Left Main Stratification
SYNTAX Score II and Beyond

Philippe Généreux, MD

Columbia University Medical Center

The Cardiovascular Research Foundation

Hôpital du Sacré-Coeur de Montréal, Québec, Canada

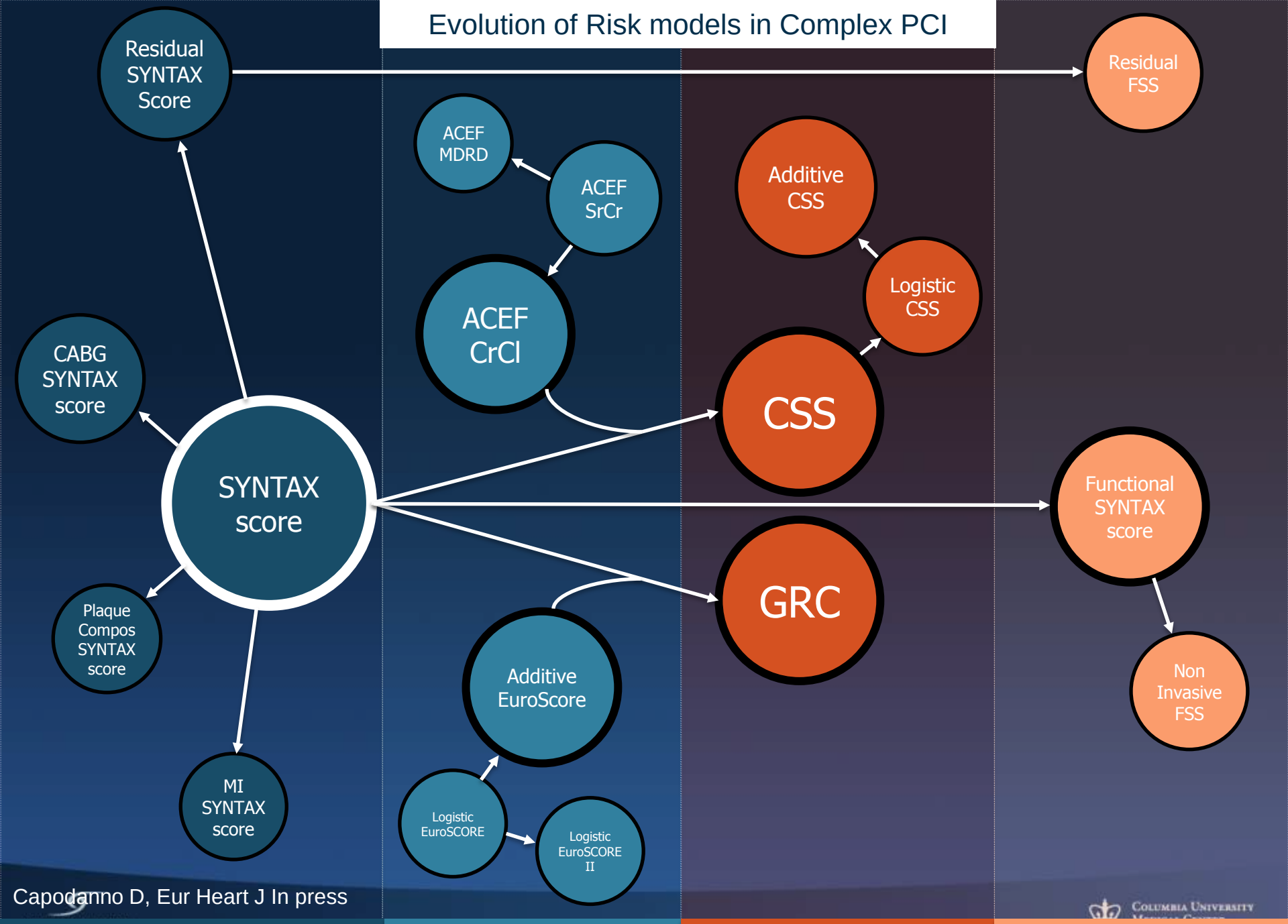
April 2014, TCTAP, Korea, Seoul

Disclosure Statement of Financial Interest

I, *Philippe Généreux,* DO NOT have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

What Scores are available?
How to incorporate them into daily practice?

Evolution of Risk models in Complex PCI



Capodanno D, Eur Heart J In press

Angiographic | Clinical | Combined | Functional

Case Summary

Patient Demographics

- Age: 82
- Gender: Female

Past Medical History

- No Previous CV events

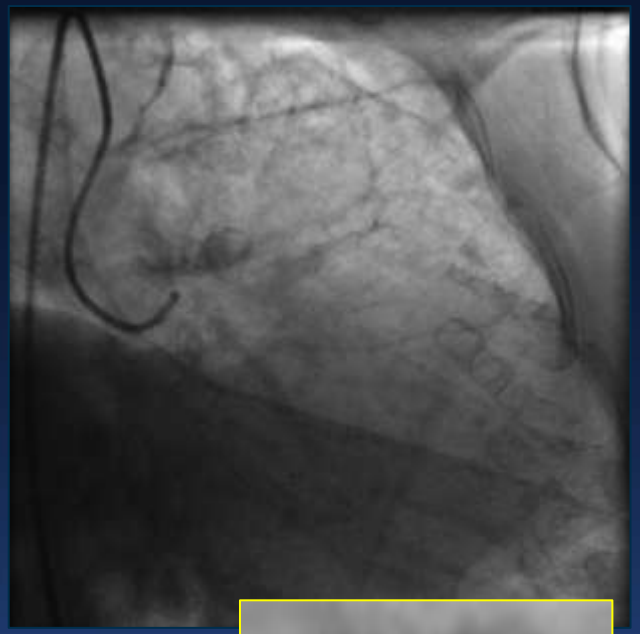
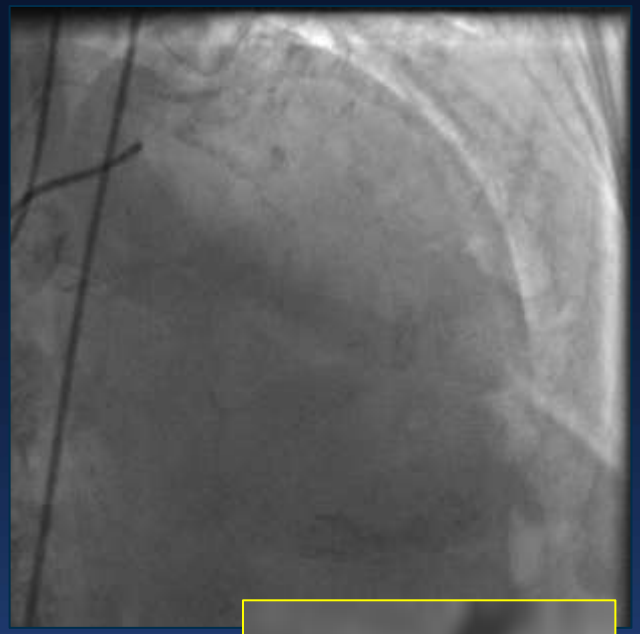
Risk Factors

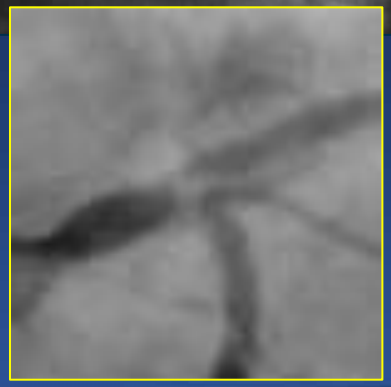
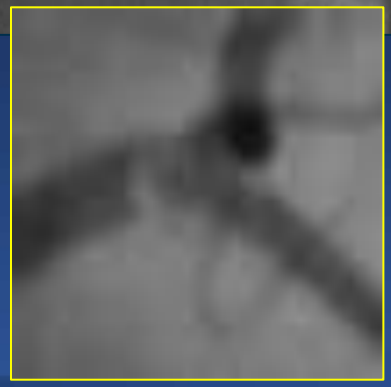
- NIDDM
- Hyperlipidemia
- Hypertension
- Moderate CKD (CrCl 45 ml/min)

Clinical Presentation

- Stable angina (CCS III)
- Inferior and antero-septal reversible SPECT defects
- Echo: LVEF 36%; mild MR

