheol Yun, Ph.D., Jung-Min Ahn, M.D., Hae Geun Song, M.D., Jong-Young Lee, M.D., Won-Jang Kim, M.D., Soo-Jin Kang, M.D., Seung-Whan Lee, M.D., Cheol-Whan Lee, M.D., Seong-Wook Park, M.D., Cheol-Hyun Chung, M.D., Jae-Won Lee, M.D., Do-Sun Lim, M.D., Seung-Woon Rha, M.D., Sang-Gon Lee, M.D., Hyeon-Cheol Gwon, M.D., Hyo-Soo Kim, M.D., In-Ho Chae, M.D., Yangsoo Jang, M.D., Myung-Ho Jeong, M.D., Seung-Jea Tahk, M.D., and Ki Bae Seung, M.D.

ABSTRACT

BACKGROUND

Percutaneous coronary intervention (PCI) is increasingly used to treat unprotected left main coronary artery stenosis, although coronary-artery bypass grafting (CABG) has been considered to be the treatment of choice.

METHODS

We randomly assigned patients with unprotected left main coronary artery stenosis to undergo CABG (300 patients) or PCI with sirolimus-eluting stents (300 patients). Using a wide margin for noninferiority, we compared the groups with respect to the primary composite end point of major adverse cardiac or cerebrovascular events (death from any cause, myocardial infarction, stroke, or ischemia-driven target-vessel revascularization) at 1 year. Event rates at 2 years were also compared between the two groups.

RESULTS

The primary end point occurred in 26 patients assigned to PCI as compared with 20 patients assigned to CABG (cumulative event rate, 8.7% vs. 6.7%; absolute risk difference, 2.0 percentage points; 95% confidence interval [CI], -1.6 to 5.6; $P=0.01$ for noninferiority). By 2 years, the primary end point had occurred in 36 patients in the PCI group as compared with 24 in the CABG group (cumulative event rate, 12.2% vs. 8.1%; hazard ratio with PCI, 1.50; 95% CI, 0.90 to 2.52; $P=0.12$). The composite rate of death, myocardial infarction, or stroke at 2 years occurred in 13 and 14 patients in the two groups, respectively (cumulative event rate, 4.4% and 4.7%, respectively; hazard ratio, 0.92; 95% CI, 0.43 to 1.96; $P=0.83$). Ischemia-driven target-vessel revascularization occurred in 26 patients in the PCI group as compared with 12 patients in the CABG group (cumulative event rate, 9.0% vs. 4.2%; hazard ratio, 2.18; 95% CI, 1.10 to 4.32; $P=0.02$).

CONCLUSIONS

In this randomized trial involving patients with unprotected left main coronary artery stenosis, PCI with sirolimus-eluting stents was shown to be noninferior to CABG with respect to major adverse cardiac or cerebrovascular events. However, the noninferiority margin was wide, and the results cannot be considered clinically directive. (Funded by the Cardiovascular Research Foundation, Seoul, Korea, and others; PRECOMBAT ClinicalTrials.gov number, NCT00422968.)

From the Heart Institute (S.-J.P., Y.-H.K., D.-W.P., J.-M.A., H.G.S., J.-Y.L., W.-J.K., S.-J.K., S.-W.L., C.W.L., S.-W.P., C.-H.C., J.-W.L.) and Division of Biostatistics (S.-C.Y.), Center for Medical Research and Information, University of Ulsan College of Medicine, Asan Medical Center; Korea University Anam (D.-S.L.) and Guro (S.-W.R.) Hospitals; Samsung Medical Center (H.-C.G.); Seoul National University Hospital (H.-S.K.); Yonsei University Severance Hospital (V.J.); and Catholic University of Korea, St. Mary's Hospital (K.B.S.) — all in Seoul; Ulsan University Hospital, Ulsan (S.-G.L.); Seoul National University Hospital, Bundang (B.-H.C.); Chonnam National University Hospital, Gwangju (M.-H.J.); and Ajou University Medical Center, Suwon (S.-J.T.) — all in Korea. Address reprint requests to Dr. S.-J. Park at the Heart Institute, Asan Medical Center, University of Ulsan, 388-1 Pungnap-dong, Songpa-gu, Seoul, 138-736, South Korea, or at sjpark@amc.seoul.kr.

*Drs. S.-J. Park and Y.-H. Kim contributed equally to this article.

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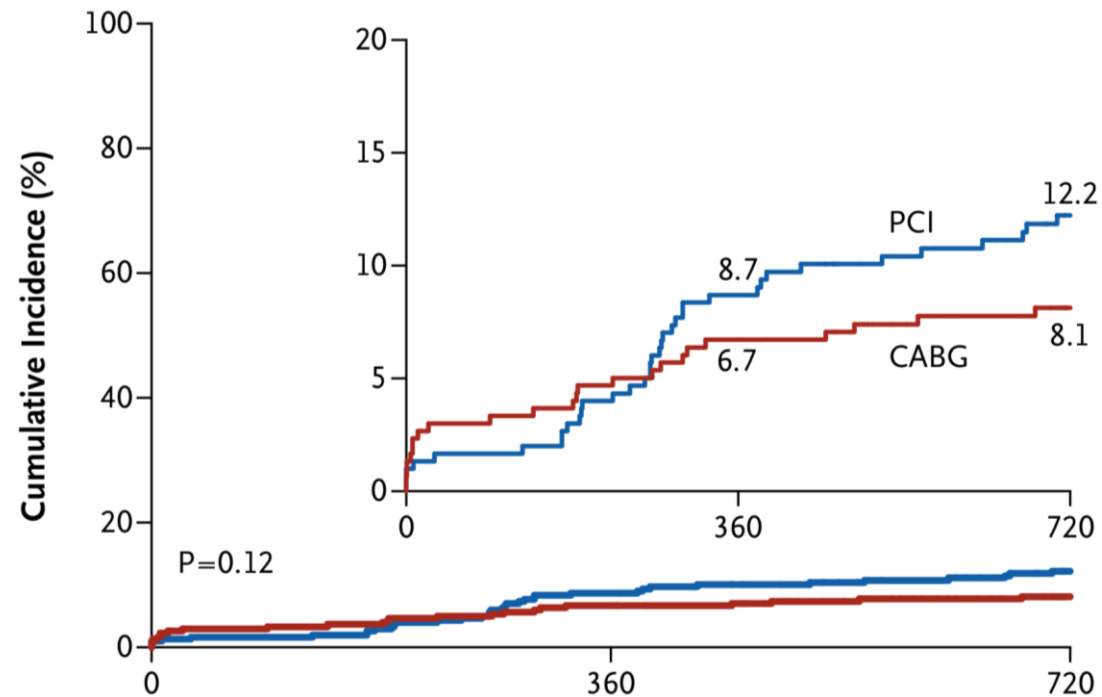
N Engl J Med 2011;364:1718-27.
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Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



