

Are Outcomes Following Coronary Artery Bypass Graft Surgery for Left Main Disease Improving Over the Last Decade?

A propensity-matched analysis from the EXCEL and SYNTAX randomized trials

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**on behalf of the SYNTAX and EXCEL investigators*



Disclosure Statement of Financial Interest

Patrick W. Serruys, MD. PhD.

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship

- *Grant/Research Support*
- *Consulting Fees/Honoraria*

Company

- *Abbott*
- *Biosensors*
- *Medtronic*
- *Philips/Volcano*
- *Sinomedical Sciences Technology*
- *SMT*
- *Qualimed*
- *St. Jude Medical*
- *Xeltis*

CABG and PCI

- ***Facts:***
 - ***New techniques and devices have been developed for PCI***
 - ***New techniques for CABG have been introduced.***
 - ***Outcomes of patients undergoing PCI has improved over time ****

CABG and PCI

- ***Facts:***

- *New techniques and devices have been developed for PCI*
- *New techniques for CABG have been introduced.*
- *Outcomes of patients undergoing PCI has improved over time*

- ***Unknown:***

- *Remains unclear whether the clinical outcomes following CABG surgery have improved over time **

Objectives

**We sought to determine whether there was improvement of clinical outcomes in patients undergoing CABG to treat left main stem coronary artery disease in the last decade, using two major randomized clinical trials:
SYNTAX and EXCEL**

Methods

- **This is a post-hoc, propensity-matched analysis of patients randomized to perform CABG for treating left main stem coronary artery disease in the SYNTAX and EXCEL trials**
- **Matching was conducted using the baseline characteristics age, sex, body mass index, smoking status, presence of diabetes, heart failure, hyperlipidemia, hypertension, previous myocardial infarction, prior cerebrovascular accident, chronic obstructive pulmonary disease, peripheral vascular disease, pulmonary hypertension, creatinine > 1.7 mg/dl, SYNTAX score as assessed by core laboratory.**