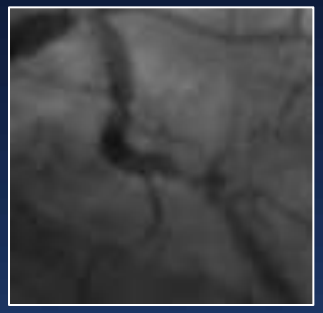
Left Coronary Angiography

Right Coronary Angiography

SYNTAX Score



Left Main

- Segment 5 — 10 points
- Segment 6 — 7 points
- Segment 11 — 3 points
- Medina 1,1,1 — 2 points
- Heavy Calcification — 2 point

Obtuse Marginal

- Segment 12a — 2 points
- Severe Tortuosity — 2 points

Right Coronary Artery

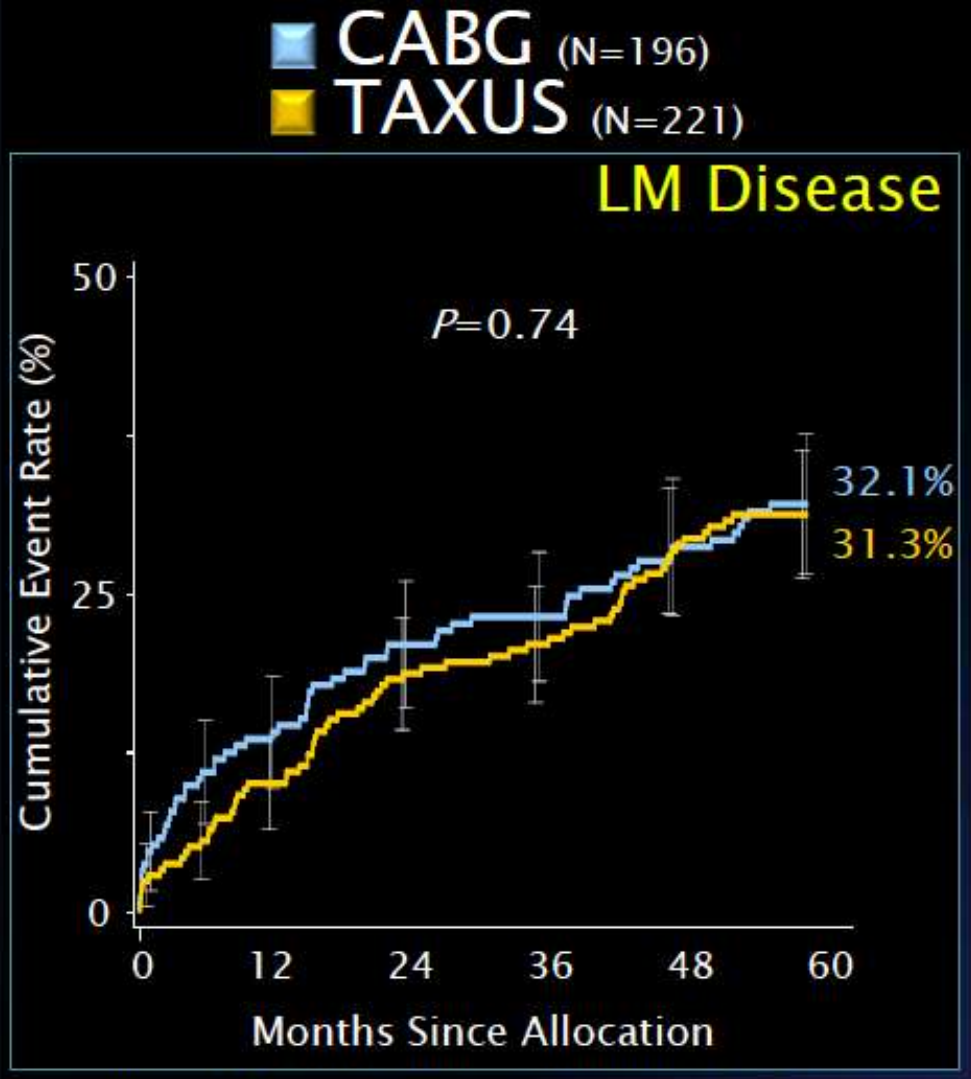
- Segment 2 — 2 points
- Length >20 mm — 1 points

SYNTAX Score

32

MACCE to 5 Years by SYNTAX Score Tercile

LM Subset Low/Intermediate Scores 0–32



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

Cumulative KM Event Rate ± 1.5 SE; log-rank *P* value

Site-reported Data; ITT population

PCI vs. CABG?

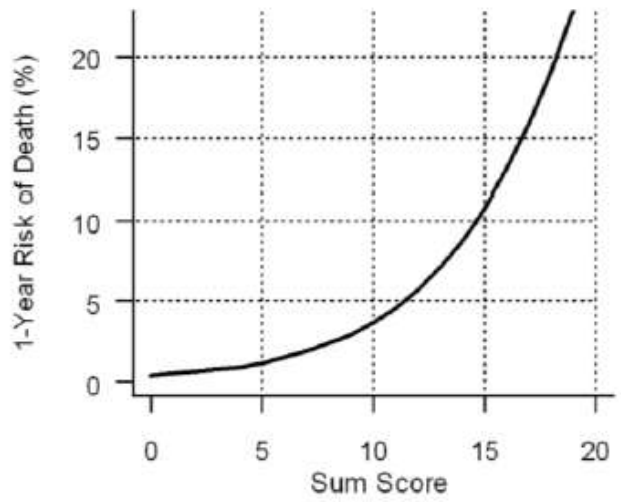
Logistic EuroScore II

Patient related factors			Cardiac related factors		
Age [1] (years)	82	0.66	NYHA	I	0
Gender	female	.2196434	CCS class 4 angina [8]	no	0
Renal impairment [2] *See calculator below for creatinine clearance*	severe (CC <50)	.8592256	LV function	moderate (LVEF 31%–50%)	.3150652
Extracardiac arteriopathy [3]	no	0	Recent MI [9]	no	0
Poor mobility [4]	no	0	Pulmonary hypertension [10]	no	0
Previous cardiac surgery	no	0	**Operation related factors**		
Chronic lung disease [5]	no	0	Urgency [11]	elective	0
Active endocarditis [6]	no	0	Weight of the intervention [12]	isolated CABG	0
Critical preoperative state [7]	no	0	Surgery on thoracic aorta	no	0
Diabetes on insulin	yes	.3542749			
EuroSCORE II	5.12 %				
EuroSCORE II					
Note: This is the 2011 EuroSCORE II	Calculate	Clear			

In-hospital Death With CABG = 5.12%

Logistic Clinical SYNTAX Score

	Points	Score
SYNTAX Score	see below	3
Age (years)	see below	7
CrCl (ml/min)	see below	2
LV Ejection Fraction	see below	6
'SYNTAX-like' Patient*	3	3
Sum Score		**21**



SYNTAX Score	≤ 17	18-22	23-27	28-32	≥ 33			
	0	1	2	3	4			
Age (years)	< 50	50-54	55-59	60-64	65-69	70-74	75-79	≥80
	0	1	2	3	4	5	6	7
CrCl (ml/min)	< 30	30-59	60-89	≥90				
	3	2	1	0				
LV Ejection Fraction (%)	< 30	30-34	35-39	40-44	45-49	≥50		
	10	8	6	4	2	0		

Logit (Death) = -7.5478 + 0.0241 * Sxscore (30) + 0.0396 * age (82) + 0.0748 * (50-LVEF [36])$_+$ + 0.0235 * (90-CrCl [45])$_+$ + 0.3649 * SYNTAX-like (1)

1-Year Death With PCI = 1/[1+exp(-Logit(Death)] = 24.82%

Farooq V. et al. Eur Heart J. 2012;33:3098-104

NERS Score II

Clinical

• Age ≥75 yrs	1.34
• LVEF ≤40%	2.03
• AMI <12 h	3.65
• Cardiogenic shock	4.17
• Diabetes	1.47
• eFGR ≤60 ml/min	1.82
• PAD, DS>70%	1.74

LMT lesions

• Ostial/Body	1.18
• Distal bifurcation/trifurcation	12.90
• Distal nonbifurcation	8.67
• LMT-CTO	13.73
• Severe LM calcification	6.13

Downstream lesions

• RCA/LCX non-CTO lesions	1.27
• LAD non CTO-lesions	5.21
• CTO in LCX or RCA	3.27
• CTO in LAD	5.49

• Age ≥75 yrs	1.34
• LVEF ≤40%	2.03
• Diabetes	1.47
• eGFR ≤60 ml/min	1.82
• eGFR ≤50 ml/min	1.5
• Distal bifurcation/trifurcation	12.90
• RCA/LCX non-CTO lesions	1.27