600 pts with UPLM underwent 1:1 randomization to CABG or PCI w/ SES. Primary composite end point of MACCE (Death, MI, stroke, or ID TVR) @ 1Y

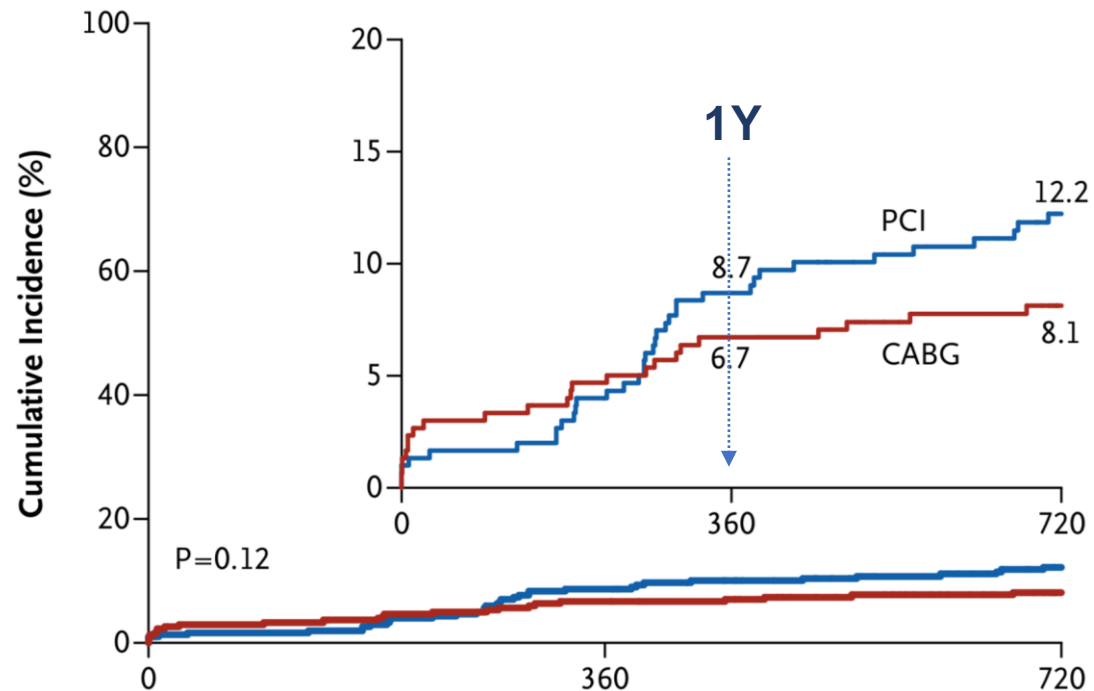


Park SJ, Kim YH, Park DW et al. *N Engl J Med* 2011;364:1718-27.

Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



PCI vs. CABG: 8.7% vs. 6.7%; absolute risk difference, 2.0 percentage points; 95% confidence interval [CI], -1.6 to 5.6; p=0.01 for non-inferiority

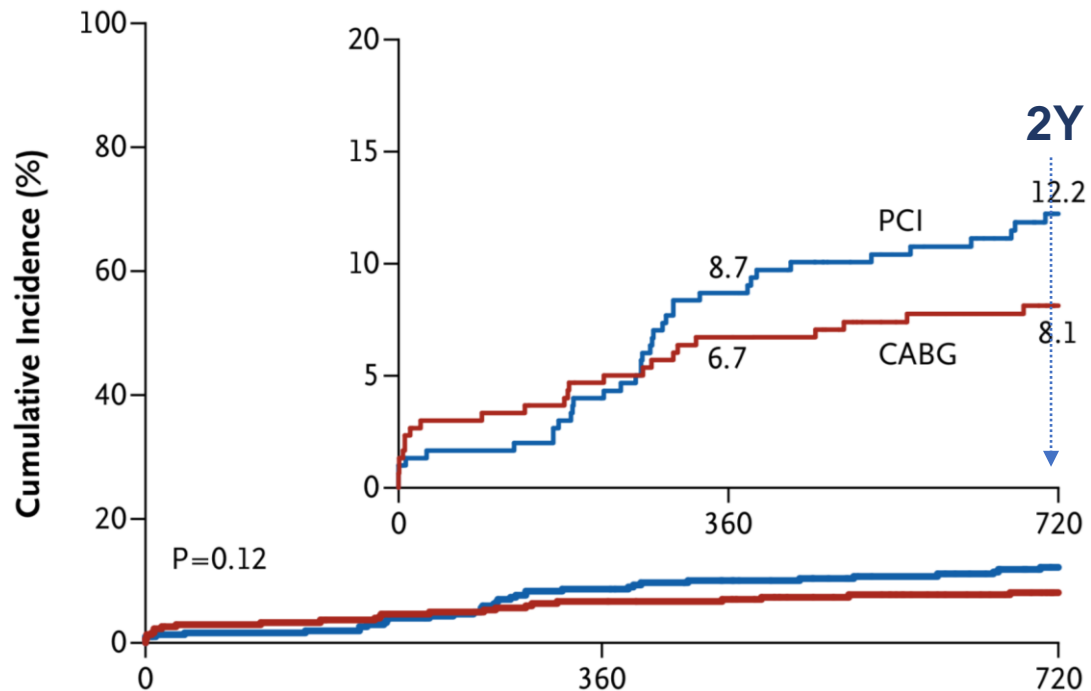


Park SJ, Kim YH, Park DW et al. N Engl J Med 2011;364:1718-27.

Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



2Y: primary end point in 36 pts in the PCI vs. 24 in the CABG (cumulative event rate, 12.2% vs. 8.1%; HR w/ PCI, 1.50; 95% CI, 0.90 to 2.52; p=0.12)