Population - Trials

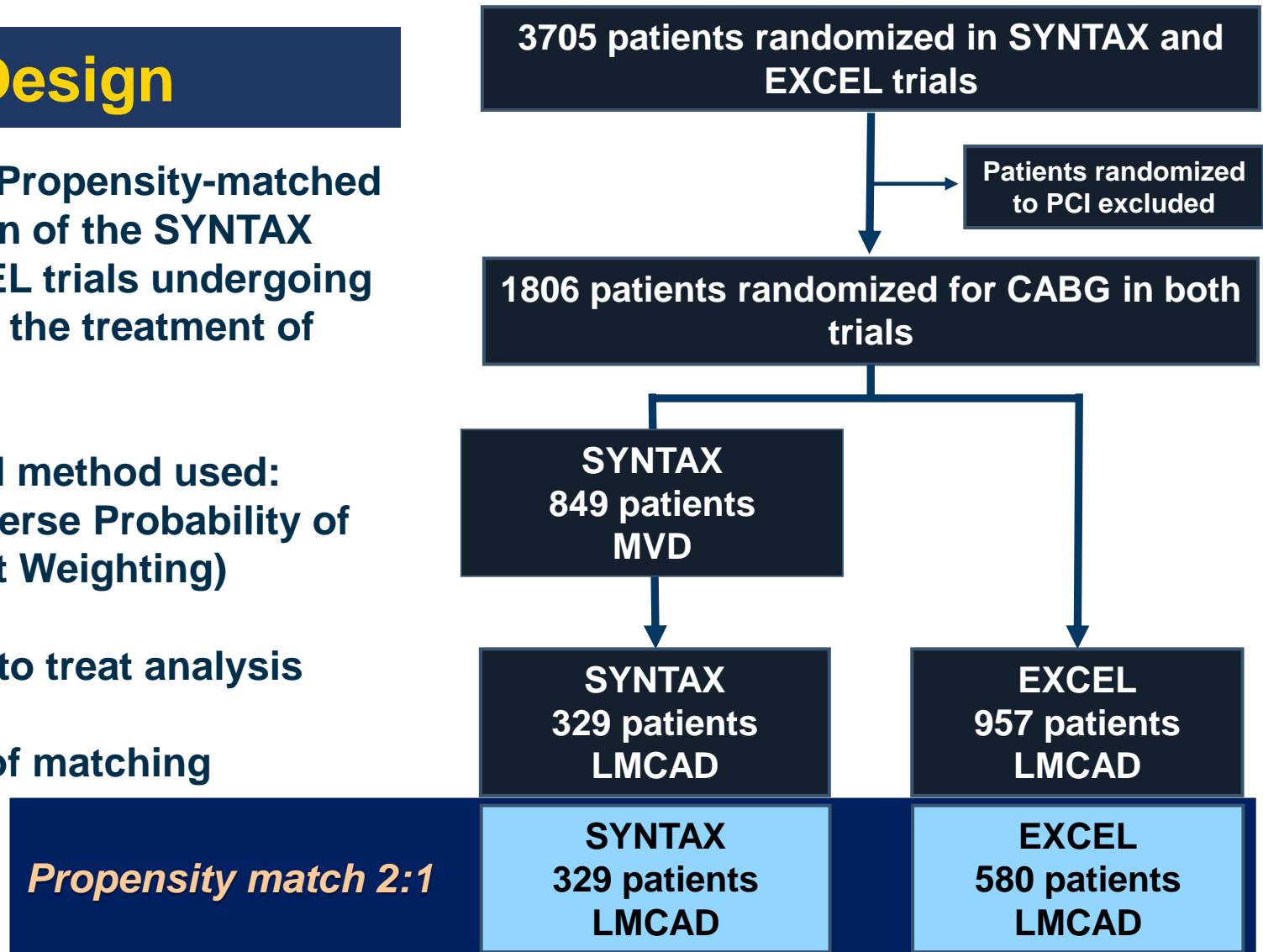
	SYNTAX	EXCEL
Randomization period	2005 – 2007	2010 – 2014
Sample size (CABG arm)	897 patients	957 patients
Coronary artery disease	Multivessel disease with or without LMCAD	LMCAD with or without MVD
Subjects with LMCAD	329 patients	957 patients
Complexity	unrestricted	Limited to Syntax score less than 32*

*site reported

Study flowchart

Design

- **DESIGN:** Propensity-matched population of the SYNTAX and EXCEL trials undergoing CABG for the treatment of LMCAD
- **Statistical method used:** IPTW (Inverse Probability of Treatment Weighting)
- **Intention to treat analysis**
- **2:1 ratio of matching**



Results – baseline characteristics

	SYNTAX (n=329)	EXCEL (n=580)	p-value
Age (years)	65.3 ± 10.1	65.5 ± 9.5	0.67
Male sex	76.0%	75.3%	0.83
Body Mass Index (kg/m ²)	27.8 ± 5.1	28.1 ± 4.7	0.35
Systolic Blood Pressure (mmHg)	135.8 ± 21.4	131.9 ± 17.6	0.003
Diastolic Blood Pressure (mmHg)	74.4 ± 12.4	73.2 ± 11.4	0.11
