European Heart Journal
doi:10.1093/eurheartj/ehu278

2014 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI)

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BMJ

BMJ 2014;348:g3859 doi: 10.1136/bmj.g3859 (Published 23 June 2014)

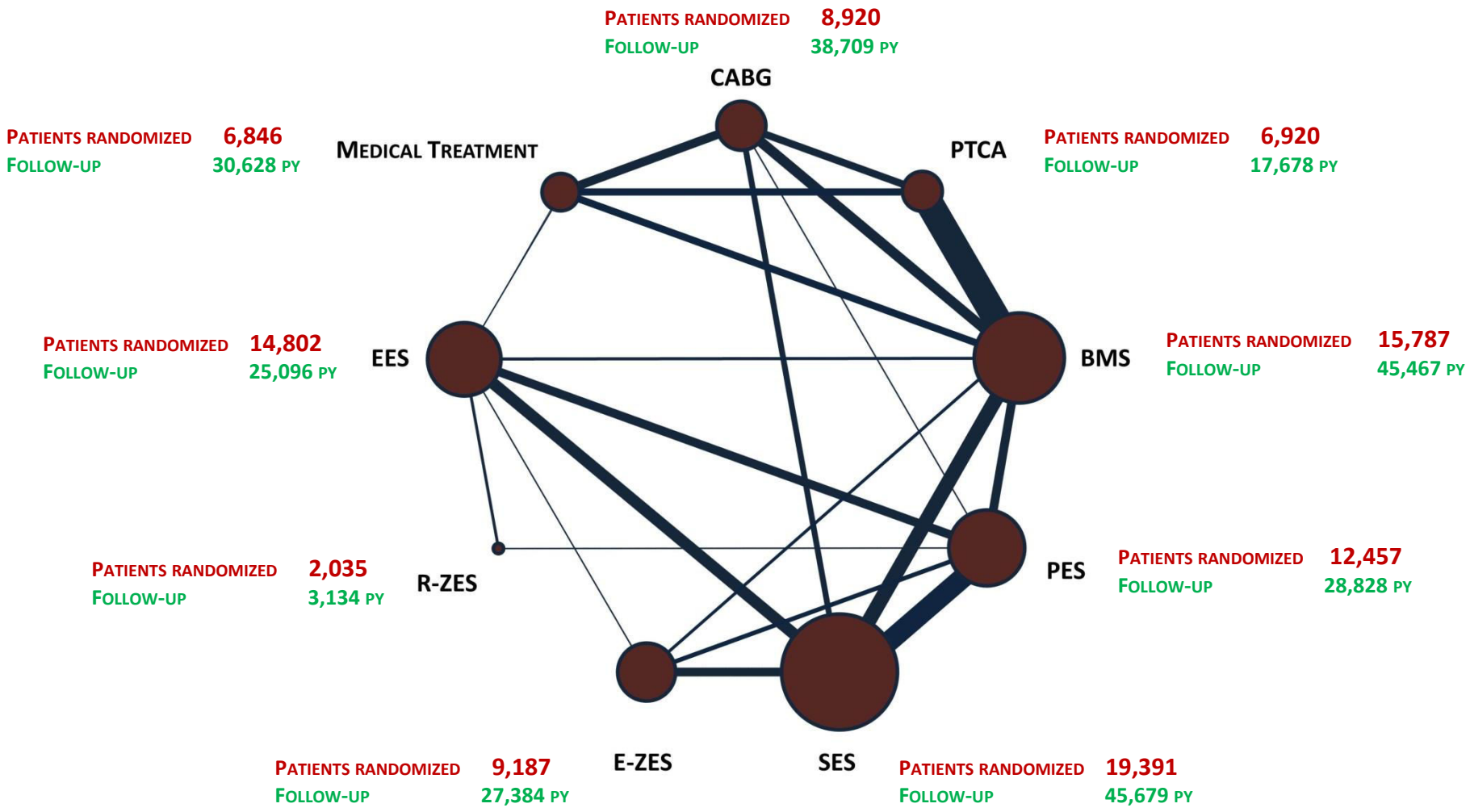
RESEARCH

Revascularisation versus medical treatment in patients with stable coronary artery disease: network meta-analysis

Stephan Windecker, Stefan Stortecky, Giulio G Stefanini, Bruno R daCosta, Anne Wilhelmina Rutjes, Marcello Di Nisio, Maria G Siletta, Ausilia Maione, Fernando Alfonso, Peter M Clemmensen, Jean-Philippe Collet, Jochen Cremer, Volkmar Falk, Gerasimos Filippatos, Christian Hamm, Stuart Head, Arie Pieter Kappetein, Adnan Kastrati, Juhani Knuuti, Ulf Landmesser, Günther Laufer, Franz-Joseph Neumann, Dimitri Richter, Patrick Schauerte, Miguel Sousa Uva, David P Taggart, Lucia Torracca, Marco Valgimigli, William Wijns, Adam Witkowski, Philippe Kolh, Peter Juni

