EES or CABG for Multivessel CAD

Extended Follow-up Outcomes of BEST Trial

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Ahn JM, DY Kang, DW Park, SJ Park et al. Circulation. 2022. PMID: 36121700 Clinical Trial.

Disclosure Statement

- The BEST Extended Outcome Study was an investigator-initiated trial and was funded by the CardioVascular Research Foundation, Seoul, Korea, and Abbott Vascular, Santa Clara, California, USA.

- The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report.

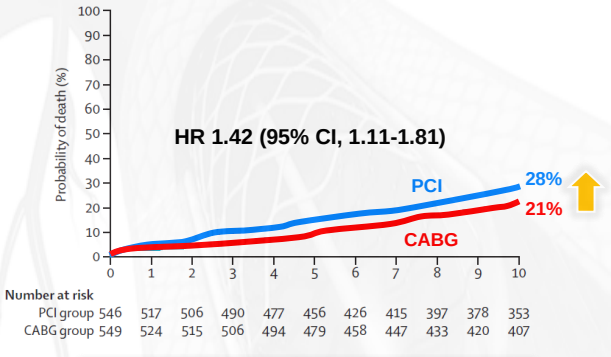
Faculty disclosure information can be found on the app

Background

PCI vs. CABG in Multivessel Disease

SYNTAXES-3VD

Mortality at 10 Years

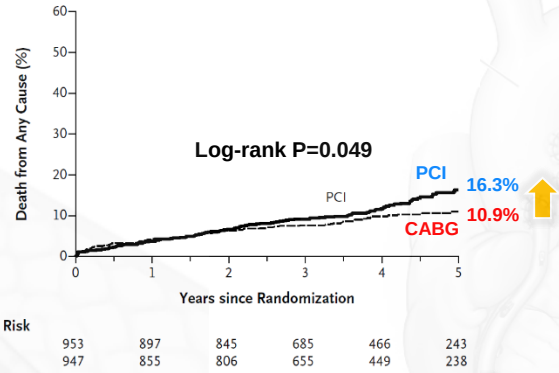


- 1st Generation-PES
- Intracoronary Imaging (-)

Lancet 2019; 394: 1325–34

FREEDOM

Mortality at 5 Years

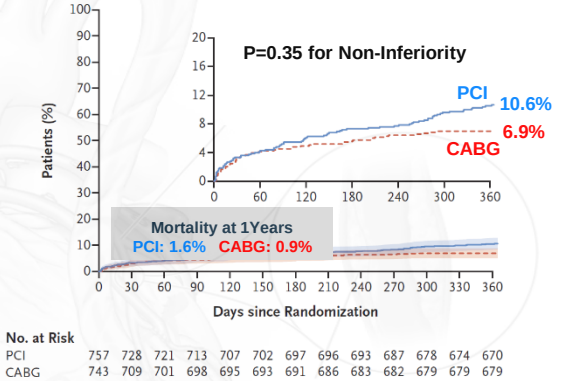


- 1st Generation-SES (51%) or PES(43%)
- Intracoronary Imaging (-)
- Diabetic population

NEJM 2012;367:2375-84

FAME 3

Death, MI, Stroke, RR at 1 Years



- Current Generation-ZES
- Intracoronary Imaging: 11.7%
- Limited Follow-up, so far

NEJM 2022;386:128-37

The BEST Trial

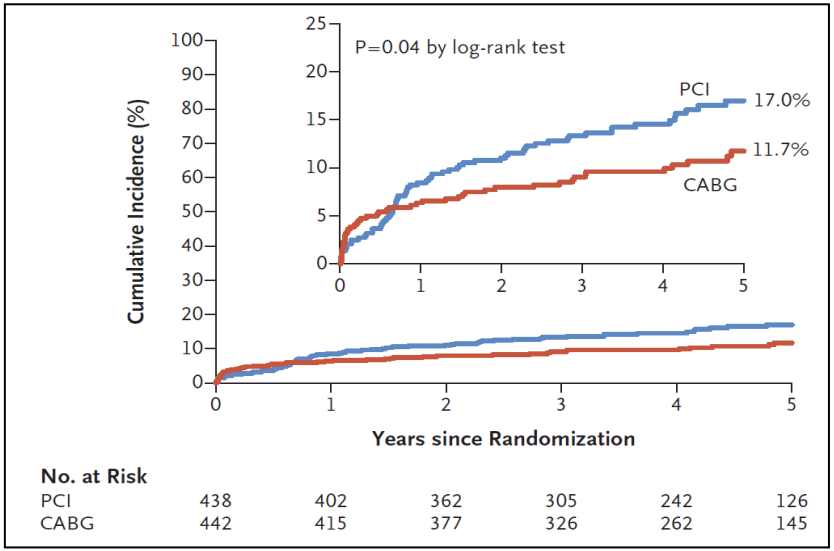
Design

- **DESIGN**: a prospective, open-label, randomized trial
- **OBJECTIVE**: To compare PCI with ***Everolimus-Eluting Stents*** and ***CABG*** for optimal revascularization of patients with multivessel coronary artery stenosis.
- **HYPOTHESIS**: PCI is non-inferior to CABG with respect to 2-year MACE.

- Trial was initially designed to randomly assign 1776 patients.
- After inclusion of 880 patients (438 in the PCI group and 442 in the CABG group) between July 2008 and September 2013, the study was terminated early due to slow enrollment.

Primary End Point: Death, MI, or TVR

(median FU of 4.6 Years)



- **Mortality: 6.6% in PCI vs. 5.0% in CABG**

Park S, Ahn JM, et al NEJM 2015;372:1204-12

The BEST Extended Follow-up Study

Study Design and Objective

- In February 2022, the principal investigator invited all sites to participate in the extended follow-up, and all centers agreed to participate. The final follow-up status was ascertained between March 1 and May 22, 2022.

- We performed an extended clinical follow-up to evaluate longer-term comparative outcomes between PCI with **Everolimus-Eluting Stents** and **CABG** among patients with multivessel coronary artery disease, who were followed for up to 13.7 years after initial enrollment in the BEST trial.