Smoking History			0.70
Current or Former Smoker	69.9%	67.2%	0.41
Current Smoker	24.6%	23.3%	0.65
Former Smoker	45.3%	44.0%	0.70
Diabetes Mellitus	26.1%	27.1%	0.76
Exercise/Diet Alone	3.3%	1.7%	0.12
Medically Treated	22.8%	25.3%	0.39
Insulin	10.3%	7.1%	0.09
Oral Agents	16.4%	21.2%	0.08
Insulin and Oral Agents	4.0%	2.9%	0.41
Insulin Alone	6.4%	4.1%	0.13
Oral Agents Alone	12.5%	18.3%	0.02
Congestive Heart Failure	4.9%	5.3%	0.75
Hyperlipidemia	75.1%	77.4%	0.42
Hypertension	75.7%	75.3%	0.91
Family History of CAD	29.5%	62.9%	<0.0001
Previous MI	23.4%	21.7%	0.56
Previous TIA or CVA	6.7%	6.4%	0.86
Previous TIA	3.3%	3.5%	0.92
Previous CVA	4.0%	3.3%	0.60
COPD	9.1%	9.7%	0.79
PVD	11.6%	9.8%	0.41
Carotid Artery Disease	8.8%	7.9%	0.65
Pulmonary Hypertension	1.2%	0.9%	0.60
Creatinine >1.7 mg/dL	2.4%	2.4%	0.99
Dialysis	0.6%	0.3%	0.56
Previous Cardiac Surgery	0.3%	0.0%	0.18
Critical Pre-Procedural State	1.8%	1.6%	0.76
LVEF (%)	58.8 ± 12.7	57.6 ± 8.9	0.14