Revascularization versus Medical Therapy in Stable CAD: A Network Meta-Analysis

100 RCTs – 93,553 patients randomized
Follow-up of 262,090 patient-years



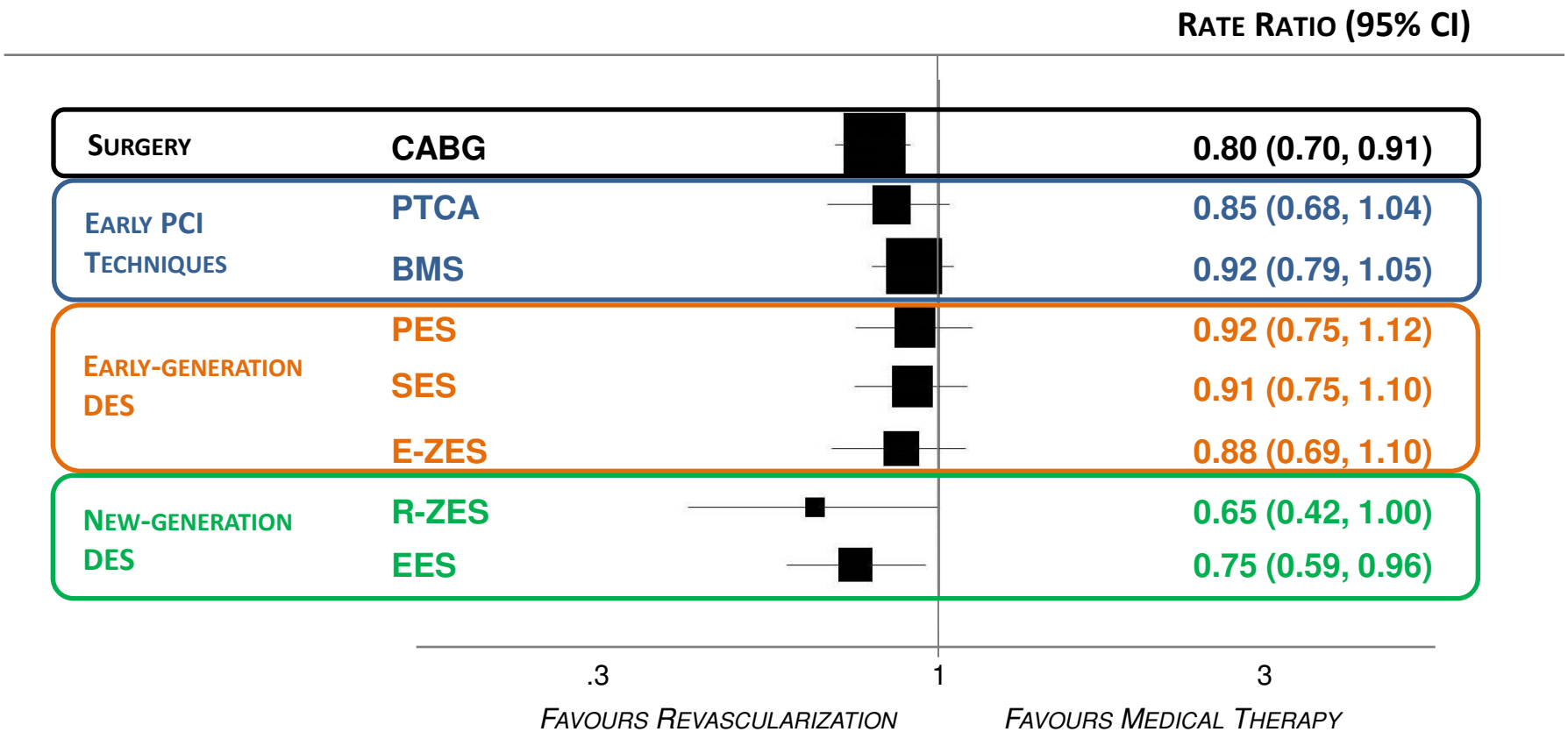
Windecker S et al. *BMJ 2014*

Revascularization versus Medical Therapy in Stable CAD: A Network Meta-Analysis

Primary Endpoint: All-Cause Mortality

The European Myocardial Revascularization Collaboration (EMRC). *BMJ* 2014, ahead of print

100 RCTs, 93,553 Randomized Patients, 262,090 patient-years of Follow-up, 5,346 Events for the Analysis



Windecker S et al. *BMJ 2014*

What is new in this guideline?

- **Scores and risk stratification**
  - Guide to calculate the SYNTAX score
- **Process for decision-making and patient information**
  - Timing of intervention
- **Revascularization in SCAD and patients with diabetes**
  - New-generation DES and type of revascularization (CABG vs PCI)
- **Revascularization in STEMI and cardiogenic shock**
  - New-generation DES, thrombus aspiration, staged and immediate revascularization of non-culprit lesions, IABP use

European Heart Journal
doi:10.1093/eurheartj/ehu278

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What is new in this guideline?

- **Procedural aspects of revascularization**
  - Progress in CABG techniques, new-generation DES, bioresorbable stents, drug-coated balloons
  - Intracoronary diagnostic techniques – FFR, IVUS, OCT
- **Antithrombotic treatment**
  - Extensive update including DAPT duration, pretreatment, bivalirudin, and antithrombotic therapy in patients requiring oral anticoagulation
- **Volume-outcome relationship**
  - Training, proficiency and operator/institutional competence

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Scores and Risk Stratification

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Risk models to assess SHORT-term (≤ 30 days) outcomes in candidates for PCI or CABG

- For CABG, STS is well validated.
- STS score undergoes periodic adjustments which makes longitudinal comparisons difficult.
- EuroScore II is an update of the logistic EuroScore in a more contemporary cohort.
- EuroScore overestimates mortality and should no longer be used.