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Participating Centers (N=27) and Investigators

Country	Site	Investigator
Korea	Asan Medical Center	Seung-Jung Park
Korea	Keimyung University Dongsan Medical Center	Seung Ho Hur
Korea	The Catholic University of Korea Seoul St. Mary's Hospital	Hun-Jun Park
Korea	Gachon University Gil Hospital	Woong Chol Kang
Korea	Gangnam Severance Hospital	Hyuck Moon Kwon
Korea	Korea University Guro Hospital	Seung-Woon Rha
Korea	Korea University Anam Hospital	Do-Sun Lim
Korea	Chonnam National University Hospital	Myung-Ho Jeong
Korea	Kangwon National University Hospital	Bong-Ki Lee
Korea	Hanyang University Medical Center	Young Hyo Lim
Korea	Konyang University Hospital	Jang Ho Bae
Korea	Inje University Sanggye Paik Hospital	Byung Ok Kim
Korea	Wonju Christian Hospital	Sung Gyun Ahn
Korea	Inje University Pusan Paik Hospital	Tae-Hyun Yang
Korea	Severance Hospital	Byeong-Keuk Kim
Korea	National Health Insurance Corporation Ilsan Hospital	Ji-Yong Jang
Korea	Yeungnam University Medical Center	Jong-Seon Park
Korea	Inje University Ilsan Paik Hospital	Sung Yun Lee
Korea	Pusan National University Yangsan Hospital	Jun Hong Kim
Korea	St.Carollo Hospital	Jang-Hyun Cho
Korea	The Catholic University of Korea, Yeouido St. Mary's Hospital	Yun Seok Choi
Korea	Ulsan University Hospital	Gyung-Min Park
China	Sir Run Run Shaw Hospital	Huang He
China	Zhongshan Hospital	JunBo Ge
Malaysia	National Heart Institute	Robaaya Zambahari
Malaysia	Sarawak General Hospital	Tiong Kiam Ong
Thailand	Siriraj Hospital	Damras Tresukosol

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Inclusion and Exclusion Criteria

All patients enrolled in **the Original BEST trial** were included in this extended follow-up study.

INCLUSION

- ≥ 18 years of age.
- Symptoms of angina and/or objective evidence of myocardial ischemia.
- Angiographically confirmed mutivessel coronary artery disease (DS>70%)
- Suitable candidates for either PCI or CABG by their treating physicians and surgeons

KEY EXCLUSION

- Significant left main stenosis
- Any contraindication to dual antiplatelet therapy
- Severe heart failure (NYHA III or IV)
- Planned surgery
- Previous CABG
- Prior PCI with DES implantation within 1 year
- CTO ≥2 vessels
- STEMI within 72 hours
- Elevated cardiac enzyme
- Disabled stroke or other significant comorbidities

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Statistical Analysis

- Due to premature termination of the recruitment of the patients, we did not perform formal hypothesis testing for the noninferiority comparison between PCI and CABG with respect to the primary endpoint.
- This report provides descriptive information on all endpoint events that occurred during the extended follow-up period.
- Survival was assessed using the Kaplan-Meier method and compared using the log-rank test. We compared the primary and secondary end points between the two groups using Cox's regression models with robust standard errors to account for the clustering effect of the participating sites.
- All analyses were performed according to the intention-to-treat principle using all available follow-up.

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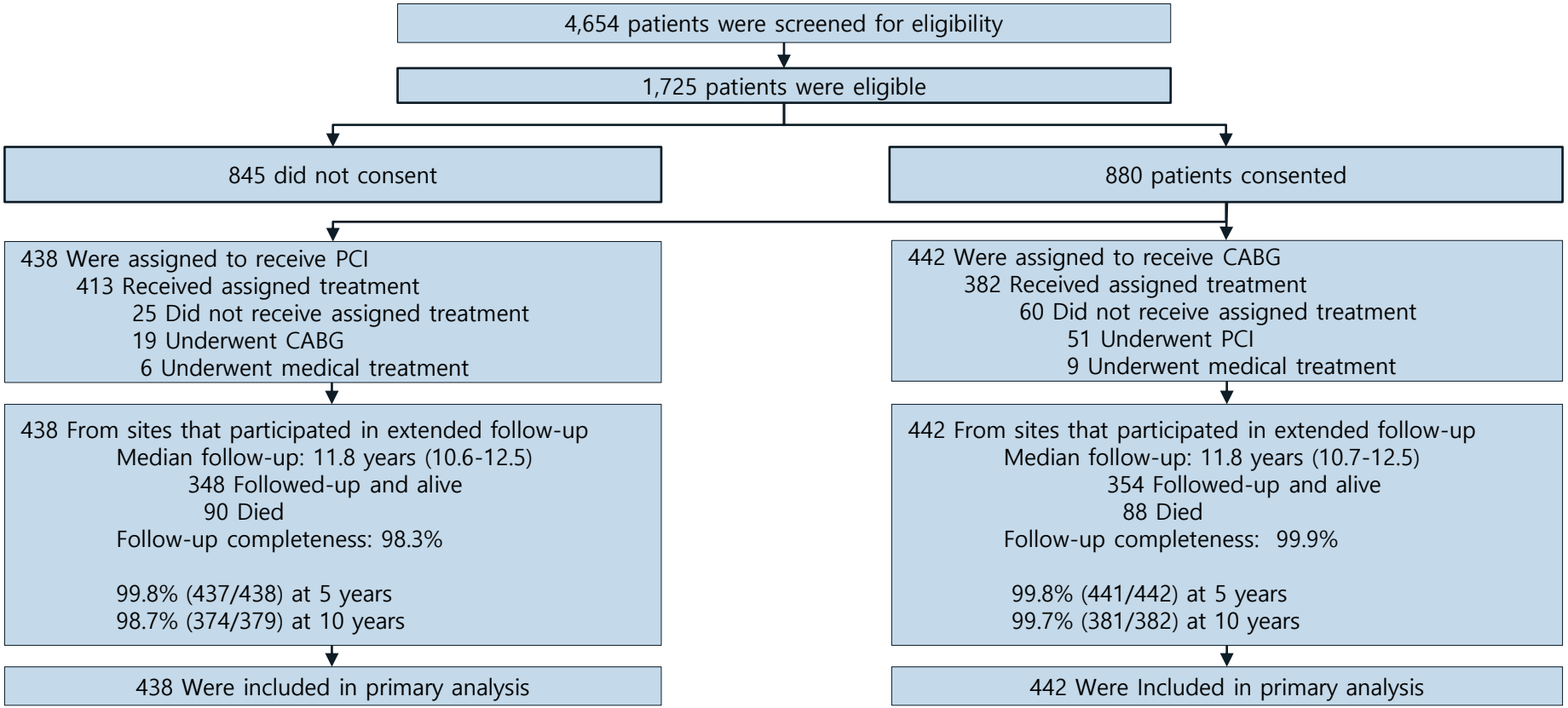
Enrollment, Randomization and Follow-up