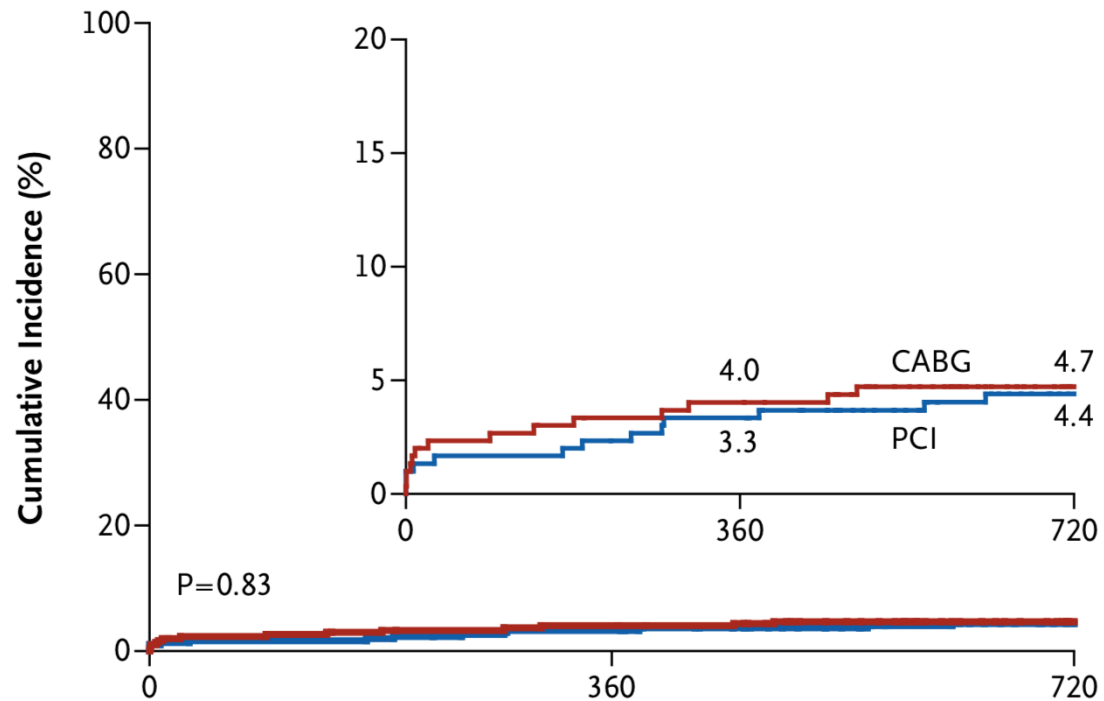
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Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



2Y composite rate: Death, MI, or stroke

PCI vs. CABG: 4.4% vs. 4.7%; HR, 0.92; 95% CI, 0.43 to 1.96; p=0.83



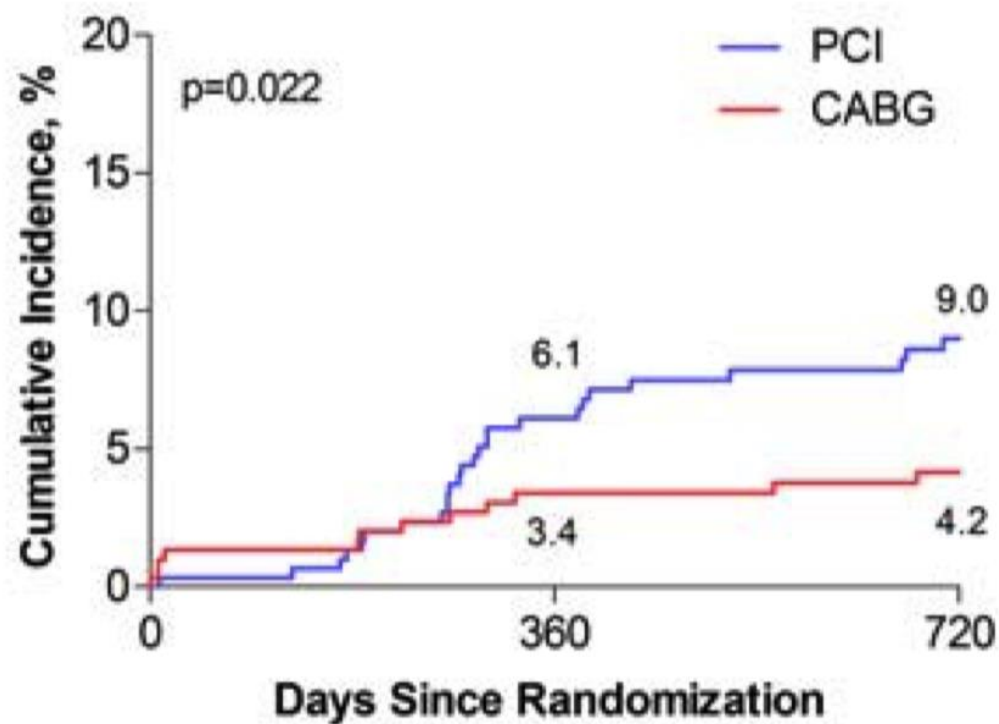
Park SJ, Kim YH, Park DW et al. N Engl J Med 2011;364:1718-27.



Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



Ischemia Driven TLR @ 2Y



Park SJ, Kim YH, Park DW et al. *N Engl J Med* 2011;364:1718-27.



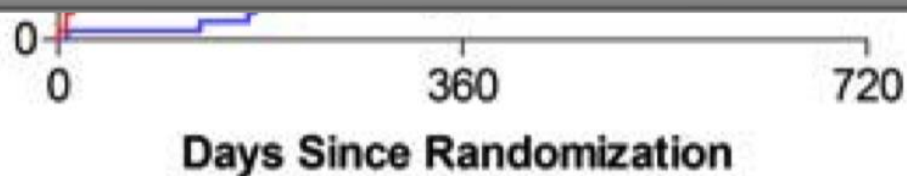
Randomized Trial of Stents versus Bypass Surgery for Left Main Coronary Artery Disease



Ischemia Driven TLR @ 2Y

Conclusion

In UPLM, **PCI** was shown to be **noninferior** to **CABG** w/ respect to MACCE



Park SJ, Kim YH, Park DW et al. *N Engl J Med* 2011;364:1718-27.



Left Main Interventions: Evidence

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The SYnergy between percutaneous coronary intervention w/ TAXus and cardiac surgery 10 year outcomes

PRECOMBAT 5Y

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Randomized Trial of Stents Versus Bypass Surgery for Left Main Coronary Artery Disease

5-Year Outcomes of the PRECOMBAT Study

Jung-Min Ahn, MD,* Jae-Hyung Roh, MD,* Young-Hak Kim, MD,† Duk-Woo Park, MD,† Sung-Cheol Yun, PhD,‡ Pil Hyung Lee, MD,† Mineok Chang, MD,† Hyun Woo Park, MD,† Seung-Wan Lee, MD,† Cheol Whan Lee, MD,† Seong-Wook Park, MD,† Suk Jung Choo, MD,† CheolHyun Chung, MD,† JaeWon Lee, MD,† Do-Sun Lim, MD,† Seung-Woon Rha, MD,† Sang-Gon Lee, MD,‡ Hyeon-Cheol Gwon, MD,§ Hyo-Soo Kim, MD,¶ In-Ho Chae, MD,** Yangsoo Jang, MD,‡‡ Myung-Ho Jeong, MD,‡‡ Seung-Jea Tahk, MD,‡‡ Ki Bae Seung, MD,‡‡ Seung-Jung Park, MD,††

ABSTRACT

BACKGROUND In a previous randomized trial, we found that percutaneous coronary intervention (PCI) was not inferior to coronary artery bypass grafting (CABG) for the treatment of unprotected left main coronary artery stenosis at 1 year.