Score	Development cohort (patients, design)	Patient inclusion	Coronary procedures	Number of variables		Outcome	Recommendation		Validation studies
				Clinical	Anatomical		CABG	PCI	
STS Score	*n* = 774 881 Multicentre	01/2006 – 12/2006	100% (i)CABG	40	2	In-hospital or 30-day[b] mortality, and in-hospital morbidity[c]	I B		5–10
EuroSCORE II	*n* =16 828 Multicentre	05/2010 – 07/2010	47% (i)CABG	18	0	In-hospital mortality	IIa B	IIb C	>10
ACEF	*n* = 4 557 Single-centre	2001 – 2003	-	3	0	In-hospital or 30-day[b] mortality	IIb C	IIb C	5–10
NCDR CathPCI	181 775 Multicentre	01/2004 – 03/2006	100% PCI	8	0	In-hospital mortality		IIb B	<5
EuroSCORE	*n* =19 030 Multicentre	09/1995 – 11/1995	64% (i)CABG	17	0	Operative mortality	III B	III C	>50

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Risk models to assess MEDIUM- to LONG-term outcomes in candidates for PCI or CABG

- **SYNTAX score grades anatomical complexity in patients with three-vessel or left main CAD. It facilitates treatment selection between PCI and CABG in patients with complex MVD.**
- **SYNTAX II score combines anatomical and clinical factors and may become preferred for treatment selection between PCI and CABG.**

Score	Development cohort	Patient inclusion	Coronary procedures	Number of variables		Outcome	Recommendation		Validation studies
				Clinical	Anatomical		CABG	PCI	
SYNTAX	none, expert opinion	none	-	0	11 (3 general, 8 per lesion)	MACCE	I B	I B	>50
SYNTAX II	1 800 Multicentre	03/2005 – 04/2007	50% CABG, 50% PCI	6	12	4-year mortality	IIa B	IIa B	<5
ASCERT CABG	174 506 Multicentre	01/2002 – 12/2007	100% (i)CABG	23	2	Mortality >2 years	IIa B		<5
ASCERT PCI	206 081 Multicentre	2004 – 2007	100% PCI	17	2	Mortality >1 year		IIa B	<5
Logistic clinical SYNTAX	6 508 Multicentre	03/2005 – 04/2007	100% PCI	3	11	1-year MACE and mortality		IIa B	<5

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Guide to calculate the SYNTAX score

- **SYNTAX score was developed to grade the anatomical complexity of coronary lesions in patients with three-vessel and left main CAD and was found to be an independent predictor of MACCE in patients undergoing PCI but not CABG.**

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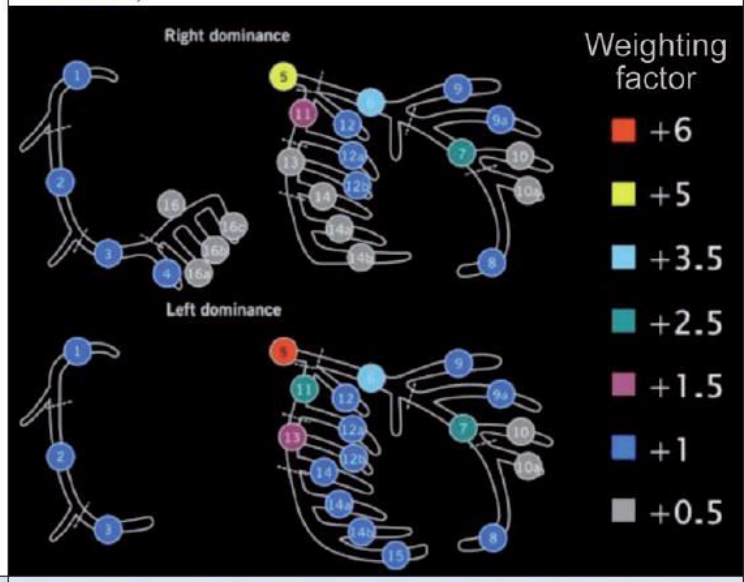
Steps	Variable assessed	Description
Step 1	Dominance	The weight of individual coronary segments varies according to coronary artery dominance (right or left). Co-dominance does not exist as an option in the SYNTAX score.
Step 2	Coronary segment	The diseased coronary segment directly affects the score as each coronary segment is assigned a weight, depending on its location, ranging from 0.5 (i.e. posterolateral branch) to 6 (i.e. left main in case of left dominance). 
Step 3	Diameter stenosis	The score of each diseased coronary segment is multiplied by 2 in case of a stenosis 50–99% and by 5 in case of total occlusion. In case of total occlusion, additional points will be added as follows: - Age >3 months or unknown +1 - Blunt stump +1 - Bridging +1 - First segment visible distally +1 per non visible segment - Side branch at the occlusion +1 if <1.5mm diameter +1 if both <1.5 and ≥1.5mm diameter +0 if ≥1.5mm diameter (i.e. bifurcation lesion)
Step 4	Trifurcation lesion	The presence of a trifurcation lesion adds additional points based on the number of diseased segments: - 1 segment +3 - 2 segments +4 - 3 segments +5 - 4 segments +6
Step 5	Bifurcation lesion	The presence of a bifurcation lesion adds additional points based on the type of bifurcation according to the Medina classification:[29] - Medina 1,0,0 or 0,1,0 or 1,1,0: add 1 additional point - Medina 1,1,1 or 0,0,1 or 1,0,1 or 0,1,1: add 2 additional point Additionally, the presence of a bifurcation angle <70° adds 1 additional point.
Step 6	Aorto-ostial lesion	The presence of aorto-ostial lesion segments adds 1 additional point
Step 7	Severe tortuosity	The presence of severe tortuosity proximal of the diseased segment adds 2 additional points
Step 8	Lesion length	Lesion length >20 mm adds 1 additional point
Step 9	Calcification	The presence of heavy calcification adds 2 additional points
Step 10	Thrombus	The presence of thrombus adds 1 additional point
Step 11	Diffuse disease/small vessels	The presence of diffusely diseased and narrowed segments distal to the lesion (i.e. when at least 75% of the length of the segment distal to the lesion has a vessel diameter of <2mm) adds 1 point per segment number