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Baseline Clinical Characteristics

	PCI (N=438)	CABG (N=442)
Age, yr	64.0	64.9
Male sex	69.4%	73.5%
Body mass index	24.7	25.0
Diabetes	40.4%	42.1%
Hypertension	67.6%	66.7%
Hyperlipidemia	54.6%	50.2%
Current smoker	20.1%	20.1%
Previous PCI	6.8%	8.6%
Previous MI	5.7%	6.6%
Previous heart failure	3.7%	2.7%

	PCI (N=438)	CABG (N=442)
Chronic renal failure	2.1%	1.6%
Peripheral vascular disease	3.4%	2.7%
Clinical manifestation		
Stable or asymptomatic	47.9%	46.2%
Unstable angina	42.2%	45.0%
Recent MI	9.8%	8.8%
Ejection fraction	59.1%	59.9%
Three vessel disease	75.3%	79.0%
EuroSCORE ≥ 6	15.1%	13.3%
SYNTAX score	24.2	24.6

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Procedural Characteristics*

PCI Group	464
Total stents number	3.4 ± 1.4
Total stent length, mm	85.3 ± 38.2
Mean stent diameter, mm	3.1 ± 0.3
IVUS guidance	***333 (71.8)***
Complete revascularization	***236 (50.9)†***
CABG Group	**401**
Total no. of grafted vessels	3.1 ± 0.9
Total no. of arterial grafts	2.1 ± 1.1
Total no. of vein grafts	1.0 ± 0.8
Left internal mammary artery graft	398 (99.3)
Off-pump surgery	258 (64.3)
Complete revascularization	***274/383 (71.5)†***

* Data were summarized according to the as-treated analysis
† P<0.05 between PCI and CABG group

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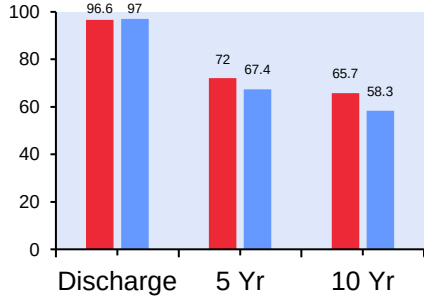
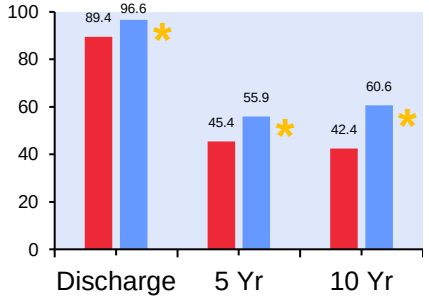
Medication at Follow-Up