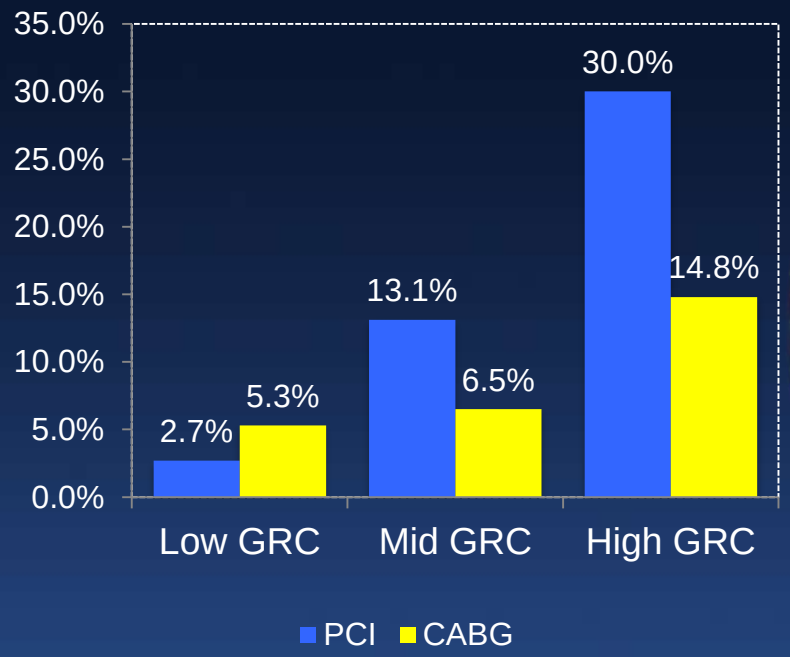
NERS Score II

21.33

1-Year MACE With PCI 30.6%

Global Risk Classification

3-Year Death in the SYNTAX LM PCI Cohort**



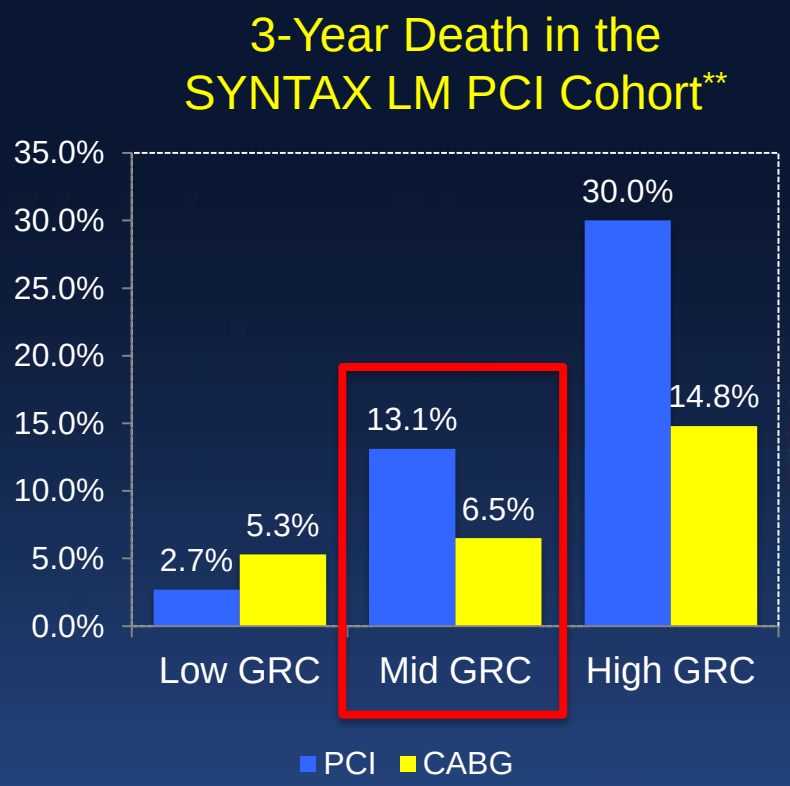
GRC*

EuroSCORE	SYNTAX score ≤22	SYNTAX score 22-32	SYNTAX score ≥32
0-2	Low	Low	Mid
3-5	Low	Low	Mid
≥6	Mid	Mid	High

EuroSCORE	SYNTAX score ≤22	SYNTAX score 22-32	SYNTAX score ≥32
0-2	PCI CABG	PCI CABG	CABG
3-5	PCI CABG	PCI CABG	CABG
≥6	CABG (PCI)	CABG (PCI)	CABG

*Capodanno D, et al. Am Heart J. 2010;159:103-9
*Capodanno D, et al. JACC Intv. 2011;4:287-97
**Serruys et al, JACC Cardiovasc Interv. 2012;5:606-17

Global Risk Classification



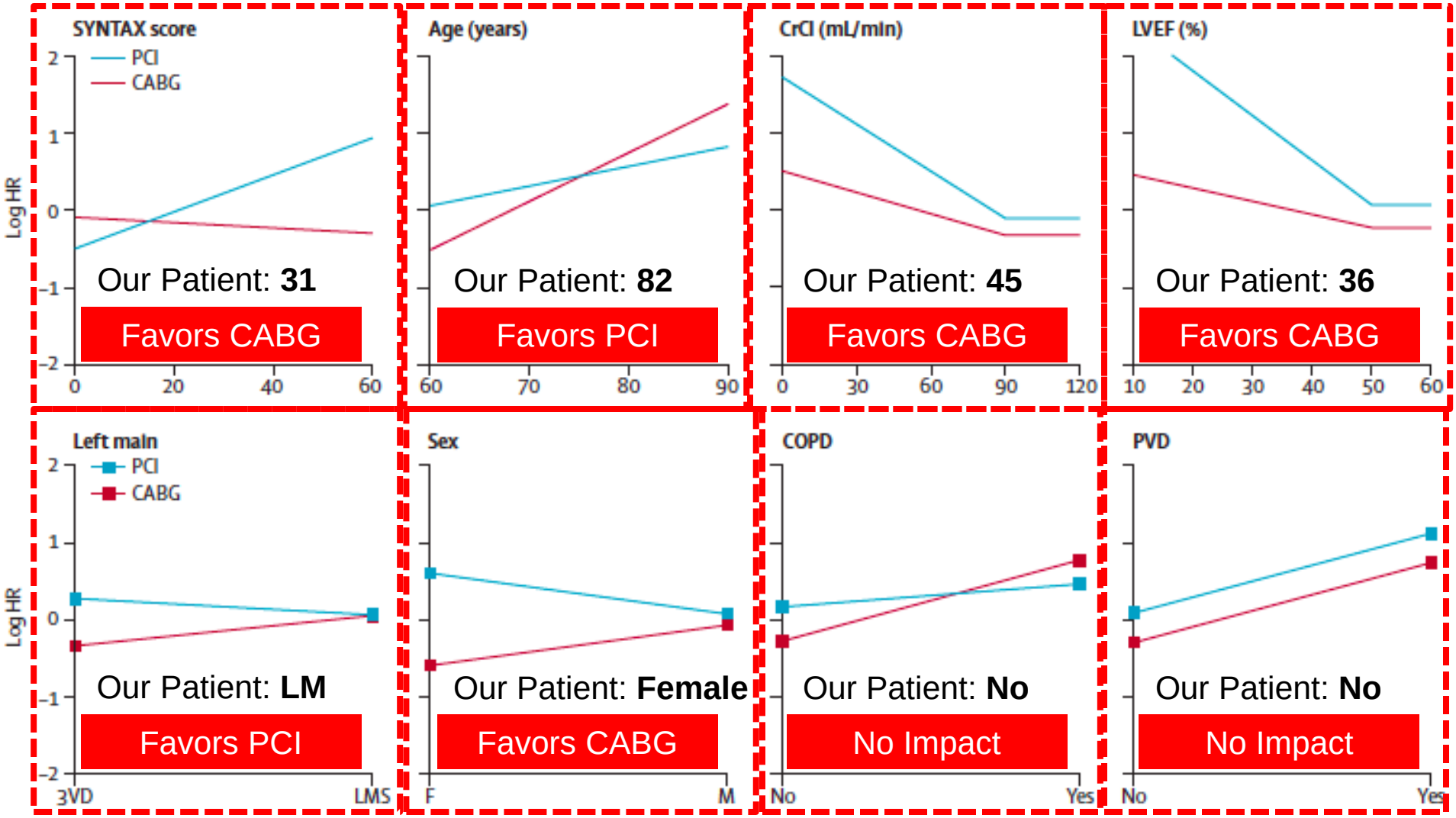
GRC*

EuroSCORE	SYNTAX score ≤22	SYNTAX score 22-32	SYNTAX score ≥32
0-2	Low	Low	Mid
3-5	Low	Low	Mid
≥6	Mid	**Mid**	High