Process for decision-making and patient information

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Recommendations for decision making and patient information in the elective setting

Agreement before action !

Recommendations	Class[a]	Level[b]
It is recommended that patients undergoing coronary angiography are informed about benefit and risks as well as potential therapeutic consequences ahead of the procedure.	I	C
It is recommended that patients are adequately informed about short- and long-term benefits and risks of the revascularization procedure as well as treatment options. Enough time should be allowed for informed decision-making.	I	C
It is recommended that institutional protocols are developed by the Heart Team to implement the appropriate revascularization strategy in accordance with current guidelines. In case of PCI centres without on-site surgery, institutional protocols should be established with partner institutions providing cardiac surgery.	I	C
It is recommended that patients for whom decision-making is complex or who are not covered by the institutional protocol are discussed by the Heart Team.	I	C

Euro
doi:10.1

Multidisciplinary decision pathways, patient informed consent and timing of intervention

- **Patient information needs to be unbiased, evidence-based, up-to-date, reliable, understandable, accessible, relevant, consistent with legal requirements.**

- **Written informed consent may not be universally required. ESC and EACTS strongly advocate documentation of patient consent.**

	ACS			Multivessel SCAD	SCAD with *ad-hoc* PCI indication according to predefined Heart-Team protocols
	Shock	STEMI	NSTE-ACS		
Multidisciplinary decision making	Not mandatory during the acute phase. Mechanical circulatory support according to Heart-Team protocol.	Not mandatory during the acute phase.	Not mandatory during the acute phase. After stabilization recommended as in stable multivessel CAD.	Required.	Not required.
Informed consent	Verbal witnessed informed consent or family consent if possible without delay.	Verbal witnessed informed consent may be sufficient unless written consent is legally required.	Written informed consent.[a]	Written informed consent.[a]	Written informed consent.[a]
Time to revascularization	Emergency: no delay.	Emergency: no delay.	Urgency: within hours if possibl and no later th 72 hours.	For patients with severe symptoms (CCS 3) and for those with high–risk anatomy (left main disease or equivalent, three-vessel disease or proximal LAD or depressed ventricular function), revascularization (PCI or CABG) should be performed within two weeks. For all other patients with SCAD, revascularization (PCI or CABG) should be performed within six weeks.	oc
Procedure	Proceed with intervention based on best evidence/ availability. Non-culprit lesions treated according to institutional protocol or Heart Team decision.	Proceed with intervention based on best evidence/ availability. Non-culprit lesions treated according to institutional protocol or Heart Team decision.	Proceed with intervention based on best evidence/ availability. Non-culprit lesions treated according to institutional protocol or Heart Team decision.	allowing enough time from diagnostic catheterization to intervention.	eed with intervention according to institutional protocol defined by Heart Team.

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Multidisciplinary decision pathways, patient informed consent and timing of intervention

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	Shock	**STEMI**	**NSTE-ACS**		
Multidisciplinary decision making	Not mandatory during the acute phase. Mechanical circulatory support according to Heart-Team protocol.	Not mandatory during the acute phase.	Not mandatory during the acute phase. After stabilization recommended as in stable multivessel CAD.		
Time to revascularization	Emergency: no delay.	Emergency: no delay.	Urgency: within 24 hours if possible and no later than 72 hours.		

ned consent.[a]

intervention
institutional
ned by Heart Team.