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Pre-procedural, anatomical and angiographic characteristics

	SYNTAX (n=329)	EXCEL (n=580)	p-value
Days from Randomization to Index Procedure	15.1 ± 28.4	6.2 ± 8.9	<0.0001
Days of In-Patient Hospitalization	13.5 ± 9.6	12.3 ± 8.4	0.059
Critical Pre-Procedural State	1.8%	1.6%	0.76
Revascularization Priority			<0.0001
Emergent	4.1%	11.0%	0.0004
Urgent	6.6%	35.8%	<0.0001
Elective	89.4%	53.3%	<0.0001
Diseased Vessels			
Presence of LMCAD	100.0%	100.0%	-
Left main only	14.3%	13.4%	0.72
Left main + 1 vessel disease	20.1%	31.3%	0.0003
Left main + 2 vessel disease	31.3%	37.8%	0.05
Left main + 3 vessel disease	34.3%	17.4%	<0.0001
SYNTAX Score (core lab)	29.3 ± 11.9	28.3 ± 10.1	0.16
SYNTAX Score II (CABG)	31.5 ± 11.5	31.2 ± 10.2	0.62

Pre-procedural, anatomical and angiographic characteristics

	SYNTAX (n=329)		EXCEL (n=580)	p-value
Days from Randomization to Index Procedure	15.1 ± 28.4	<	6.2 ± 8.9	<0.0001
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Elective	89.4%	>	53.3%	<0.0001
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Procedural characteristics

	SYNTAX (n=329)	EXCEL (n=580)	p-value
Procedure Duration (min)*	202.0 ± 67.6	195.8 ± 64.5	0.18
Bypass Duration (min)	81.9 ± 37.4	85.8 ± 48.8	0.28
Cross Clamp Duration (min)	51.2 ± 26.4	54.9 ± 26.5	0.09
Procedure Related Factors			
Off Pump	15.4%	29.6%	<0.0001
Crystalloid Cardioplegia	31.7%	32.7%	0.76
Blood Cardioplegia	52.0%	64.7%	0.0006
Need for inotropic agents >48 hours	10.3%	11.7%	0.55
Hemodynamic Support Device	3.4%	2.8%	0.61
Ventricular Assist Device	0.0%	0.2%	0.45
Intra-aortic Balloon Pump	3.4%	2.7%	0.50
Total Arterial Conduits	1.3 ± 0.6	1.4 ± 0.6	0.08
Total Venous Conduits	1.3 ± 0.9	1.3 ± 1.0	1.00
Any IMAs Used	96.9%	98.6%	0.08
LIMA	96.6%	97.3%	0.51
In Situ	98.7%	94.4%	0.002
Free	1.6%	6.0%	0.003
RIMA	23.8%	25.3%	0.61
In Situ	76.3%	66.4%	0.13
Free	23.7%	33.6%	0.13
Both IMAs Used	23.4%	25.3%	0.53
Any Radial Artery Used	10.3%	5.7%	0.01

*From skin incision to closure. IMA: internal mammary artery, LIMA: left internal mammary artery, RIMA: right internal mammary artery.