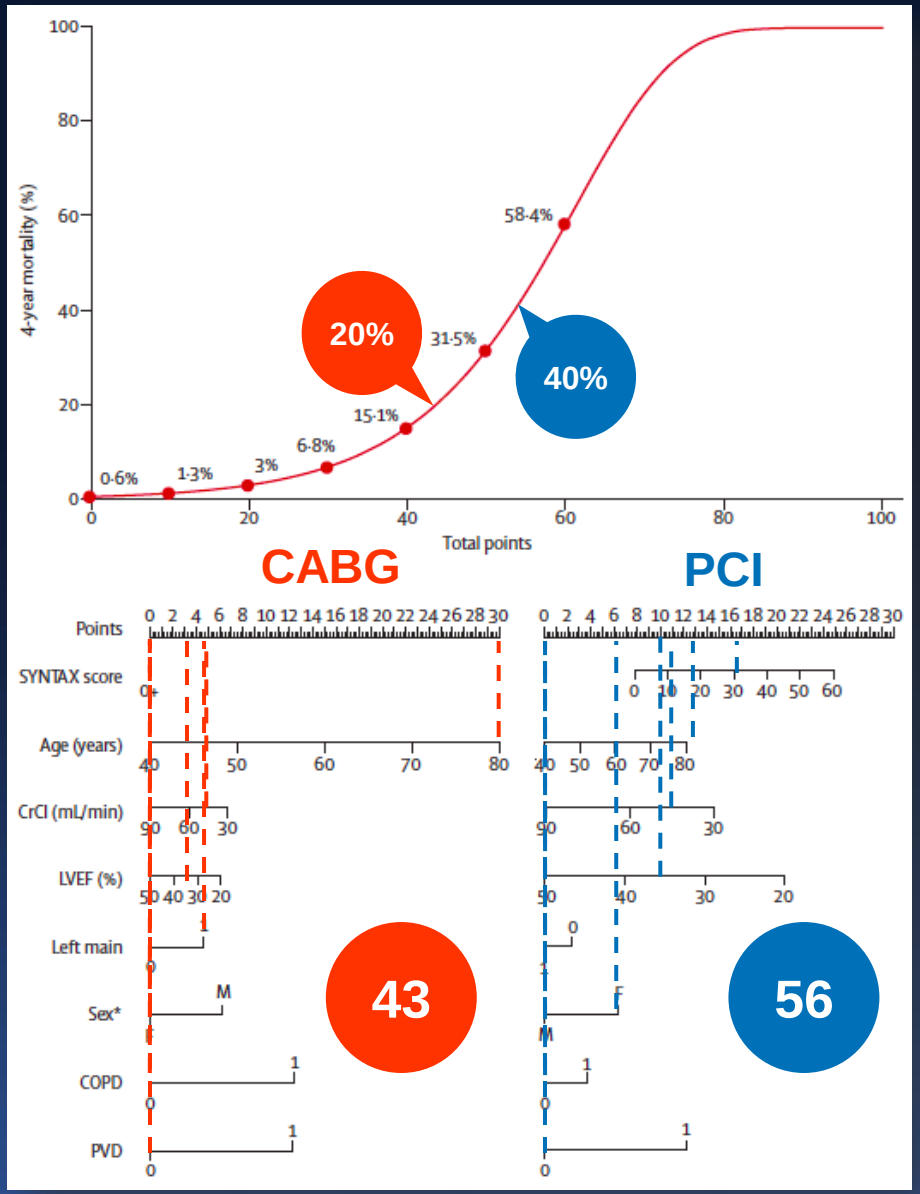
EuroSCORE	SYNTAX score ≤22	SYNTAX score 22-32	SYNTAX score ≥32
0-2	PCI CABG	PCI CABG	CABG
3-5	PCI CABG	PCI CABG	CABG
≥6	CABG (PCI)	**CABG (PCI)**	CABG

*Capodanno D, et al. Am Heart J. 2010;159:103-9
*Capodanno D, et al. JACC Intv. 2011;4:287-97
**Serruys et al, JACC Cardiovasc Interv. 2012;5:606-17

SYNTAX Score II



SYNTAX Score II



4-Year Mortality With PCI

≈40%

4-Year Mortality With CABG

≈20%

Farooq V, et al. Lancet. 2013;381:639-50

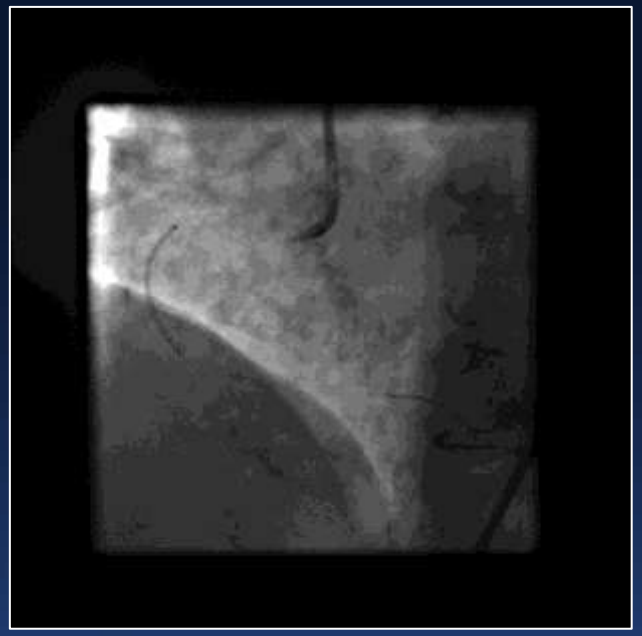
Summary Of Risk Stratification

	PCI	CABG	
SYNTAX Score 5-Year Death	7.9%	15.1%	Favors PCI
Logistic EuroSCORE II In-Hospital Death	-	5.1%	-
Logistic CSS 1-Year Death	24.8%	-	-
NERS Score II 1-Year MACE	30.6%	-	-
Global Risk 3-Year Death	13.1%	6.5%	Favors CABG
SYNTAX Score II 4-Year Death	40.0%	20.0%	Favors CABG