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Indications for diagnostic testing in patients with suspected CAD and stable symptoms

	Asymptomatic[a]		Symptomatic					
			Probability of significant disease[b]					
			Low (<15%)		Intermediate (15–85%)		High (>85%)	
	Class[c]	Level[d]	Class[c]	Level[d]	Class[c]	Level[d]	Class[c]	Level[d]
Anatomical detection of CAD								
Invasive angiography	III	A	III	A	IIb	A	I	A
CT angiography[f,g]	III	B	III	C	IIa	A	III	B
Functional test								
Stress echo	III	A	III	A	I	A	III	A
Nuclear imaging	III	A	III	A	I	A	III	A
Stress MRI	III	B	III	C	I	A	III	B
PET perfusion	III	B	III	C	I	A	III	B
Combined or hybrid imaging test								
	III	C	III	C	IIa	B	III	B

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The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Outcomes of Anatomical versus Functional Testing for Coronary Artery Disease

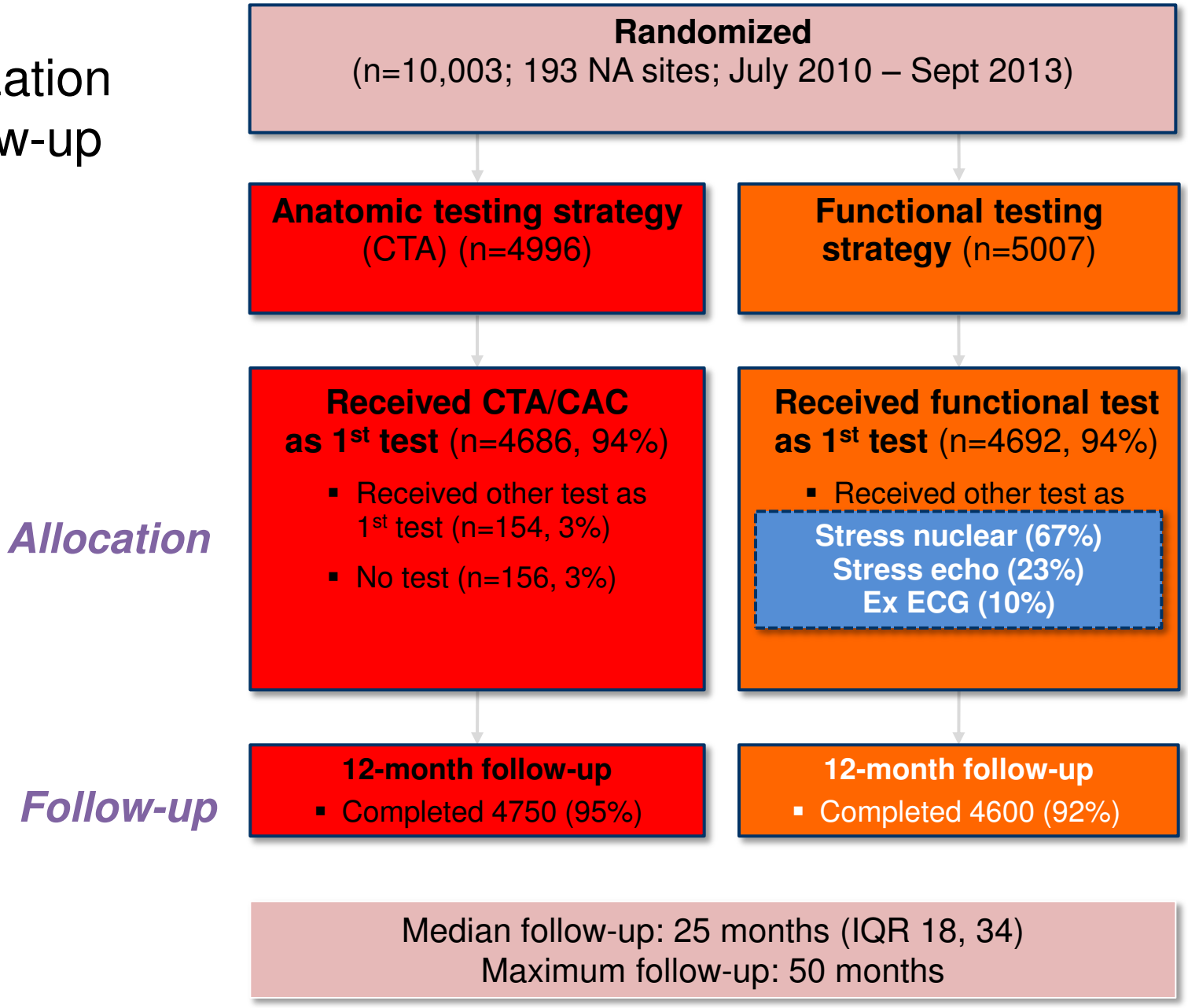
Pamela S. Douglas, M.D., Udo Hoffmann, M.D., M.P.H., Manesh R. Patel, M.D., Daniel B. Mark, M.D., M.P.H., Hussein R. Al-Khalidi, Ph.D., Brendan Cavanaugh, M.D., Jason Cole, M.D., Rowena J. Dolor, M.D., Christopher B. Fordyce, M.D., Megan Huang, Ph.D., Muhammad Akram Khan, M.D., Andrzej S. Kosinski, Ph.D., Mitchell W. Krucoff, M.D., Vinay Malhotra, M.D., Michael H. Picard, M.D., James E. Udelson, M.D., Eric J. Velazquez, M.D., Eric Yow, M.S., Lawton S. Cooper, M.D., M.P.H., and Kerry L. Lee, Ph.D., for the PROMISE Investigators*