OBJECTIVES This study sought to determine the 5-year outcomes of PCI compared with CABG for the treatment of unprotected left main coronary artery stenosis.

METHODS We randomly assigned 600 patients with unprotected left main coronary artery stenosis to undergo PCI with a sirolimus-eluting stent (n = 300) or CABG (n = 300). The primary endpoint was a major adverse cardiac or cerebrovascular event (MACCE): a composite of death from any cause, myocardial infarction, stroke, or ischemia-driven target vessel revascularization) and compared on an intention-to-treat basis.

RESULTS At 5 years, MACCE occurred in 52 patients in the PCI group and 42 patients in the CABG group (cumulative event rates of 17.5% and 14.3%, respectively; hazard ratio [HR], 1.27; 95% confidence interval [CI], 0.84 to 1.90; p = 0.26). The 2 groups did not differ significantly in terms of death from any cause, myocardial infarction, or stroke as well as their composite (8.4% and 9.6%; HR, 0.89; 95% CI, 0.52 to 1.52; p = 0.66). Ischemia-driven target vessel revascularization occurred more frequently in the PCI group than in the CABG group (11.4% and 5.5%, respectively; HR, 2.11; 95% CI, 1.16 to 3.84; p = 0.012).

CONCLUSIONS During 5 years of follow-up, our study did not show significant difference regarding the rate of MACCE between patients who underwent PCI with a sirolimus-eluting stent and those who underwent CABG. However, considering the limited power of our study, our results should be interpreted with caution. (Bypass Surgery Versus Angioplasty Using Sirolimus-Eluting Stent in Patients With Left Main Coronary Artery Disease [PRECOMBAT]; NCT00422968) (J Am Coll Cardiol 2015;65:2198-206) © 2015 by the American College of Cardiology Foundation.

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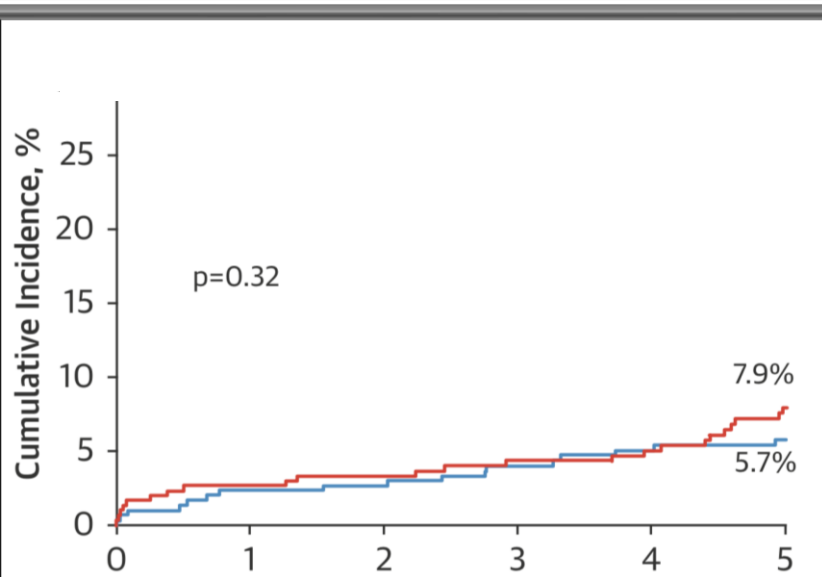
Randomized Trial of Stents Versus Bypass Surgery for Left Main Coronary Artery Disease