CABG
PCI

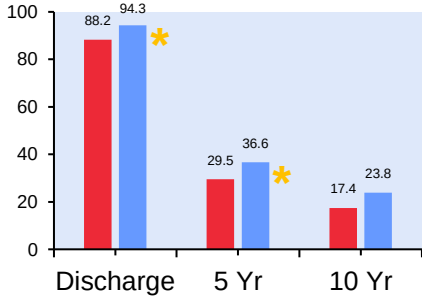
Aspirin



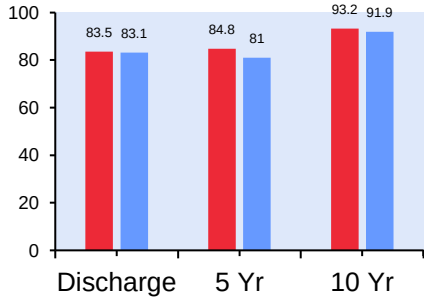
Thienopyridine



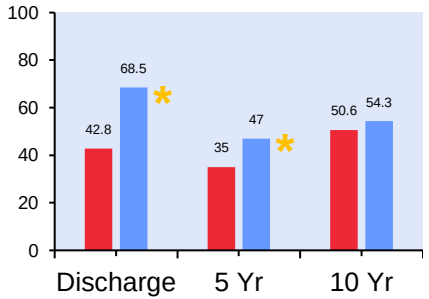
DAPT



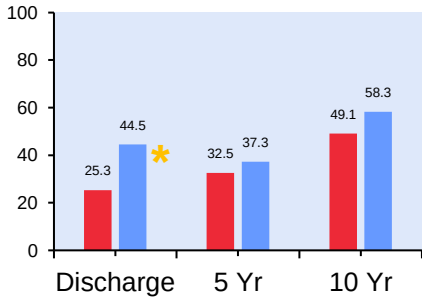
Statin



Beta blocker



ACEi or ARB



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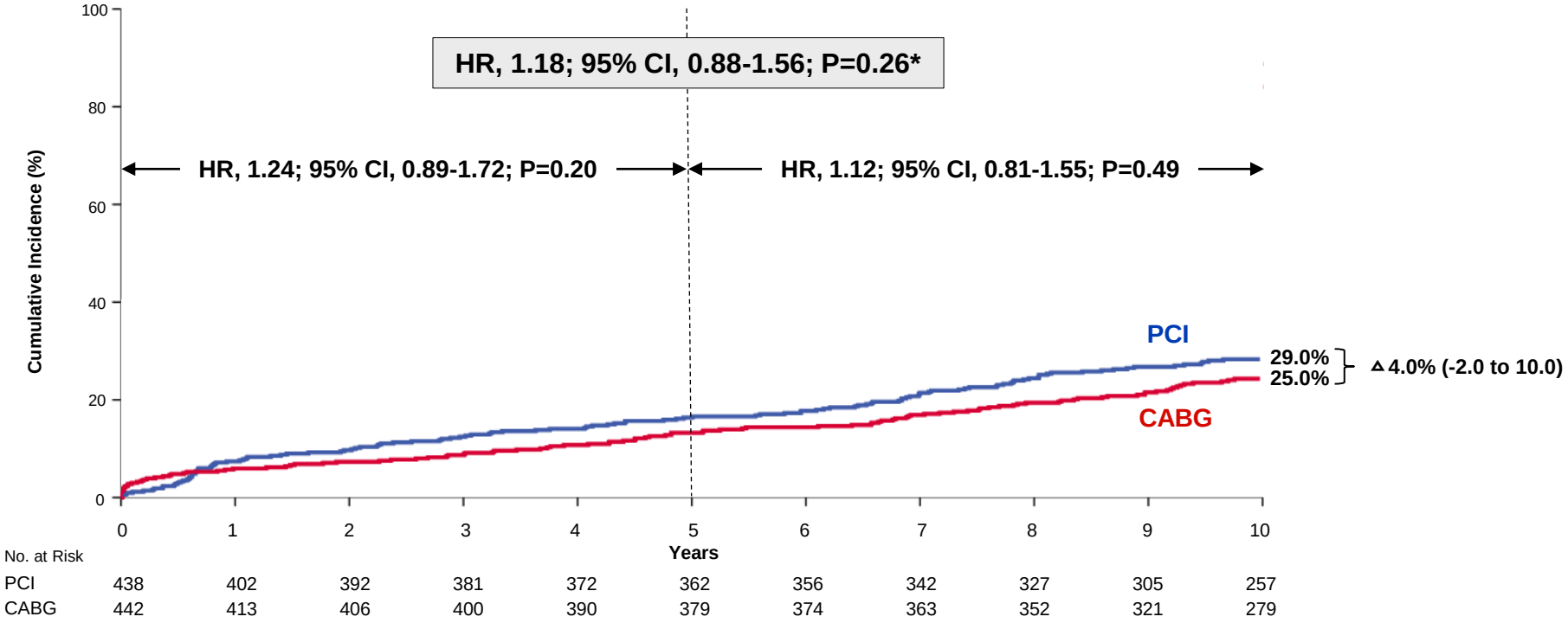
*P<0.05

Primary End Point: Death, MI, and TVR



*HR, 1.18 (95% CI, 0.91-1.54; P=0.24) accounting for all recurrent events by the Wei, Lin, Weissfeld method

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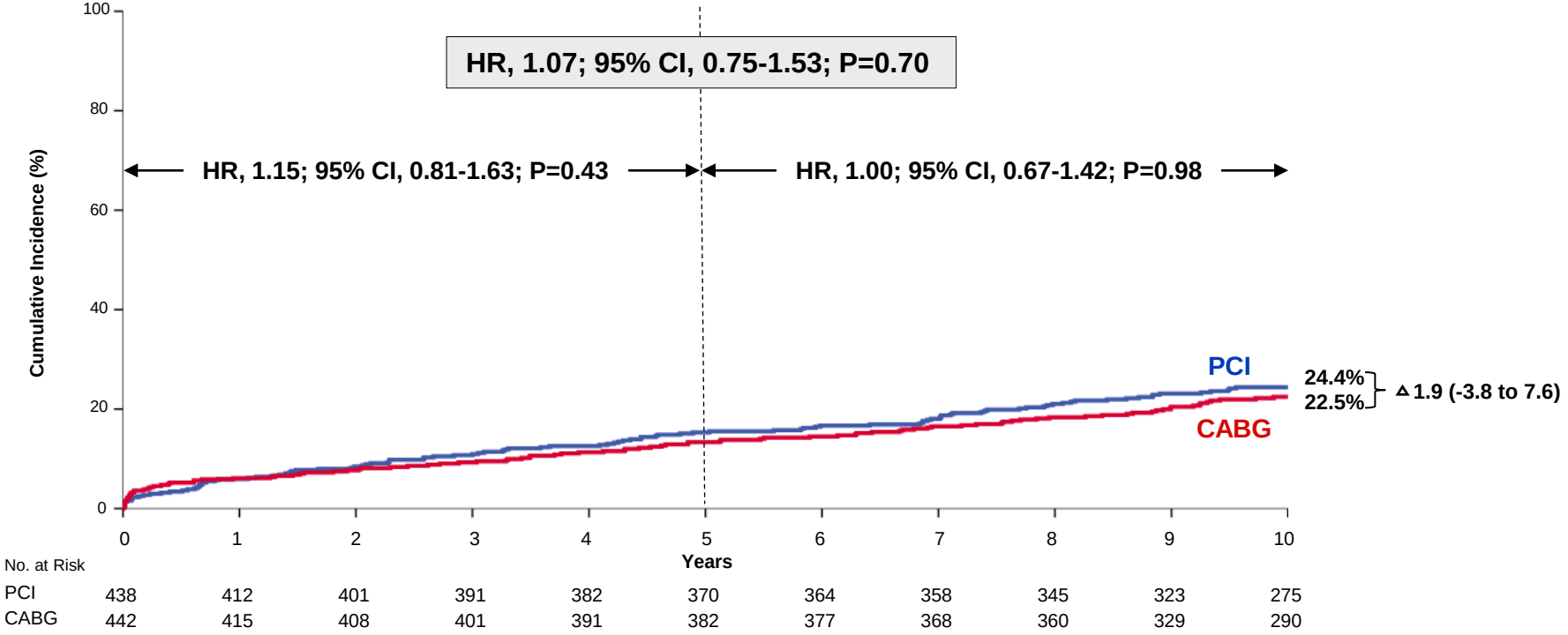
Death, MI, or Stroke