Case Management / 1

Pre-dilation

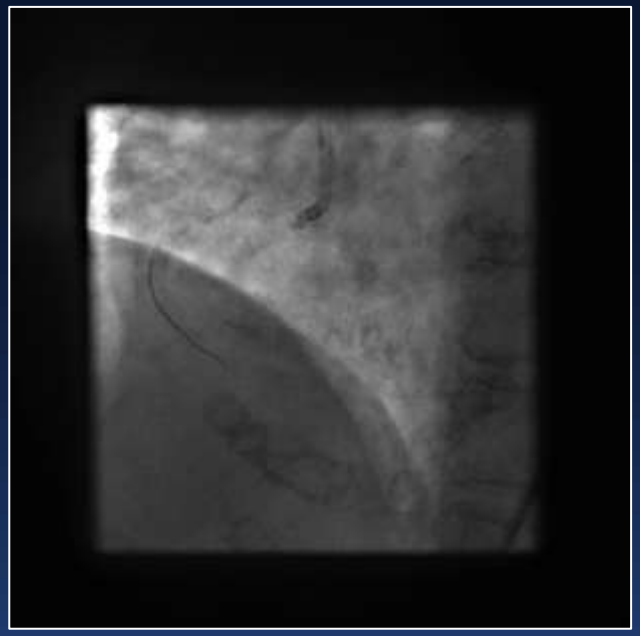
Conic 3.0-2.5/25 mm



Stent BES 3.0/28mm

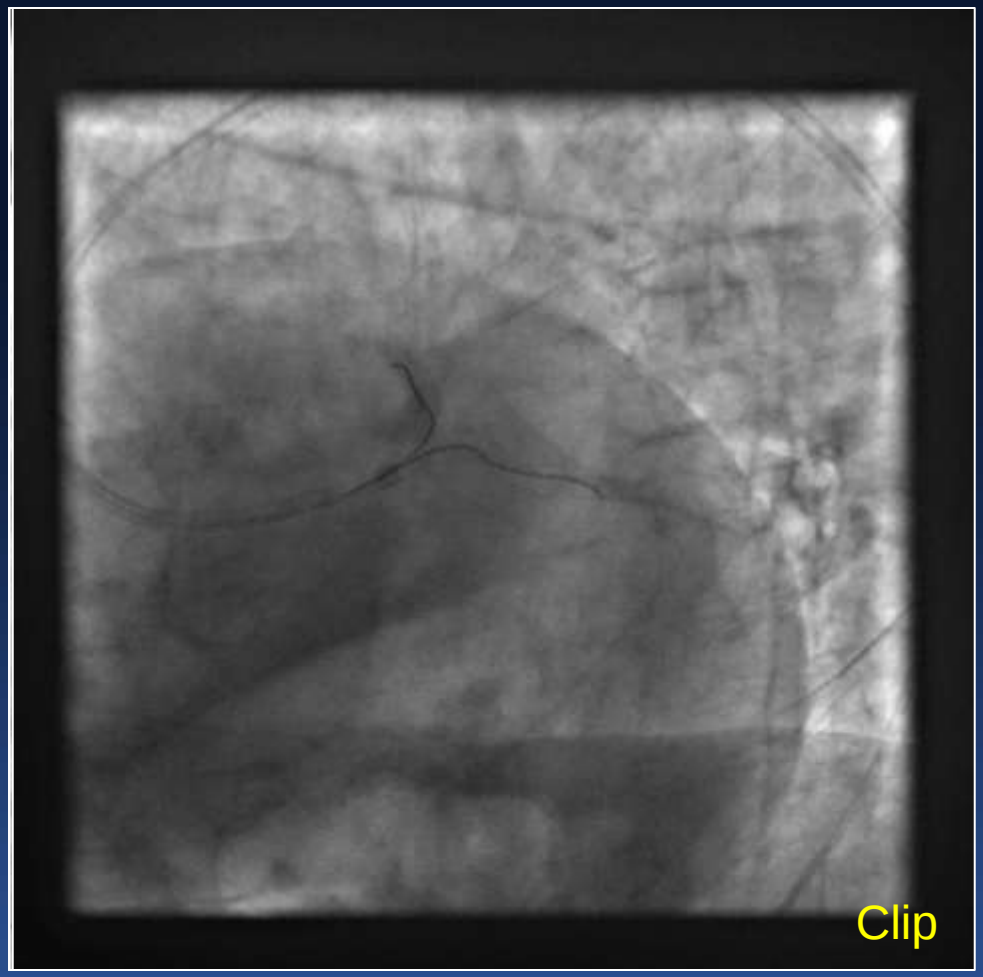
Post-dilation

NC 3.5/20 mm



Final result

Case Management / 2 (Staged PCI)



1. IAPB
2. LM-LAD-LCX pre-dilation
3. OM_1 predilation
4. OM_1 EES 2.5/23mm
5. IVUS (from both LCX and LAD)
6. LM-LAD-LCX lesion preparation
7. Scoring balloon 3.0/15mm
8. LCX EES 2.5/28mm
9. LM-LCX-LAD “culotte” stenting EES 3.0/12mm (LCX) e 2.75/23mm (LAD) + FK

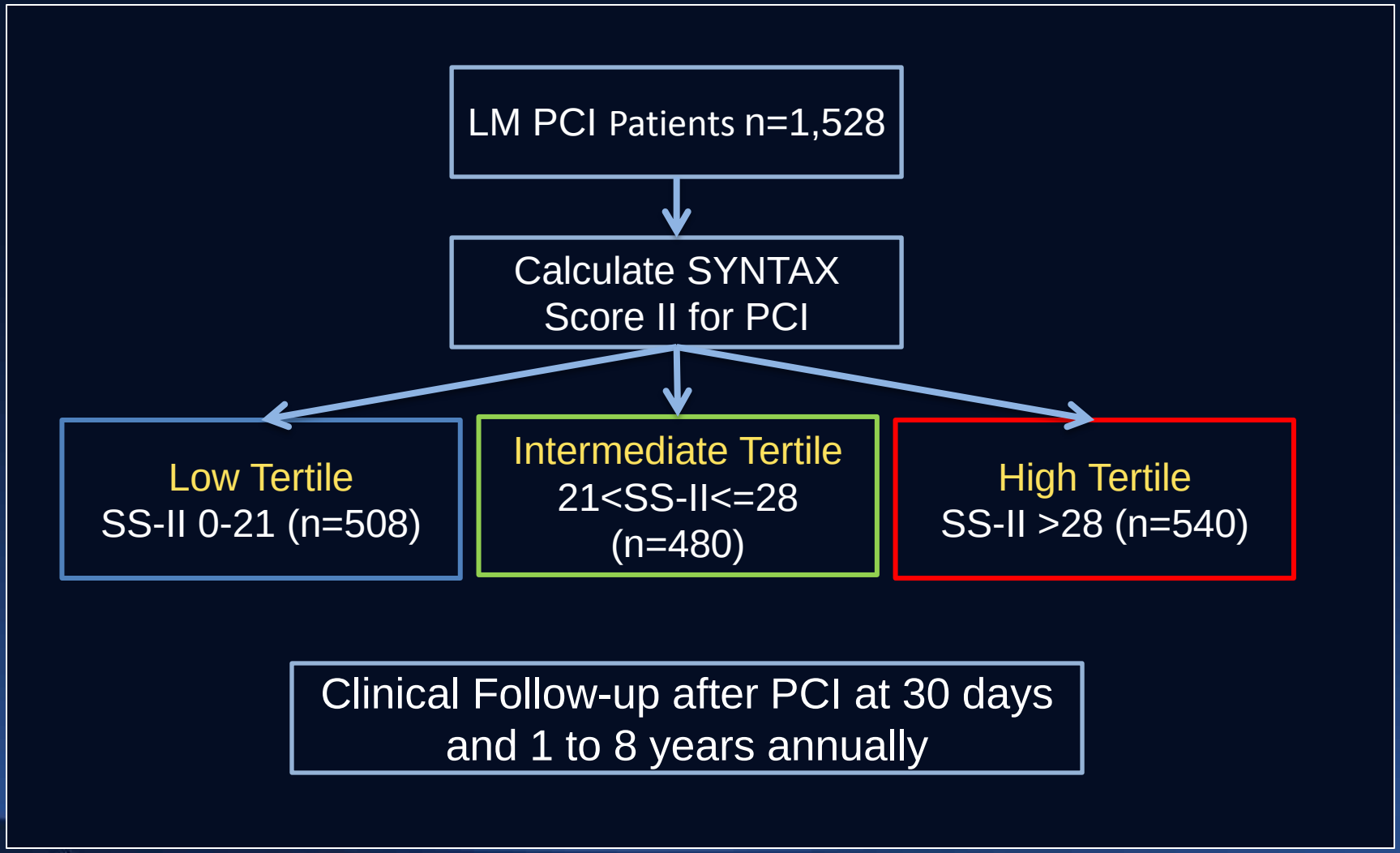
On Behalf of Fu Wai-CRF Collaboration

Validation and Comparison of the Long-Term Prognostic Capability of the SYNTAX Score-II Among 1,528 Consecutives Patients Who Underwent Left Main PCI