5-Year Outcomes of the PRECOMBAT Study

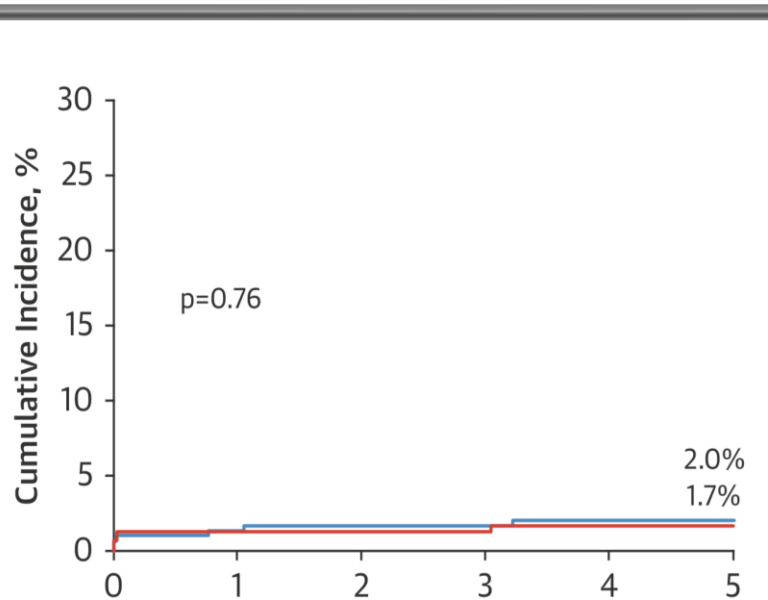


MACCE @ 5Y: No Difference

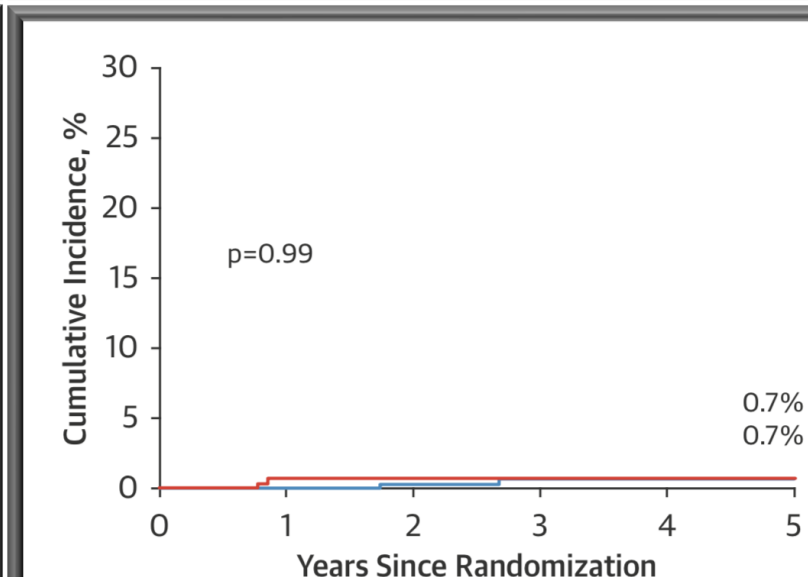
Death



MI



Stroke



Ahn JM, Roe JH, Kim YH et al. *J Am Coll Cardiol* 2015;65:2198–206

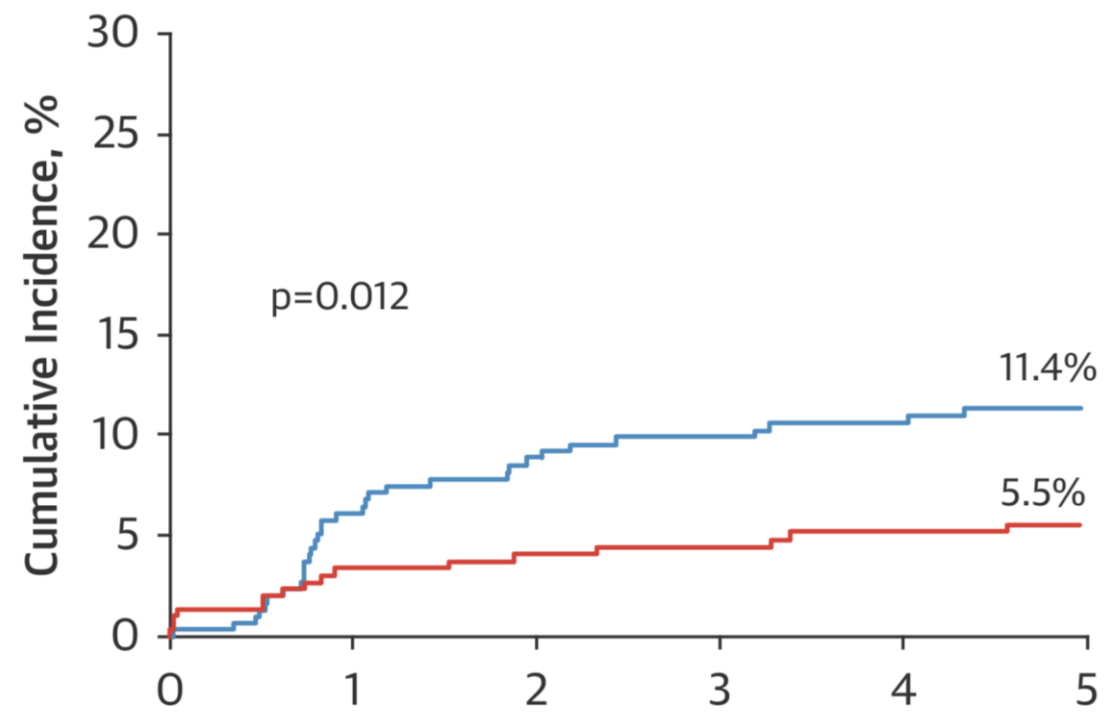


Randomized Trial of Stents Versus Bypass Surgery for Left Main Coronary Artery Disease

5-Year Outcomes of the PRECOMBAT Study



MACCE @ 5Y: IDTVR



Ahn JM, Roe JH, Kim YH et al. J Am Coll Cardiol 2015;65:2198–206



Randomized Trial of Stents Versus Bypass Surgery for Left Main Coronary Artery Disease

5-Year Outcomes of the PRECOMBAT Study



MACCE @ 5Y: IDTVP

Conclusion

During 5 years of follow-up **the study did not show significant differences regarding the rate of MACCE** between pts who underwent PCI with a **SES** & those who underwent CABG

0 1 2 3 4 5

Ahn JM, Roe JH, Kim YH et al. J Am Coll Cardiol 2015;65:2198–206

Left Main Interventions: Evidence

SYNTAX 10Y

The SYnergy between percutaneous coronary intervention w/ TAXus and cardiac surgery 10 year outcomes

PRECOMBAT 5Y

Bypass Surgery Versus Angioplasty Using Sirolimus-Eluting Stent in Patients With Left Main Coronary Artery Disease

EXCEL 5Y

Everolimus-Eluting Stents or Bypass Surgery for LM Coronary Artery Disease

NOBLE 5Y

Bioresorbable polymer DES vs coronary artery CABG in the treatment of UPLM

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. Karamaliotis, 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. Buzzman, 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*

ABSTRACT

BACKGROUND

Long-term outcomes after percutaneous coronary intervention (PCI) with contemporary drug-eluting stents, as compared with coronary-artery bypass grafting (CABG), in patients with left main coronary artery disease are not clearly established.

METHODS

We randomly assigned 1905 patients with left main coronary artery disease of low or intermediate anatomical complexity (according to assessment at the participating centers) to undergo either PCI with fluoropolymer-based cobalt-chromium everolimus-eluting stents (PCI group, 948 patients) or CABG (CABG group, 957 patients). The primary outcome was a composite of death, stroke, or myocardial infarction.

RESULTS

At 5 years, a primary outcome event had occurred in 22.0% of the patients in the PCI group and in 19.2% of the patients in the CABG group (difference, 2.8 percentage points; 95% confidence interval [CI], -0.9 to 6.5; $P=0.13$). Death from any cause occurred more frequently in the PCI group than in the CABG group (in 13.0% vs. 9.9%; difference, 3.1 percentage points; 95% CI, 0.2 to 6.1). In the PCI and CABG groups, the incidences of definite cardiovascular death (5.0% and 4.5%, respectively; difference, 0.5 percentage points; 95% CI, -1.4 to 2.5) and myocardial infarction (10.6% and 9.1%; difference, 1.4 percentage points; 95% CI, -1.3 to 4.2) were not significantly different. All cerebrovascular events were less frequent after PCI than after CABG (3.3% vs. 5.2%; difference, -1.9 percentage points; 95% CI, -3.8 to 0), although the incidence of stroke was not significantly different between the two groups (2.9% and 3.7%; difference, -0.8 percentage points; 95% CI, -2.4 to 0.9). Ischemia-driven revascularization was more frequent after PCI than after CABG (16.9% vs. 10.0%; difference, 6.9 percentage points; 95% CI, 3.7 to 10.0).

CONCLUSIONS

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. (Funded by Abbott Vascular; EXCEL ClinicalTrials.gov number, NCT01205776.)

The authors' full names, academic degrees, and affiliations are listed in the Appendix. Address reprint requests to Dr. Stone at the Cardiovascular Research Foundation, 1700 Broadway, 8th Fl., New York, NY 10019, or at gstone@crf.org.

*A complete list of investigators, institutions, and research organizations participating in the EXCEL trial is provided in the Supplementary Appendix, available at NEJM.org.