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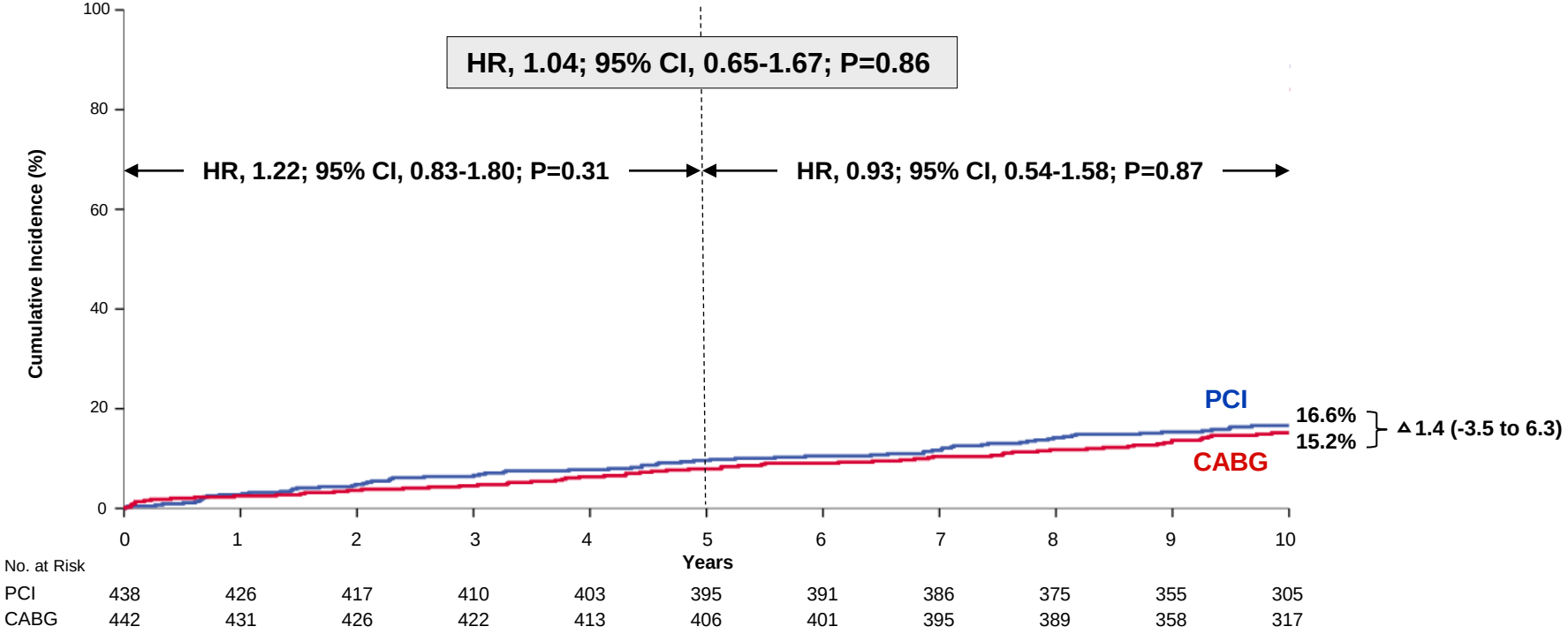
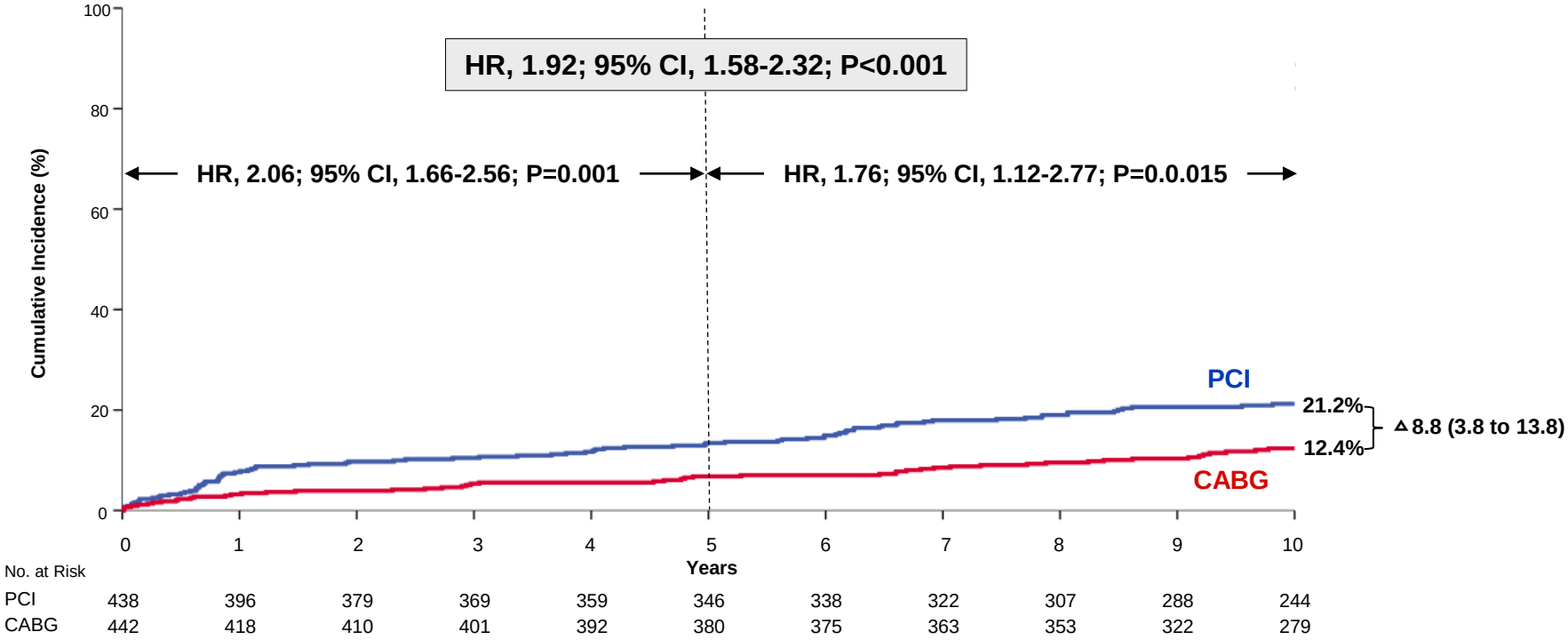
Death from Any Cause