ABSTRACT

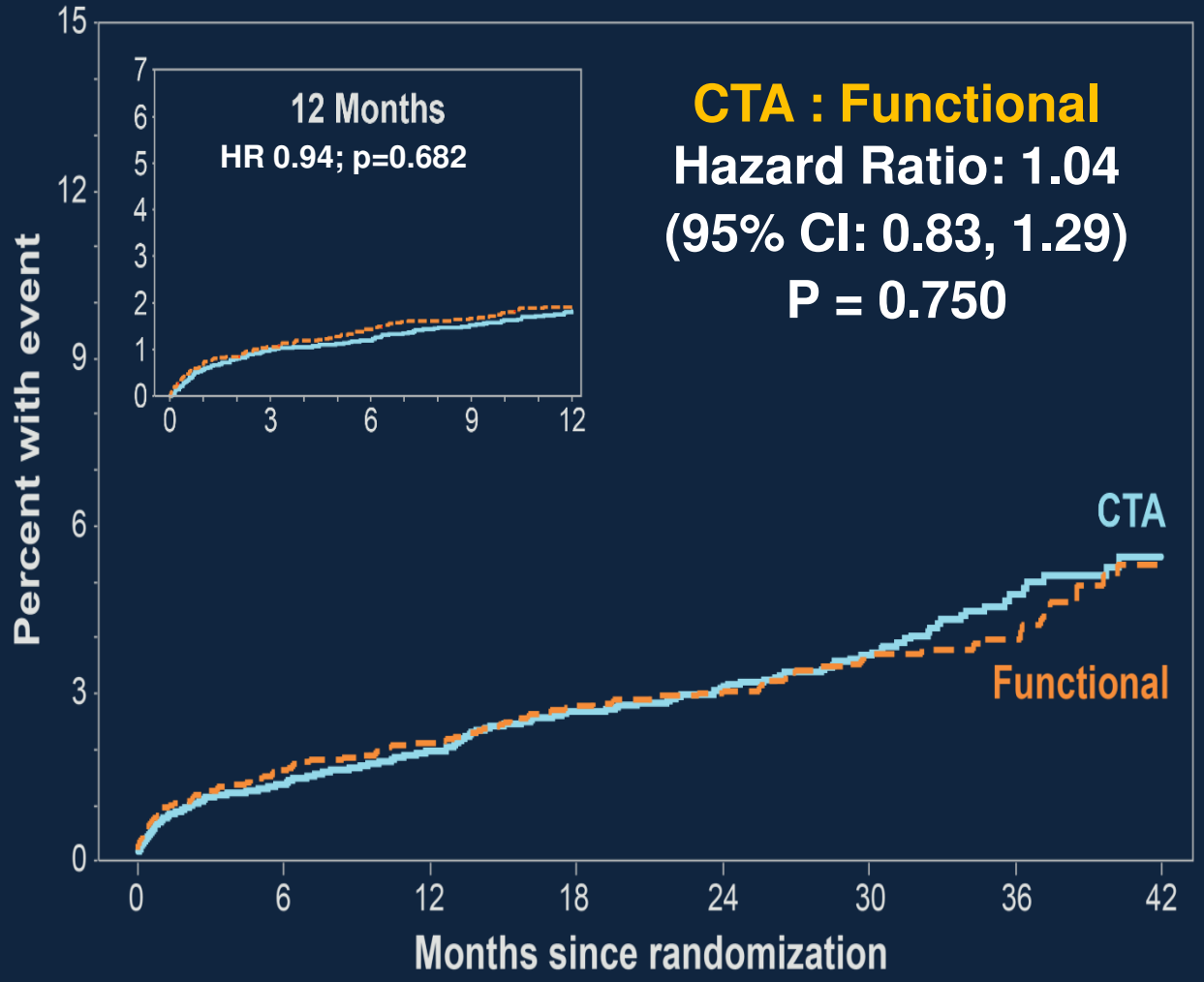
BACKGROUND

Many patients have symptoms suggestive of coronary artery disease (CAD) and are often evaluated with the use of diagnostic testing, although there are limited data from randomized trials to guide care.

Randomization and Follow-up



Primary Endpoint:
Death, MI, Unstable Angina, Major Complications



# at risk	Baseline (0)	6 Mo.	12 Mo.	18 Mo.	24 Mo.	30 Mo.	36 Mo.	42 Mo.
CTA	4996	4703	4362	3551	2652	1705	902	269
Functional	5007	4536	4115	3331	2388	1518	832	258

Secondary Endpoint:
Catheterization Without Obstructive CAD ≤90 days

	CTA (n=4996)	Functional (n=5007)	P value
Invasive catheterization without obstructive CAD — N (%)	**170 (3.4)**	**213 (4.3)**	**0.022**
Invasive catheterization	**609 (12.2%)**	**406 (8.1%)**	
With obstructive CAD (% of caths)	**439 (72.1%)**	**193 (47.5%)**	
Revascularization	**311 (6.2%)**	**158 (3.2%)**	
CABG	**72**	**38**	

Revascularization for stable CAD

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Indications for revascularisation in stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class[b]	Level[c]
For prognosis	Left main disease with stenosis >50%[a]	I	A
	Any proximal LAD stenosis >50%[a]	I	A
	Two-vessel or three-vessel disease with stenosis > 50%[a] with impaired LV function (LVEF<40%)[a]	I	A
	Large area of ischaemia (>10% LV)	I	B
	Single remaining patent coronary artery with stenosis >50%[a]	I	C
For symptoms	Any coronary stenosis >50%[e] in the presence of limiting angina or angina equivalent, unresponsive to medical therapy	I	A

[a] With documented ischaemia or Fractional Flow Reserve (FFR) <0.80 for angiographic diameter stenosis 50-90%.