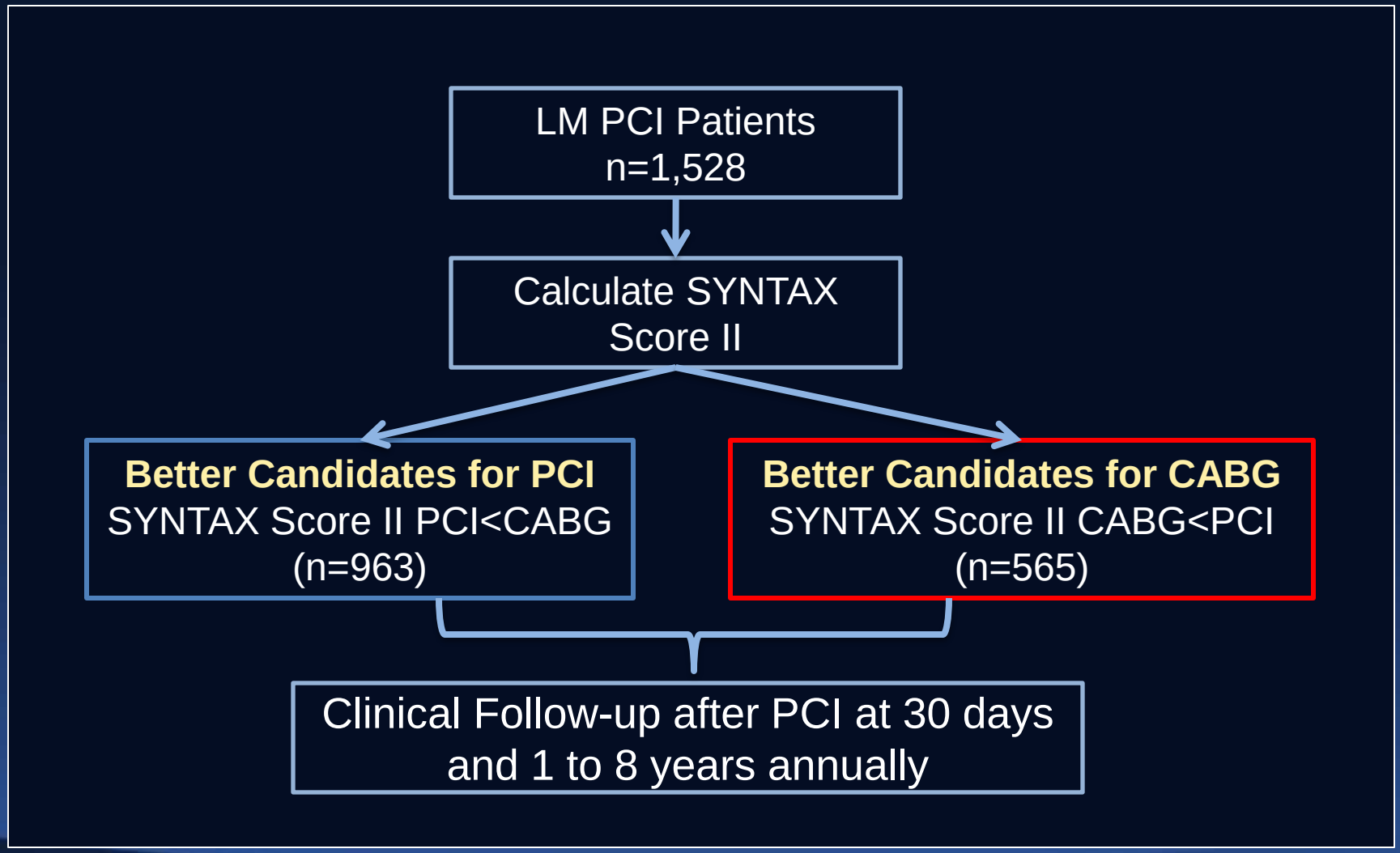
Bo Xu, MBBS;* Philippe Généreux, MD;†‡ Yuejin Yang, MD;* Martin B. Leon, MD;† Liang Xu, MSc;* Shubin Qiao, MD;* Yongjian Wu, MD;* Hongbing Yan, MD;* Jilin Chen, MD;* Yelin Zhao, MSc;* Yanyan Zhao, BS;* Tullio Palmerini, MD;§ ,Gregg W. Stone, MD,† ; Runlin Gao, MD*