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Cross Clamp Duration (min)	51.2 ± 26.4		54.9 ± 26.5	0.09
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Results – 30-day outcomes

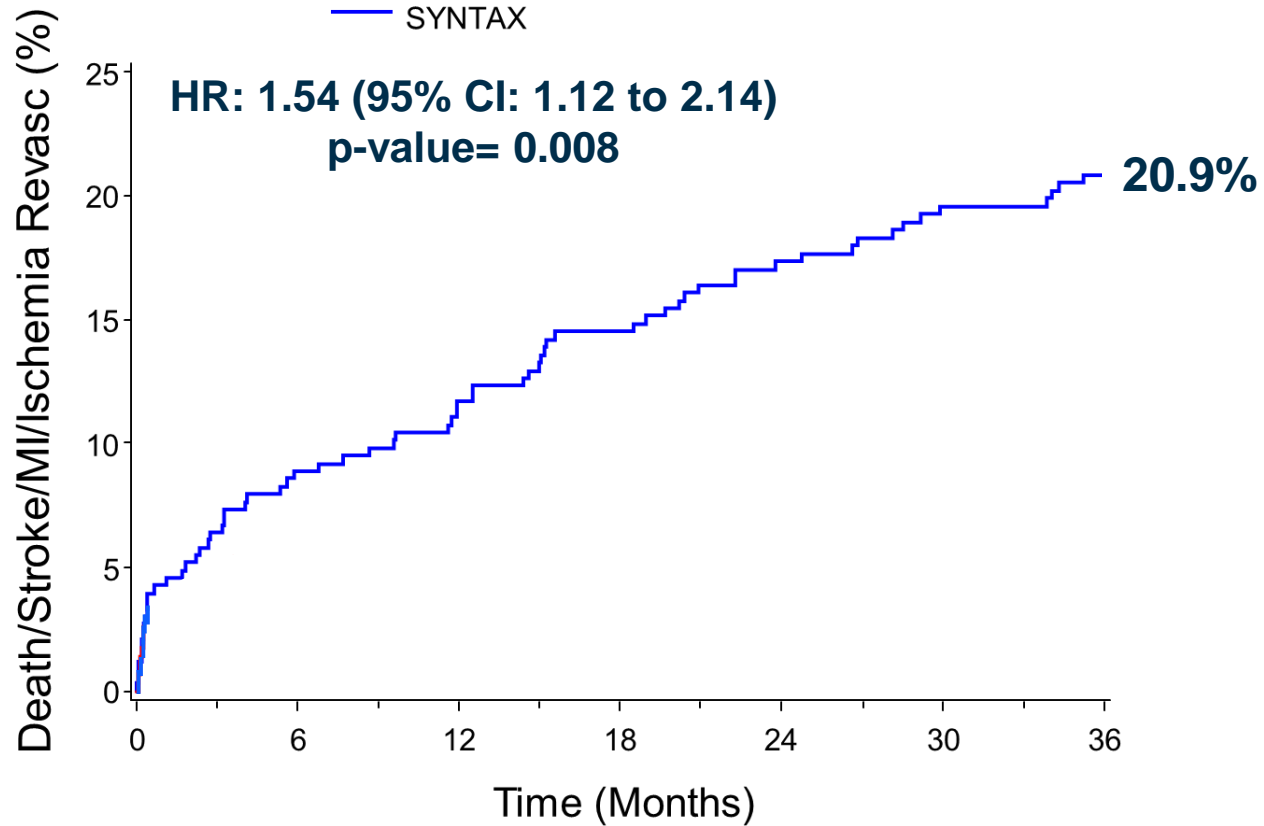
	SYNTAX (n=329)	EXCEL (n=580)	p-value
Composite Endpoints			
Death, MI, Stroke or IDR	4.3%	3.5%	0.54
Death, MI or Stroke	4.3%	2.8%	0.23
Death			
All Cause	0.9%	0.7%	0.72
Cardiovascular	0.9%	0.7%	0.72
Myocardial Infarctions (MI)			
Any	3.0%	1.4%	0.09
Peri-procedural	2.7%	1.2%	0.09
Spontaneous	0.0%	0.2%	0.45
Cerebrovascular Events			
Any	1.8%	1.0%	0.32
Stroke	1.2%	1.0%	0.81
Ischemic	0.9%	0.9%	0.94
Hemorrhagic	0.3%	0.2%	0.69
TIA	0.6%	0.0%	0.06
Revascularizations			
Any	2.1%	0.9%	0.11
Ischemia Driven (IDR)	0.9%	0.9%	0.94
Graft Occlusion	0.3%	1.0%	0.22