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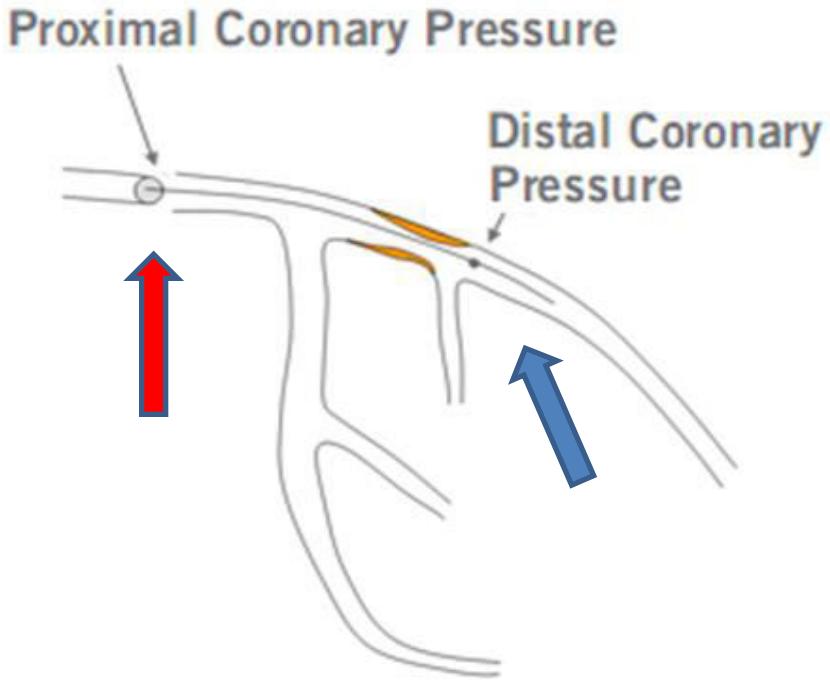
$$FFR = \frac{\text{Distal Coronary Pressure}}{\text{Proximal Coronary Pressure}}$$

(During Maximum Hyperemia)