Submitted, Under Review JACC

Patient Flow



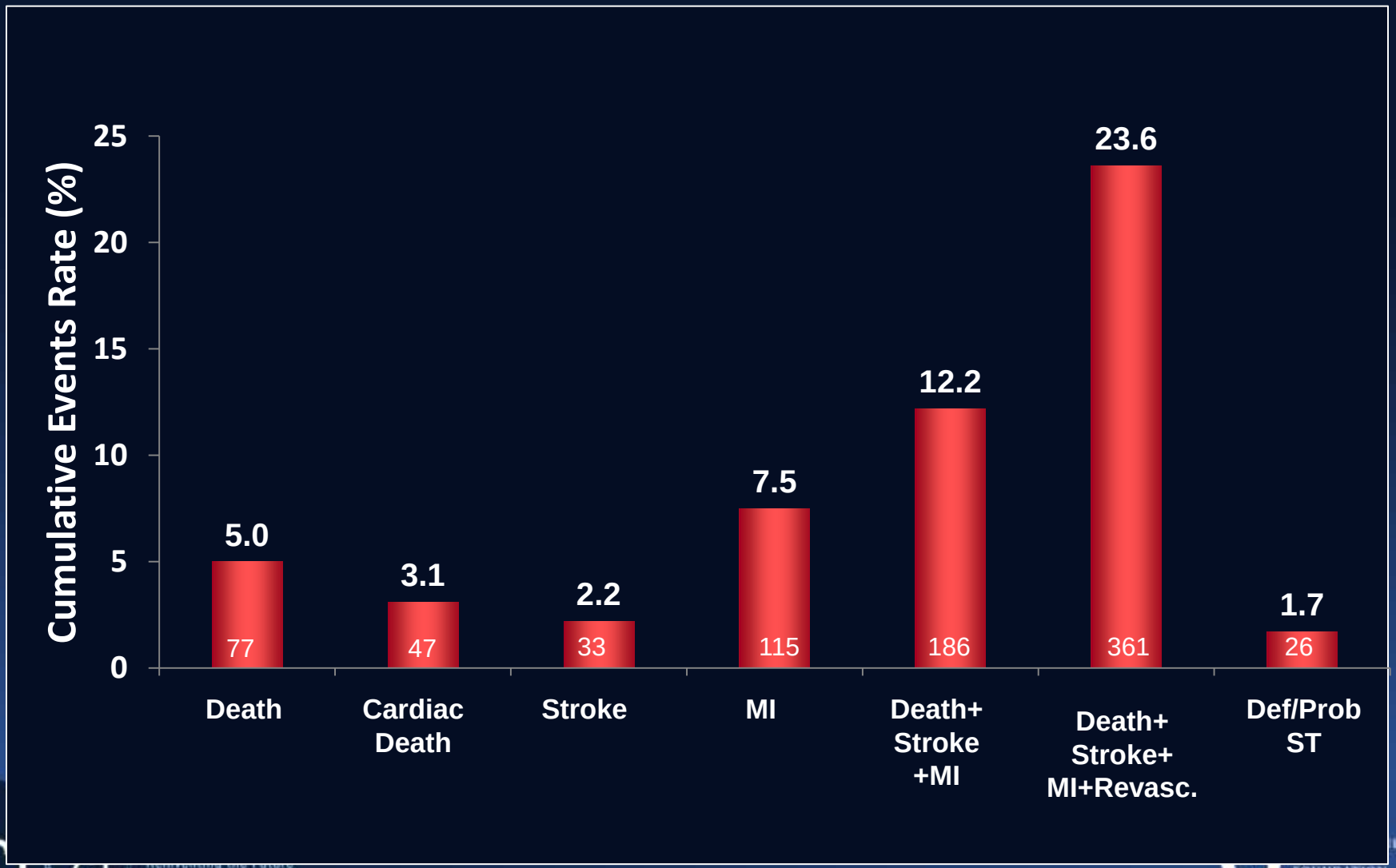
Patient Flow



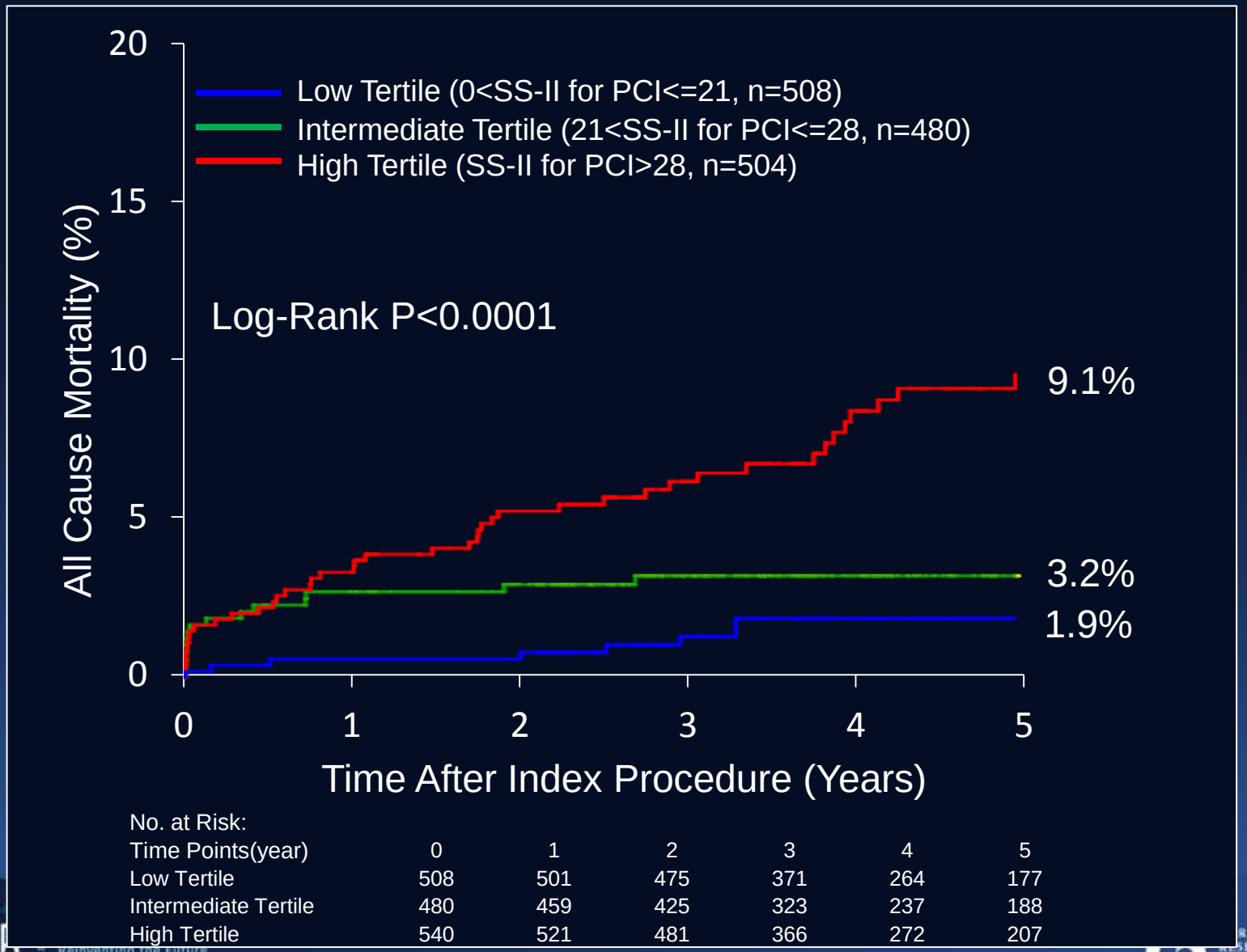
Results; n=1,528 LM-PCI

- Among the entire cohort, mean values for baseline SS and rSS were 23.9±7.1 and 4.4±5.9
- SS-II for PCI was 25.6±7.8, and the SS-II for CABG was 26.7±9.6.
- 963 (63.0%) had a SS-II for PCI < SS-II for CABG
- 565 (37.0%) had a SS-II for CABG < SS-II for PCI

Long-Term Clinical Outcomes; n=1,528 (Mean Follow-up of 4.4 Years)



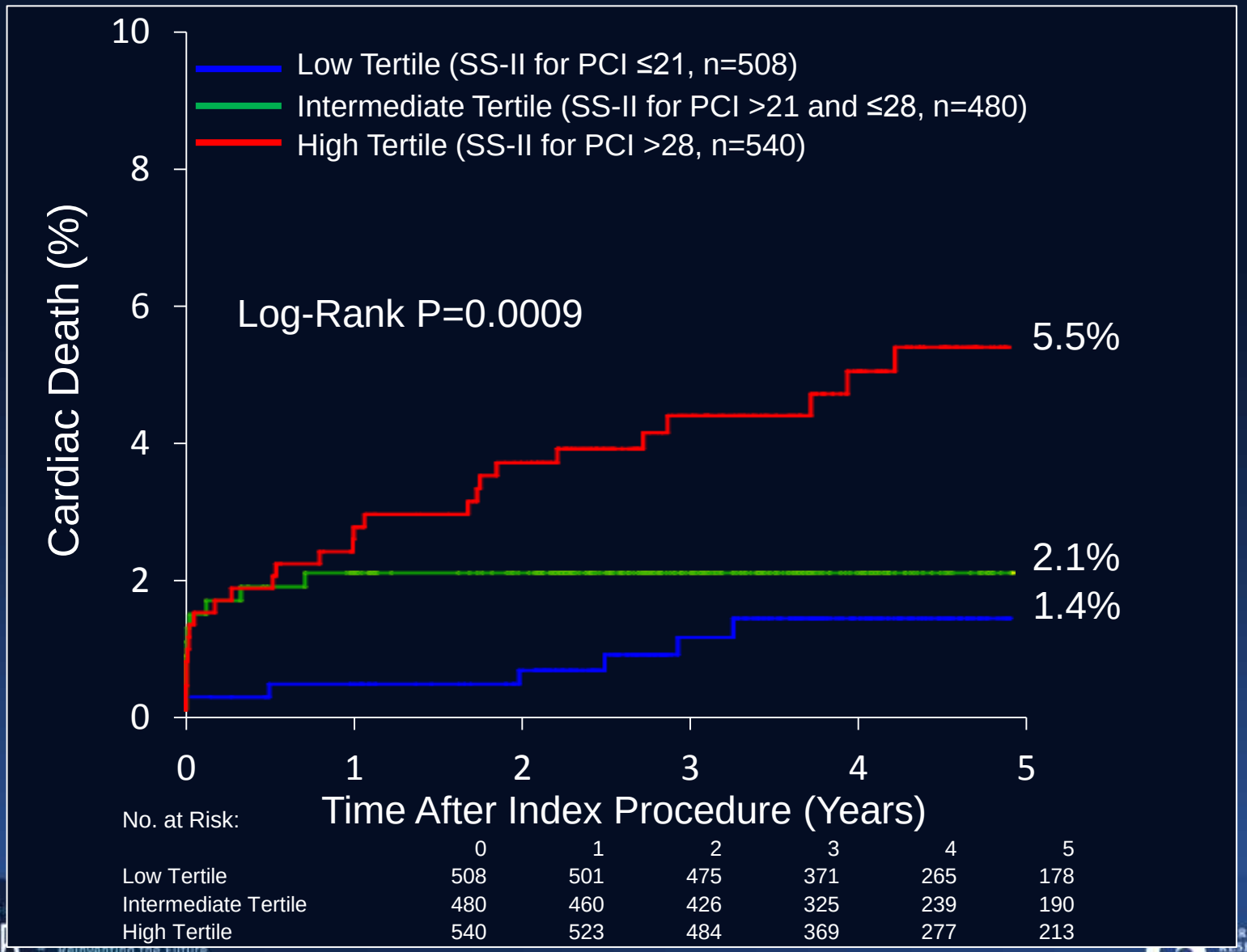
All Cause Mortality



No. at Risk:

Time Points(year)	0	1	2	3	4	5
Low Tertile	508	501	475	371	264	177
Intermediate Tertile	480	459	425	323	237	188
High Tertile	540	521	481	366	272	207