Any Repeat Revascularization



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Long-Term Outcomes*

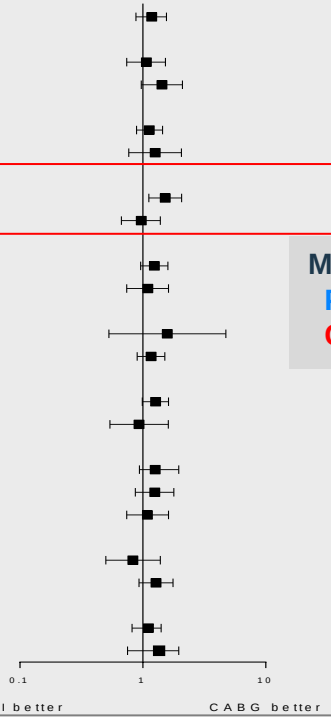
End points	PCI (N=438)	CABG (N=442)	Hazard ratio† (95% CI)	P-value
Primary End Points: Death, MI, or TVR	151 (34.5)	134 (30.3)	1.18 (0.88-1.56)	0.26
Secondary End Points				
Death from any cause	90 (20.5)	88 (19.9)	1.04 (0.65-1.67)	0.86
Myocardial Infarction	34 (7.8)	22 (5.0)	1.57 (0.91-2.68)	0.10
Spontaneous MI	31 (7.1)	17 (3.8)	1.86 (1.06-3.27)	0.03
Target Vessel Related	11 (2.5)	8 (1.8)	1.40 (0.86-2.28)	0.18
Non-Target Vessel Related	20 (4.6)	9 (2.0)	2.27 (0.97-5.31)	0.06
Stroke	23 (5.3)	25 (5.7)	0.94 (0.62-1.42)	0.76
Death, or Myocardial Infarction	110 (25.1)	105 (23.8)	1.07 (0.73-1.56)	0.74
Any Repeat Revascularization	99 (22.6)	56 (12.7)	1.92 (1.58-2.32)	<0.001
Target Vessel Revascularization	59 (13.5)	42 (9.5)	1.47 (1.12-1.93)	0.005
Target Lesion Revascularization	46 (10.5)	37 (8.4)	1.28 (0.90-1.82)	0.16
Non-target Lesion Revascularization	71 (16.2)	26 (5.9)	2.94 (1.99-4.34)	<0.001
Death, MI, Stroke, or Any Repeat Revascularization	194 (44.3)	155 (35.1)	1.36 (1.14-1.63)	<0.001

*Percentages are crude rates on the basis of all available follow-up data and are from the intention-to-treat analysis.

†Hazard ratios and 95% confidence intervals (CIs) were assessed for events on the basis of all available follow-up data.

Subgroup Analysis

Subgroup	Primary End Point		Hazard Ratio (95% CI)	P value for Interaction
	PCI	CABG		
	n / total n. (%)			
Overall	151/438 (34.5)	134/442 (30.3)	1.18 (1.88-1.56)	-
Age				0.18
≥65 yr	88/229 (38.4)	91/252 (36.1)	1.07 (0.74-1.53)	
<65 yr	63/209 (30.1)	43/190 (22.6)	1.43 (0.97-2.10)	
Sex				0.59
Male	101/304 (33.2)	98/325 (30.2)	1.13 (0.89-1.45)	
Female	50/134 (37.3)	36/117 (30.8)	1.26 (0.77-2.06)	
Diabetes				0.009
Yes	76/177 (42.9)	59/186 (31.7)	1.52 (1.12-2.07)	
No	75/261 (28.7)	75/256 (29.3)	0.97 (0.67-1.39)	
ACS				
Yes	87/228 (38.2)	76/238 (31.9)		
No	64/210 (30.5)	58/204 (28.4)		
Ejection fraction				
≤40%	13/17 (76.5)	11/17 (64.7)		
>40%	138/421 (32.8)	123/425 (28.9)		
Vascular extent				0.22
3VD	126/330 (38.2)	111/349 (31.8)	1.27 (0.99-1.62)	
2VD	25/108 (23.1)	23/93 (24.7)	0.93 (0.54-1.61)	
SYNTAX score				0.42
Score≥33	27/66 (40.9)	27/79 (34.2)	1.26 (0.94-1.69)	
Score 23-32	66/187 (35.3)	54/177 (30.5)	1.25 (0.87-1.79)	
Score≤22	58/185 (31.4)	53/186 (28.5)	1.09 (0.74-1.62)	
EuroSCORE				0.038
≥6	22/51 (43.1)	29/59 (49.2)	0.83 (0.50-1.39)	
<6	129/387 (33.3)	105/383 (27.4)	1.28 (0.93-1.76)	
Complete Revascularization				0.43
Yes	70/215 (32.6)	86/295 (29.2)	1.09 (0.83-1.42)	
No	79/215 (36.7)	39/122 (32.0)	1.27 (0.80-2.00)	