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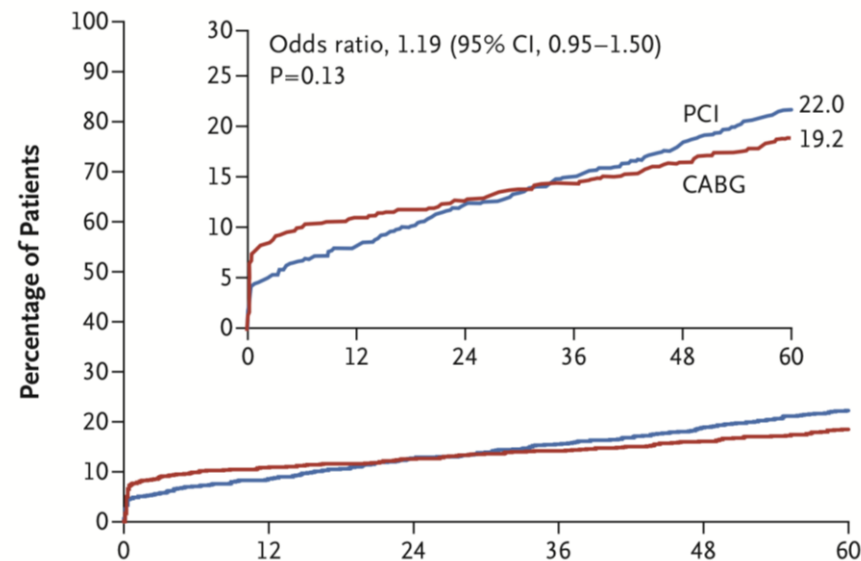
Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease



1905 pts w/ UPLM of low or intermediate anatomical complexity underwent either PCI w/ EES (n = 948) or CABG (n = 957)

The primary outcome was a composite of: Death, stroke, or MI

Death, Stroke, or Myocardial Infarction

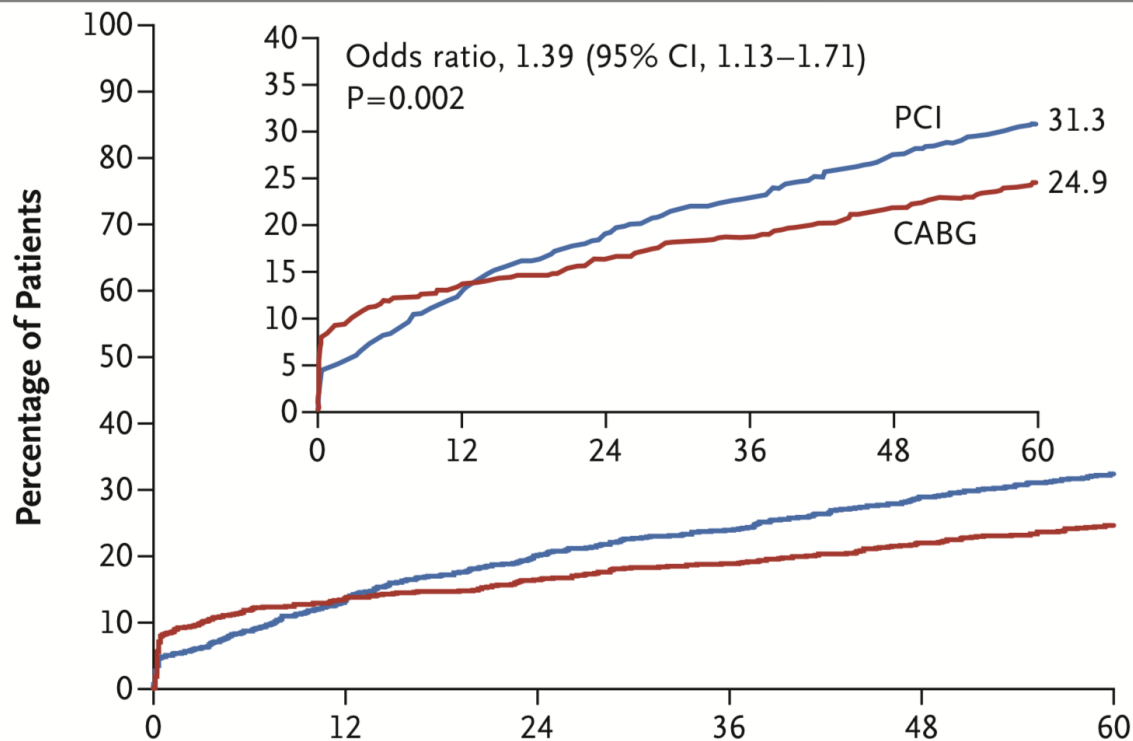


Stone PW, Kappetein AP, Sabik JF et al. N Engl J Med DOI: 10.1056/NEJMoa1909406

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



The secondary outcome was: Death, stroke, or MI, ID-Revasc



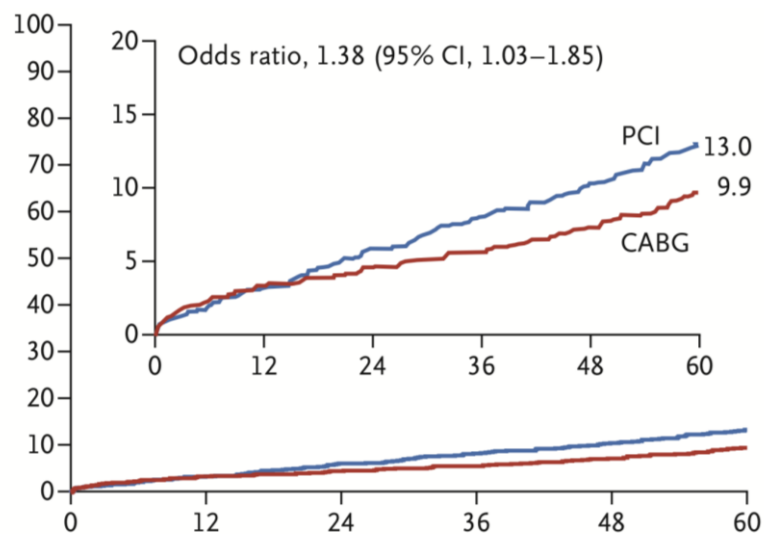
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Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease