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Any	2.1%	0.9%	0.11
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Graft Occlusion	0.3%	1.0%	0.22

Primary endpoint

Death / Stroke / MI / Ischemia driven revascularization

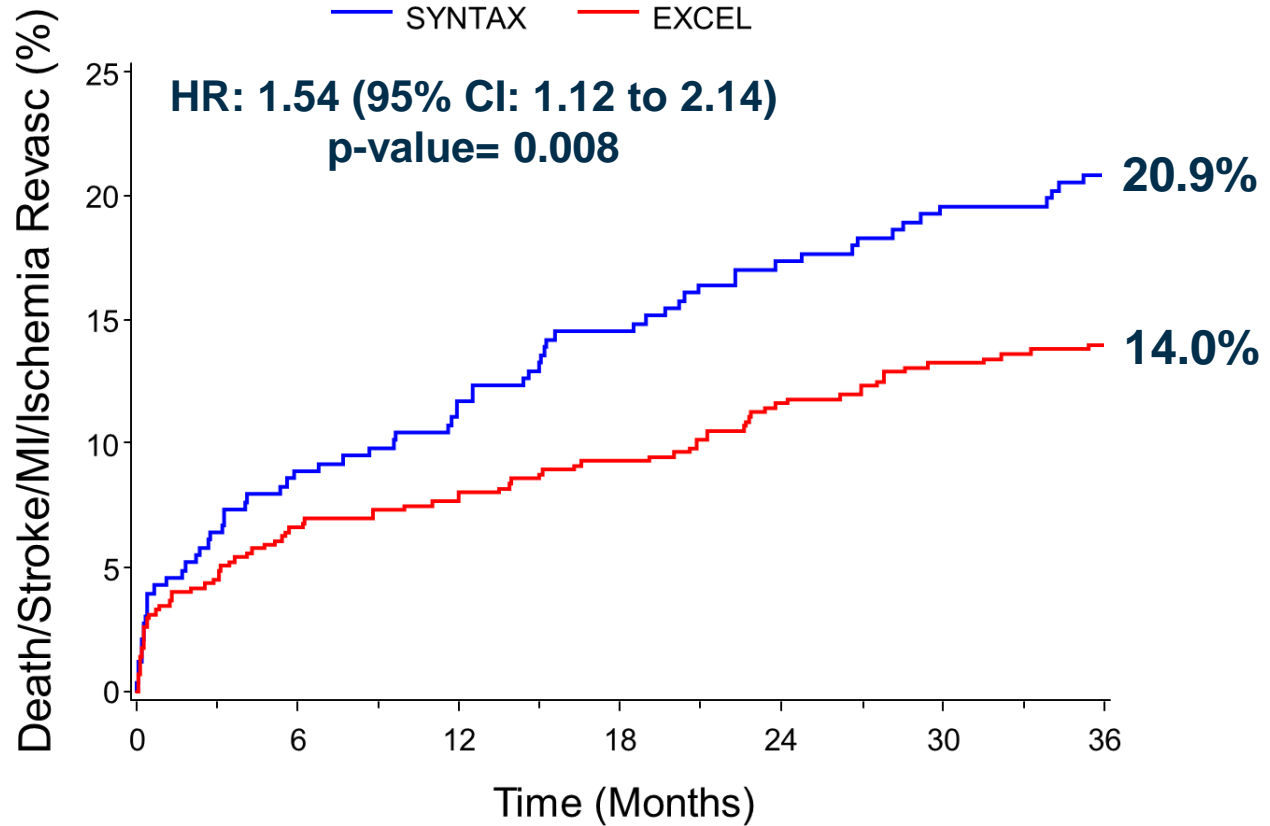


Number at risk:

SYNTAX	329	294	282	272	261	252	248
EXCEL	580	530	519	506	492	476	461

Primary endpoint

Death / Stroke / MI / Ischemia driven revascularization

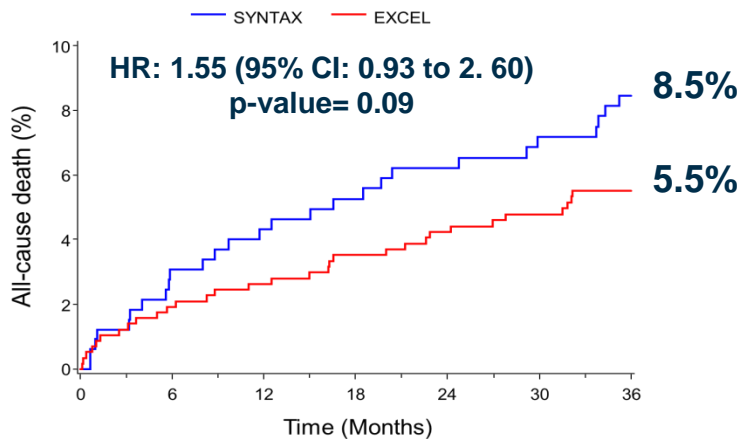


Number at risk:

	0	6	12	18	24	30	36
SYNTAX	329	294	282	272	261	252	248
EXCEL	580	530	519	506	492	476	461

Individual components

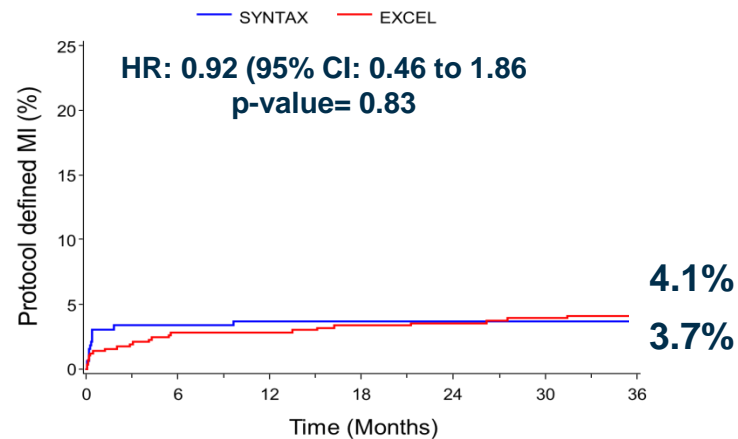
A



Number at risk:

SYNTAX	329	313	305	300	295	290	286
EXCEL	580	557	549	538	533	521	505

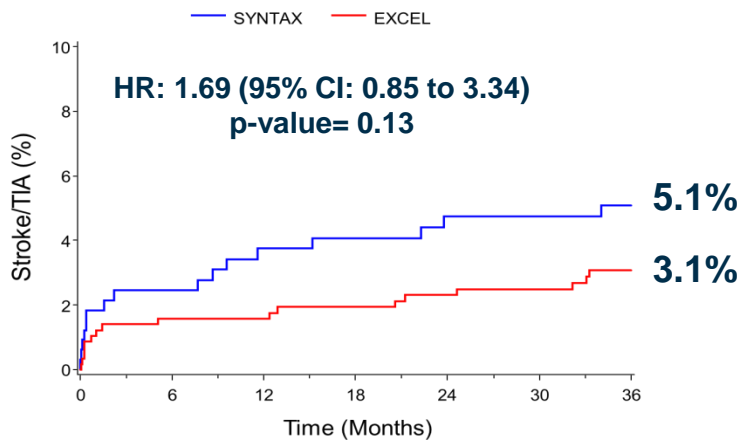
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Number at risk:

SYNTAX	329	305	298	293	288	283	279
EXCEL	580	542	535	523	518	505	489

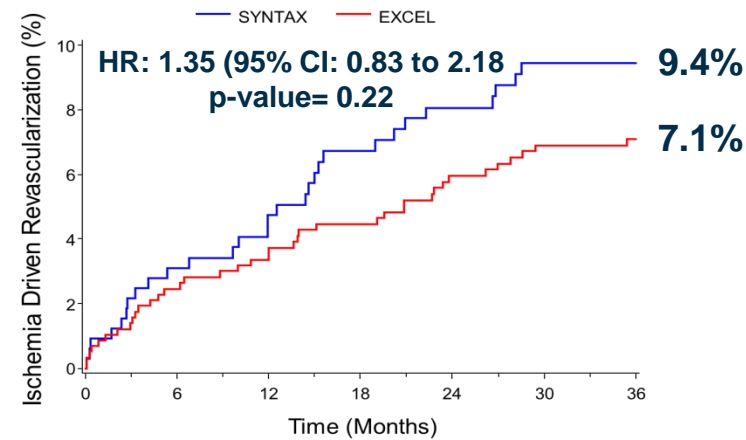
B



Number at risk:

SYNTAX	329	305	296	291	284	279	274
EXCEL	580	551	543	531	524	512	495

D



Number at risk:

SYNTAX	329	303	290	280	271	262	259
EXCEL	580	544	530	516	503	488	473

Summary – procedure related findings

- *Over the 5 to 7-year period separating both trials we could observe:*
 - *Increase in off-pump procedures*
 - *Little (non-significant, $p=0.059$) decrease in in-hospital patient stay*
 - *Longer cross clamp time (not significant, $p=0.09$)*
 - *Less use of radial artery as a graft.*

Conclusions

- *Comparing surgical outcomes in the historical SYNTAX trial and the contemporary EXCEL trial in patients with LM disease over a 5-7-year period, CABG outcomes at 30 days did not differ*
- *However at 3 years there was significant improvement in event-free survival, consistent with improving results over time with cardiac surgery.*
- **With the time difference between the trials and obvious difference in variables such as medication intake, surgical technique, etc, no conclusion can be made on which particular variable might be responsible for the improvement in outcome.**

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Contemporary Outcomes Following Coronary Artery Bypass Graft Surgery for Left Main Disease

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ABSTRACT

BACKGROUND Although results of percutaneous coronary intervention (PCI) have been steadily improving, whether surgical outcomes have improved over time is not fully elucidated.

OBJECTIVES The authors sought to compare the current outcomes of patients undergoing coronary artery bypass grafting (CABG) with prior surgical results, in the context of randomized trials including the left main coronary artery (LM) stem.

METHODS The authors performed a propensity-matched analysis of patients randomized to CABG in the SYNTAX (Synergy Between PCI With Taxus and Cardiac Surgery) (enrollment period 2005 to 2007) and EXCEL (Evaluation of XIENCE Versus Coronary Artery Bypass Surgery for Effectiveness of Left Main Revascularization) (enrollment period 2010