Mortality in DM at 10 Years

PCI: 26.0%

CABG: 27.4%

P=0.87

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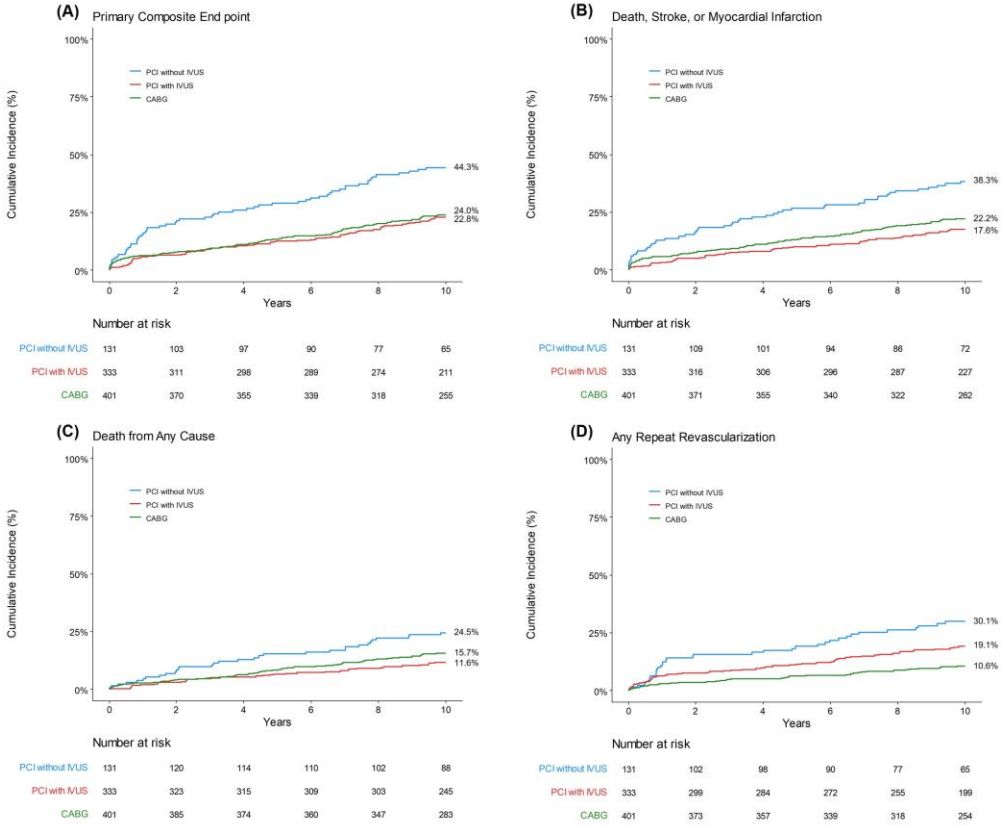
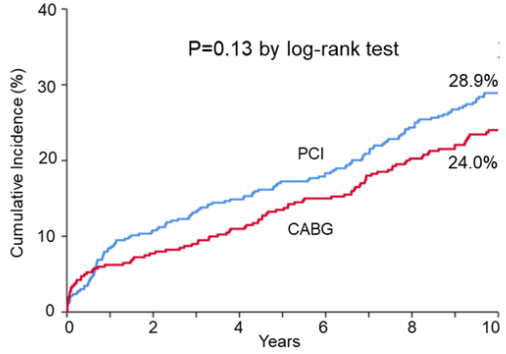
PCI with Intravascular Imaging vs. CABG