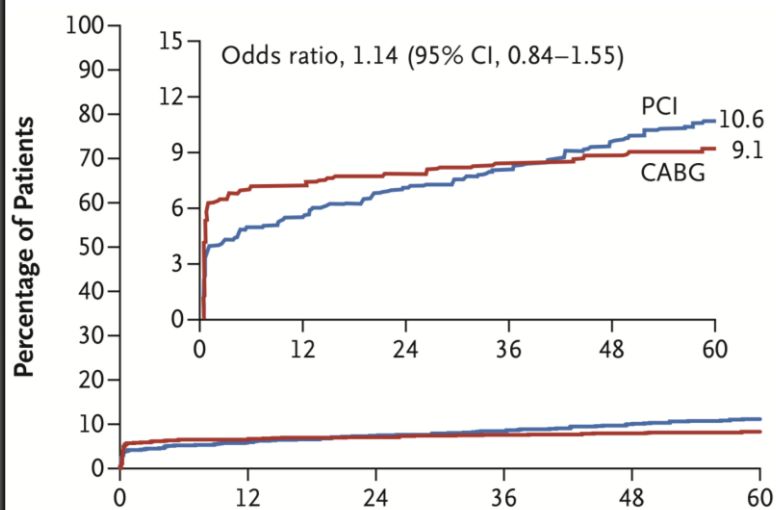


Individual Components @ 5Y

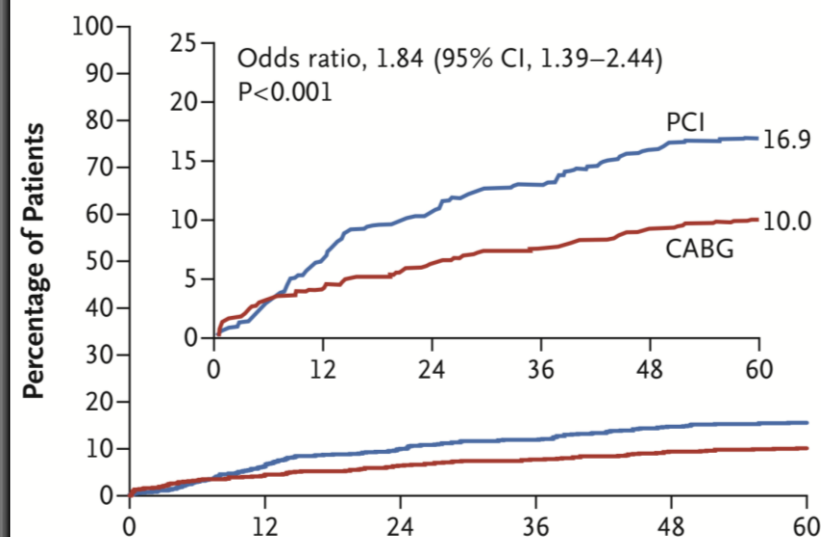
Death



MI



ID Revasc



Stone PW, Kappetein AP, Sabik JF et al. *N Engl J Med* DOI: 10.1056/NEJMoa1909406





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

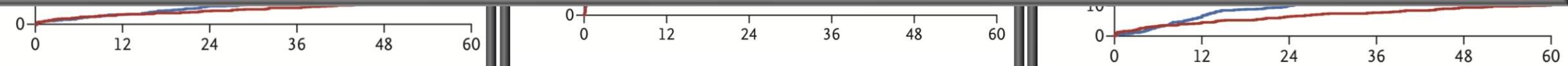


Individual Components @ 5Y

Conclusion

In pts w/ UPLM of low or intermediate anatomical complexity, there was **no significant difference between PCI and CABG w/ respect to the rate of Death, stroke, or MI at 5 years.**

Percentage of Patients



Stone PW, Kappetein AP, Sabik JF et al. N Engl J Med DOI: 10.1056/NEJMoa1909406

Left Main Interventions: Evidence

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The SYnergy between percutaneous coronary intervention w/ TAXus and cardiac surgery 10 year outcomes

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EXCEL 5Y

Everolimus-Eluting Stents or Bypass Surgery for LM Coronary Artery Disease

NOBLE 5Y

Bioresorbable polymer DES vs coronary artery CABG in the treatment of UPLM

Articles

Percutaneous coronary angioplasty versus coronary artery bypass grafting in treatment of unprotected left main stenosis (NOBLE): a prospective, randomised, open-label, non-inferiority trial

Timo Mäkitallio, Niels P Hahn, Mitchell Lindsay, Mark S Spencer, Andrej Erglis, Jan B A Meneveau, Thor Tronk, Markku Eskola, Hannu Rönkä, Thomas Kollerth, Jan Runkhild, Liette O Jensen, Gintaras Kalinauskas, Rikard B A Lindert, Markku Penttiläinen, Anders Herwald, Adrian Barwing, Adjar Zaman, James Cottan, Erlend Erikson, Sulev Mägi, Henrik T Saveman, Per H Nielsen, Matti Niemelä, Kari Kivimäki, Jens F Lassen, Michael Maeng, Keith Oldroyd, Geoff Beng, Simon J Walsh, Colin G Haeresty, Indrak Kumar, Petrus Stradius, Teje K Steigen, Ole Frøbert, Alastair N J Graham, Petter C Endresem, Matthias Corbaccio, Olli Kajander, Uday Trivedi, Juha Hartikainen, Vesa Anttila, David Hildick-Smith, Lutz Thuesen, Ewald H Christiansen, for the NOBLE study investigators*

Summary

Background Coronary artery bypass grafting (CABG) is the standard treatment for revascularisation in patients with left main coronary artery disease, but use of percutaneous coronary intervention (PCI) for this indication is increasing. We aimed to compare PCI and CABG for treatment of left main coronary artery disease.

Methods In this prospective, randomised, open-label, non-inferiority trial, patients with left main coronary artery disease were enrolled in 36 centres in northern Europe and randomised 1:1 to treatment with PCI or CABG. Eligible patients had stable angina pectoris, unstable angina pectoris, or non-ST-elevation myocardial infarction. Exclusion criteria were ST-elevation myocardial infarction within 24 h, being considered too high risk for CABG or PCI, or expected survival of less than 1 year. The primary endpoint was major adverse cardiac or cerebrovascular events (MACCE), a composite of all-cause mortality, non-procedural myocardial infarction, any repeat coronary revascularisation, and stroke. Non-inferiority of PCI to CABG required the lower end of the 95% CI not to exceed a hazard ratio (HR) of 1.35 after up to 5 years of follow-up. The intention-to-treat principle was used in the analysis if not specified otherwise. This trial is registered with ClinicalTrials.gov identifier, number NCT01496651.

Findings Between Dec 9, 2008, and Jan 21, 2015, 1201 patients were randomly assigned, 598 to PCI and 603 to CABG, and 592 in each group entered analysis by intention to treat. Kaplan-Meier 5 year estimates of MACCE were 28% for PCI (121 events) and 18% for CABG (80 events), HR 1.51 (95% CI 1.13–2.00), exceeding the limit for non-inferiority, and CABG was significantly better than PCI (p=0.0044). As-treated estimates were 28% versus 18% (1.48, 1.11–1.98, p=0.0069). Comparing PCI with CABG, 5 year estimates were 11% versus 9% (1.08, 0.67–1.74, p=0.84) for all-cause mortality, 6% versus 2% (2.87, 1.40–5.89, p=0.0040) for non-procedural myocardial infarction, 15% versus 10% (1.50, 1.04–2.17, p=0.0304) for any revascularisation, and 5% versus 2% (2.20, 0.91–5.36, p=0.08) for stroke.

Interpretation The findings of this study suggest that CABG might be better than PCI for treatment of left main stem coronary artery disease.