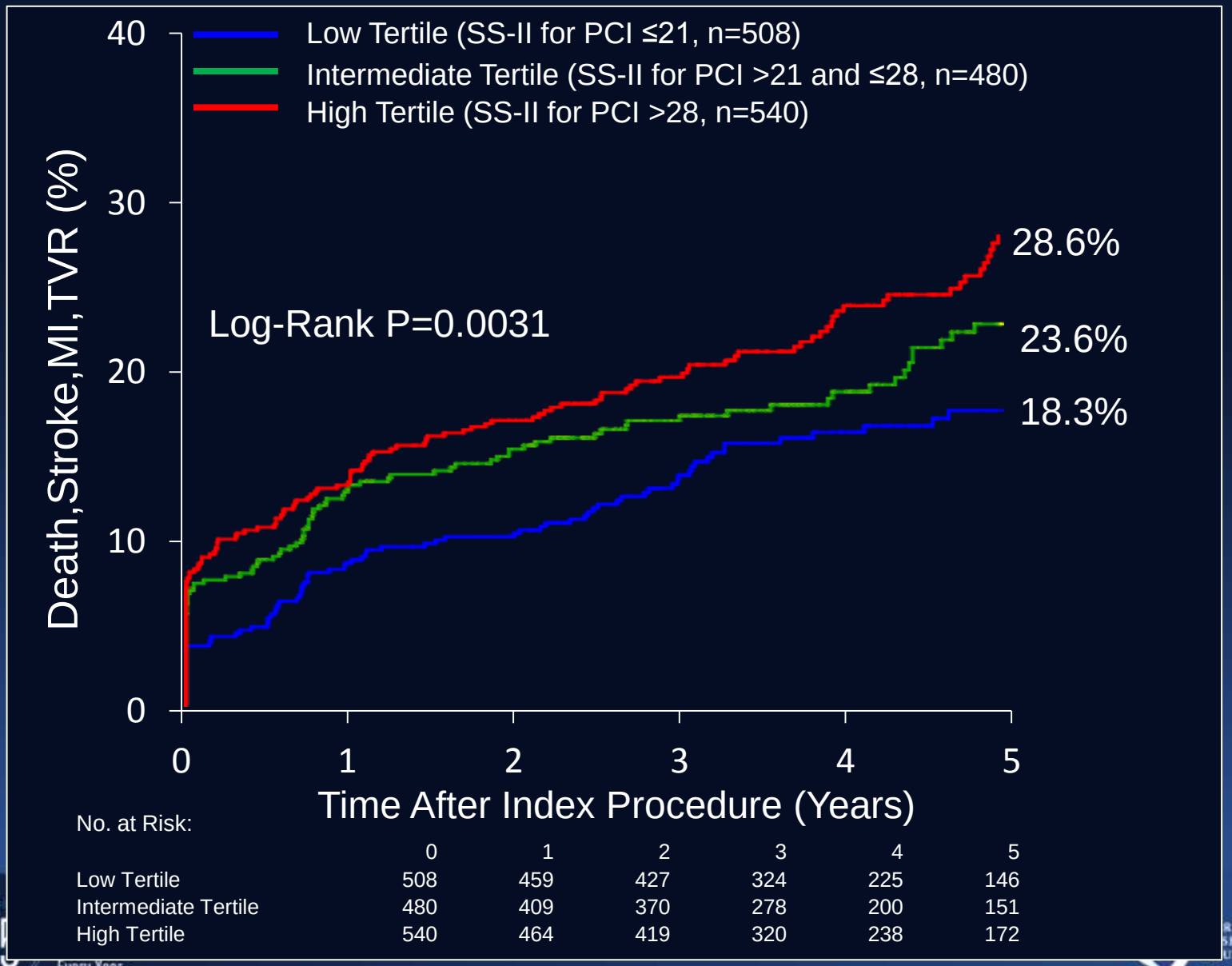
Cardiac Mortality



No. at Risk:

	0	1	2	3	4	5
Low Tertile	508	501	475	371	265	178
Intermediate Tertile	480	460	426	325	239	190
High Tertile	540	523	484	369	277	213

Death/Stroke/MI/Revasc.



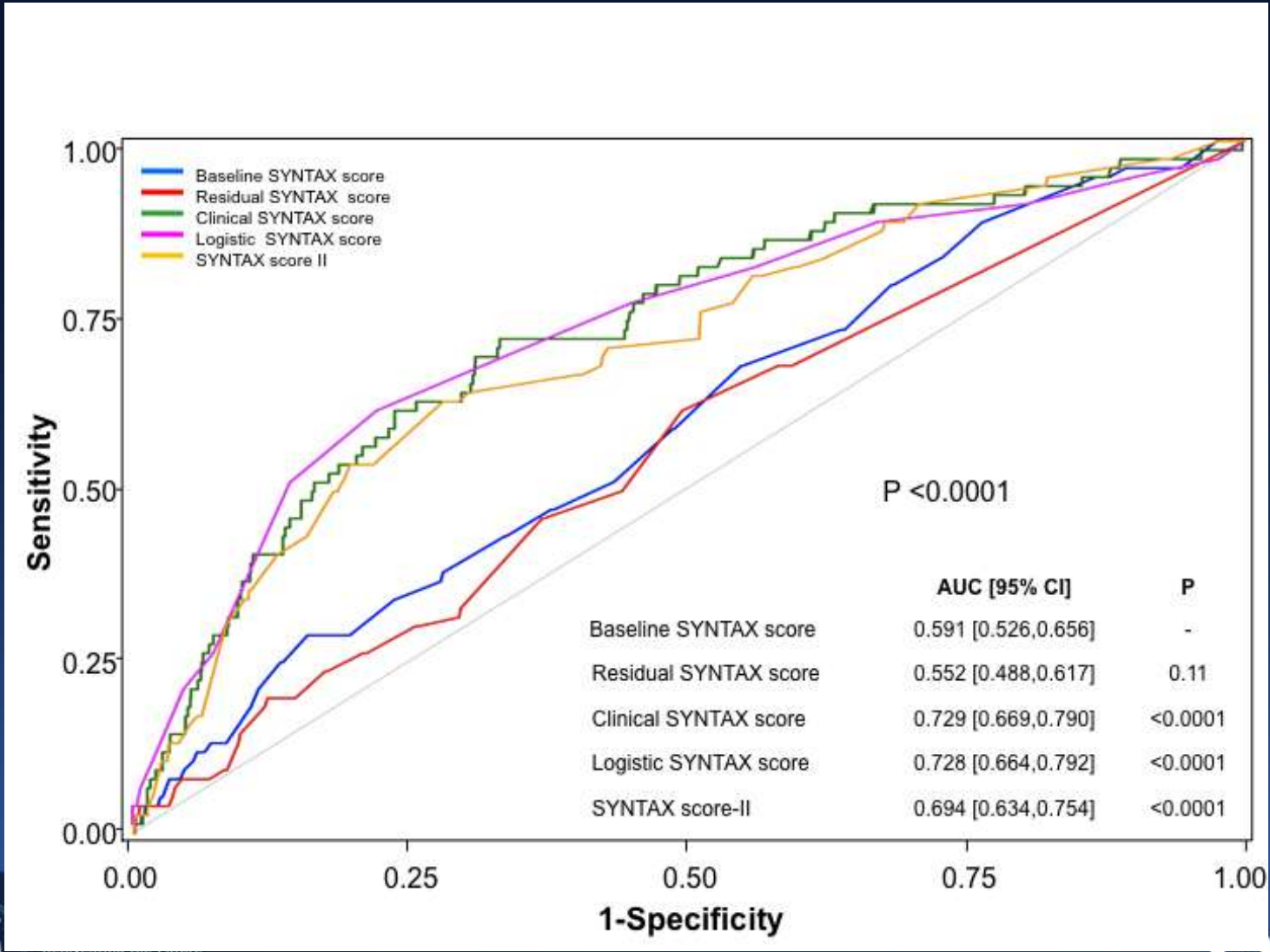
No. at Risk:

	0	1	2	3	4	5
Low Tertile	508	459	427	324	225	146
Intermediate Tertile	480	409	370	278	200	151
High Tertile	540	464	419	320	238	172

Independent Predictors of Mortality
n=1,528 LM-PCI

Variable	Adjusted HR [95% CI]	P value
Age (per 10 years increase)	1.30 [0.92, 1.83]	0.14
Male gender	1.79 [0.92, 3.49]	0.08
LVEF (per 10% increase)	***0.65 [0.49, 0.86]***	***0.003***
COPD	***3.28 [1.00, 10.75]***	***0.05***
Creatinine clearance (per 10 cc increase)	1.06 [0.95, 1.17]	0.32
Prior MI	***1.69 [1.03, 2.78]***	***0.04***
History of Stroke	1.60 [0.82, 3.15]	0.17
SS II for PCI (per 10 points increase)	***1.76 [1.10, 2.82]***	***0.02***

All-Cause Mortality Predictability
n=1,528 LM-PCI



Reclassification of Adverse Ischemic Events
SYNTAX Score-II vs. Anatomical SYNTAX Score

	NRI or IDI	p Value
All-cause mortality		
NRI	***0.25***	***0.002***
IDI	***0.015***	***0.003***
Cardiac mortality		
NRI	0.05	0.60
IDI	0.001	0.83
Non-Cardiac mortality		
NRI	0.50	0.0003
IDI	0.007	0.002
Definite/probable stent thrombosis		
NRI	0.06	0.69
IDI	-0.005	0.11
All-cause mortality/stroke/MI		
NRI	0.09	0.15
IDI	0.018	<0.0001
All-cause mortality/stroke/MI/ischemia driven revascularization		
NRI	0.02	0.66
IDI	0.00	0.96

Limitations

- ***Single-center experience***, with 6 highly experienced operators: it may affect the generalizability of our findings
- ***Determination of SS-II is fairly new***; mistakes could happen with normogram (website under development)
- Determination of ***SS is associated with inter- and intra-observer variability:*** physiological assessment (fractional flow reserve-guided) may help in reducing this variability
- ***Retrospective nature of our analysis:*** our findings should be considered hypothesis-generating

Conclusion

- Results from this larges series of consecutive patients who underwent LM PCI *validated the prognostic capability of the SS-II for long-term mortality* among patients with complex coronary artery disease, and *confirmed its incremental value in risk prognostication* compared to the baseline anatomical SS.

Conclusion

1. Combined risk models give a comprehensive picture of a patient's clinical and angiographic risk.
2. Whether new scores impact on decisions and related outcomes better than conventional SYNTAX score tertiles is to be demonstrated.
3. Regardless of any clinical, technical, score or 'Heart Team' consideration, patient's decision remains the most powerful determinant of the final strategy.