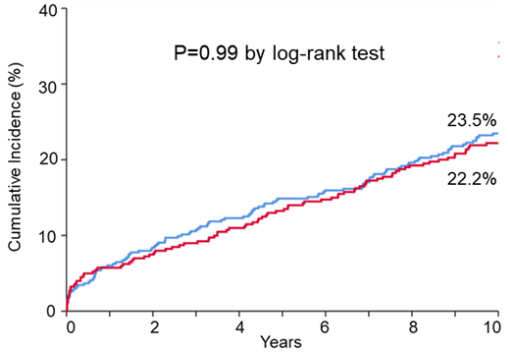


As-Treated Analysis

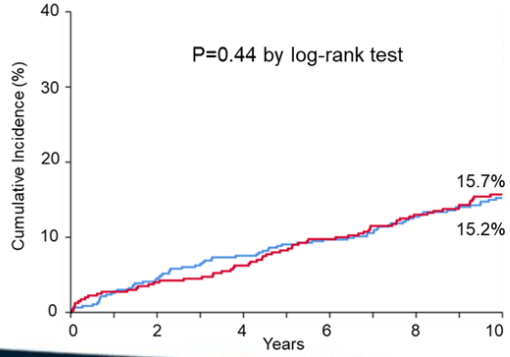
Primary End Point



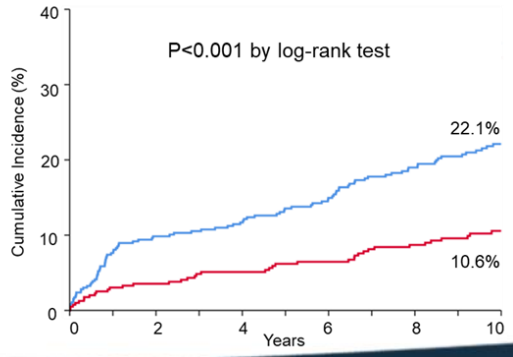
Death,MI, Stroke



Death from Any Cause



Any Repeat Revascularization



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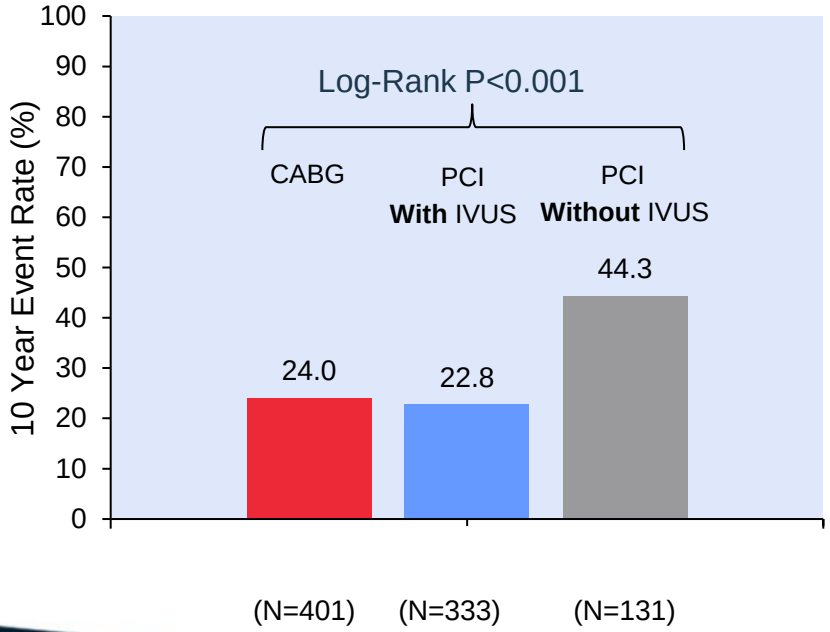
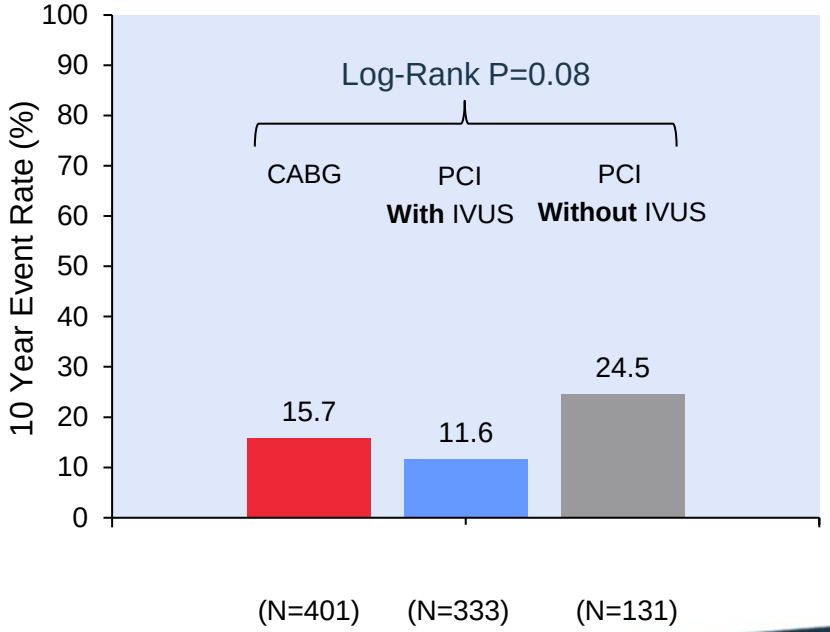
PCI with Intravascular Imaging vs. CABG

IVUS was used in 71.8%

Primary End Point



Death from Any Cause



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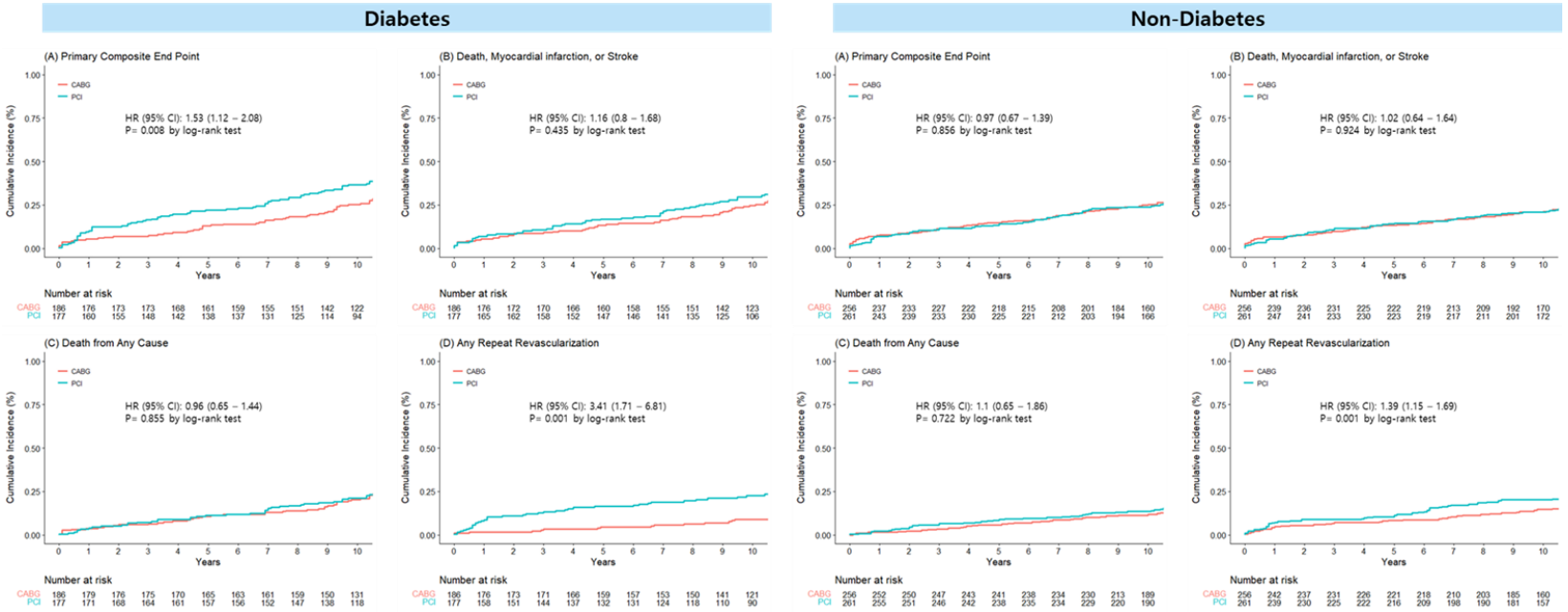
Diabetes Subgroup



CRF TCT

Limitation

- The original trial was prematurely terminated. And the statistical power for clinical end point would be insufficient although long-term follow-up may partially compensate for such a limitation.
- This was open-label trial, hence clinical outcomes may be influenced by knowledge of treatment allocation.
- The only patients in which clinical and procedural equipoise between CABG and PCI was assumed were included. The results of randomized trials are not generalizable to a broad spectrum of patients with diverse clinical and lesion complexity. Therefore, a heart team discussion is crucial and revascularization strategy should be individualized in the real-world practice.
- The proportion of patients with high Syntax score was low (16.5%).

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Conclusions

- In the BEST trial, 2nd generation EES was the default stent platform and IVUS was used in 71.8% of patients who underwent PCI.
- During a median follow-up of 11.8 years, there were no significant differences between PCI and CABG in the incidence of the composite of death from any cause, MI, or TVR, and in mortality.
- The incidence of spontaneous MI and repeat revascularization was higher in the PCI as compared with the CABG group.
- The extended follow-up of the BEST trial provides important long-term insights that could aid in decision-making for the optimal revascularization strategy in patients with multivessel coronary artery disease.

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