Funding Biosensors, Aarhus University Hospital, and participating sites.

Introduction

Treatment of unprotected left main coronary artery disease with percutaneous coronary intervention (PCI) has increased rapidly during the past decade, following the favourable results of randomised trials^{1,2} and observational registry studies comparing PCI and coronary artery bypass grafting (CABG).^{3,4} At present, both options are used to treat left main coronary artery disease.⁵ Present guidelines recommend PCI in patients with left main coronary artery disease and coronary pathology favourable to PCI (ie, in the absence of complex and diffuse lesions).⁶ The guidelines are based primarily on the prespecified and powered subgroup of 705 patients with left main coronary artery disease in the

SYNTAX trial,^{1,2} which compared PCI and the drug-eluting Taxus stent with CABG in patients with three-vessel or left main coronary artery disease. The guidelines also refer to the findings of the randomised trials LE MANS (100 patients),⁷ PRECOMBAT (600 patients),⁸ and Boudriot and colleagues (201 patients)⁹ trials, which included patients with left main coronary artery stenosis. In the randomised trials, the non-inferiority margin was wide, because of relatively small patient sample sizes, and thus the trials were not powered to definitively determine the best treatment for unprotected left main coronary artery disease.

In the NOBLE trial, we postulated that PCI with drug-eluting stents would produce non-inferior clinical results



Lancet 2016, 388, 2243–52

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This online publication has been corrected. The first corrected version first appeared at www.lancet.com on November 2, 2016. The second corrected version appeared on March 16, 2017.

See Comment page 2735

*NOBLE study investigators are listed in the appendix

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Department of Cardiovascular





Focus on Interventional Cardiology
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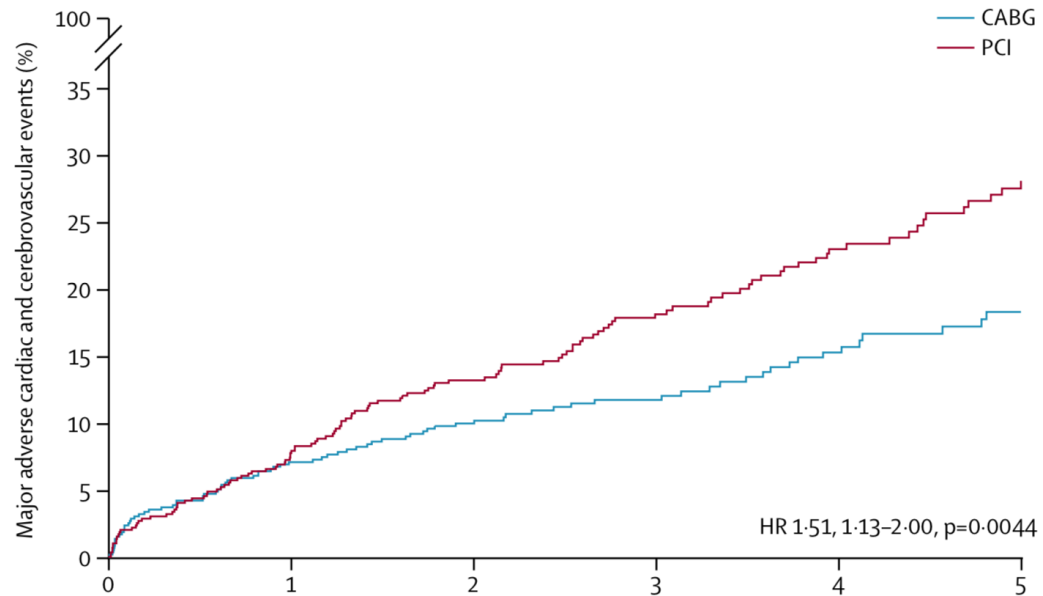
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Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease



1,201 pts were randomly assigned, 598 to PCI and 603 to CABG
 The primary endpoint was major adverse cardiac or CerebroV events (MACCE)
 All-cause Death, non-procedural MI, any repeat Revasc, & stroke



Makikallio T, Holm NR, Lindsay M, et al. Lancet 2016; 388: 2743–52

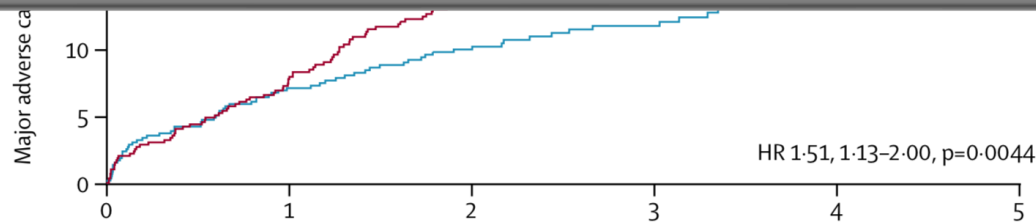
Five-Year Outcomes after PCI or CABG for Left Main Coronary Disease



1,201 pts were randomly assigned, 598 to PCI and 603 to CABG

Conclusion

CABG might be better than PCI for treatment of **Left Main** stem coronary artery disease



Makikallio T, Holm NR, Lindsay M, et al. Lancet 2016; 388: 2743–52

Left Main Disease

Heart Team Approach

Low SX Score 0-22		Intermediate SX Score 23-32		High SX Score >33	
ESC: PCI I B	ESC: CABG I B	ESC: PCI II a B	ESC: CABG I B	ESC/ACC/AHA: CABG I B	ESC/ACC/AHA: PCI III B
ACC/AHA: PCI II a B	ACC/AHA: CABG I B	ACC/AHA: PCI II b B	ACC/AHA: CABG I B		Exceptions: CABG Ineligible patients w/ STS> 4, Age> 85 End Stage Lung, Renal, Hepatic Disease, Complex CAD w/ Low EF & MCS

Emergency Left Main PCI: AMI (cardiogenic shock), post-op non-CABG & CABG failure

ESC: European Society of Cardiology Guidelines

ACC/AHA: American College of Cardiology/American Heart Association Guidelines

STS: Society of Thoracic Surgeons Risk Score

MCS: Mechanical Circulatory Support

The Spencer B. King III
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Joint Meeting in Coronary Revascularization
Busan, South Korea
Dec 12, 15:46 pm: Complex PCI Session

Conclusions

1. PCI & CABG are both good options for UPLM disease
2. CABG favors UPLM w/ 3VD & High Sx Scores
3. PCI is favorable option for low anatomic complexity pts
4. The cautionary tale of PCI is Repeat Revasc
5. PCI should be performed only by experienced operators
6. Guidelines are Guidelines: Individualized approach matters





Joint Meeting in Coronary Revascularization
Busan, South Korea
Dec 12, 15:46 pm: Complex PCI Session

Thank you

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 [@billgogas](https://twitter.com/billgogas)