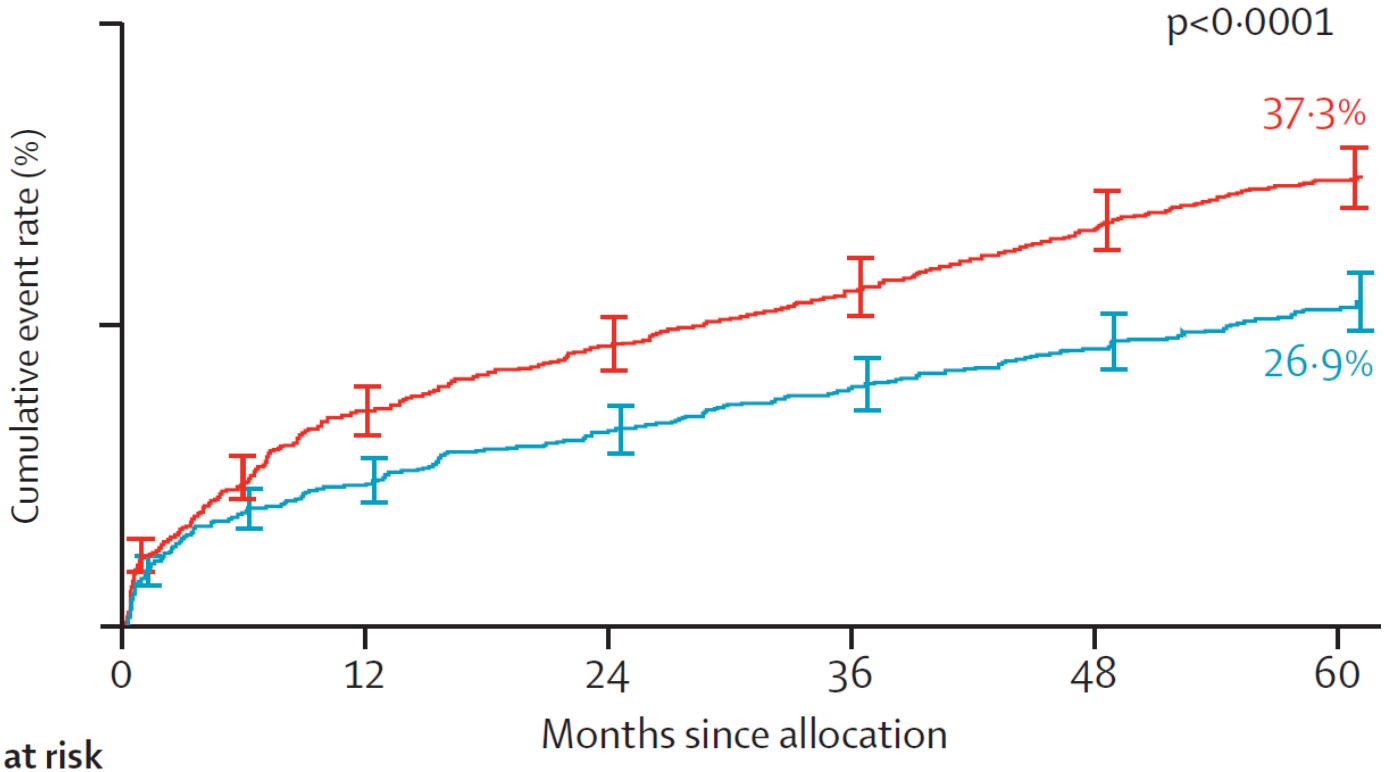


FFR<0,8

5-Year Outcomes of the SYNTAX Trial

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

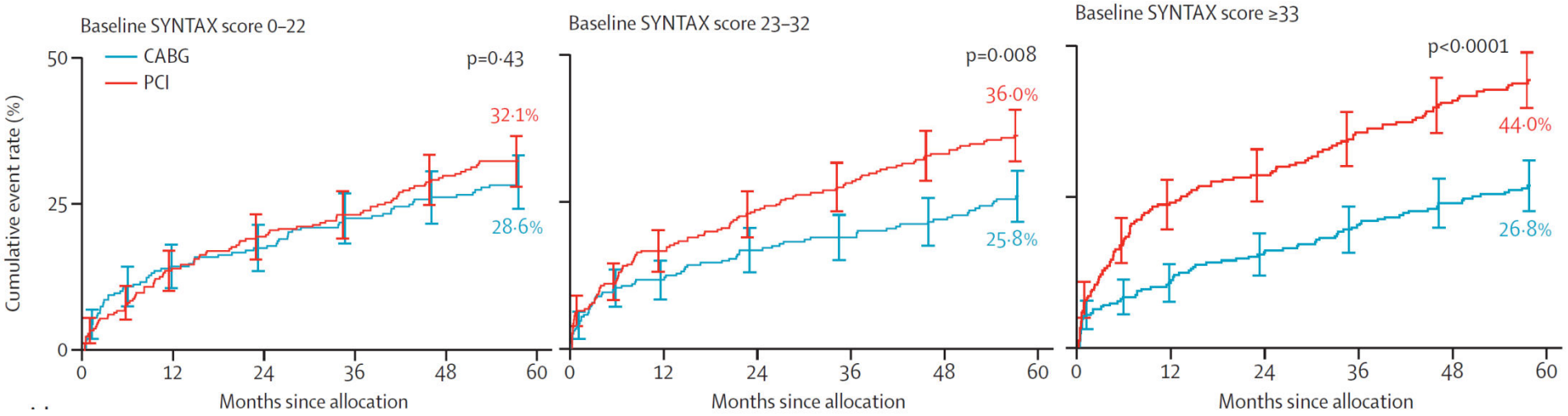
MACCE: Death, MI, Stroke, or Repeat Revasc



MACCE to 5 Years by SYNTAX Score

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

Low Scores (0-22) | **Intermediate Scores (23-32)** | **High Score ≥33**



	Death	MI	Death	MI	Death	MI
PCI	**8.9**	**7.8**	**13.8**	**11.2**	**19.2**	**10.1**
CABG	**10.1**	**4.2**	**12.7**	**3.6**	**11.4**	**3.9**
	P=0.64	***P=0.11***	***P=0.68***	***P=0.0009***	***P=0.005***	***P=0.004***

PCI versus CABG in Left Main Disease

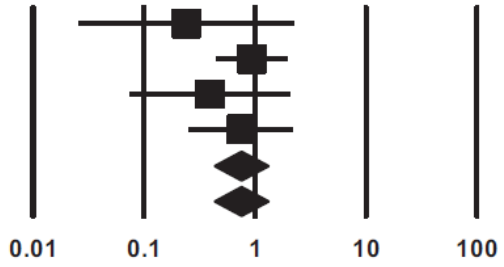
Capodanno D et al. *J Am Coll Card* 2011;58:1426–32

N=1,611 Patients

Death

Model	Study name	Odds ratio	Lower limit	Upper limit	p-Value	Events / Total PCI	Events / Total CABG
	LEMANS	0.240	0.026	2.225	0.209	1 / 52	4 / 53
	SYNTAX left main	0.944	0.454	1.963	0.878	15 / 355	15 / 336
	Boudriot et al.	0.392	0.074	2.069	0.270	2 / 100	5 / 101
	PRECOMBAT	0.745	0.255	2.173	0.590	6 / 300	8 / 300
Fixed	Pooled estimate	0.741	0.427	1.284	0.285		
Random	Pooled estimate	0.741	0.427	1.284	0.285		
	I^2 = 0%						

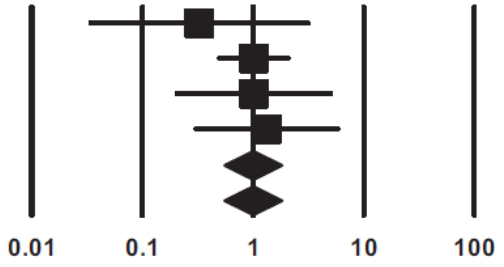
Odds ratio and 95% CI



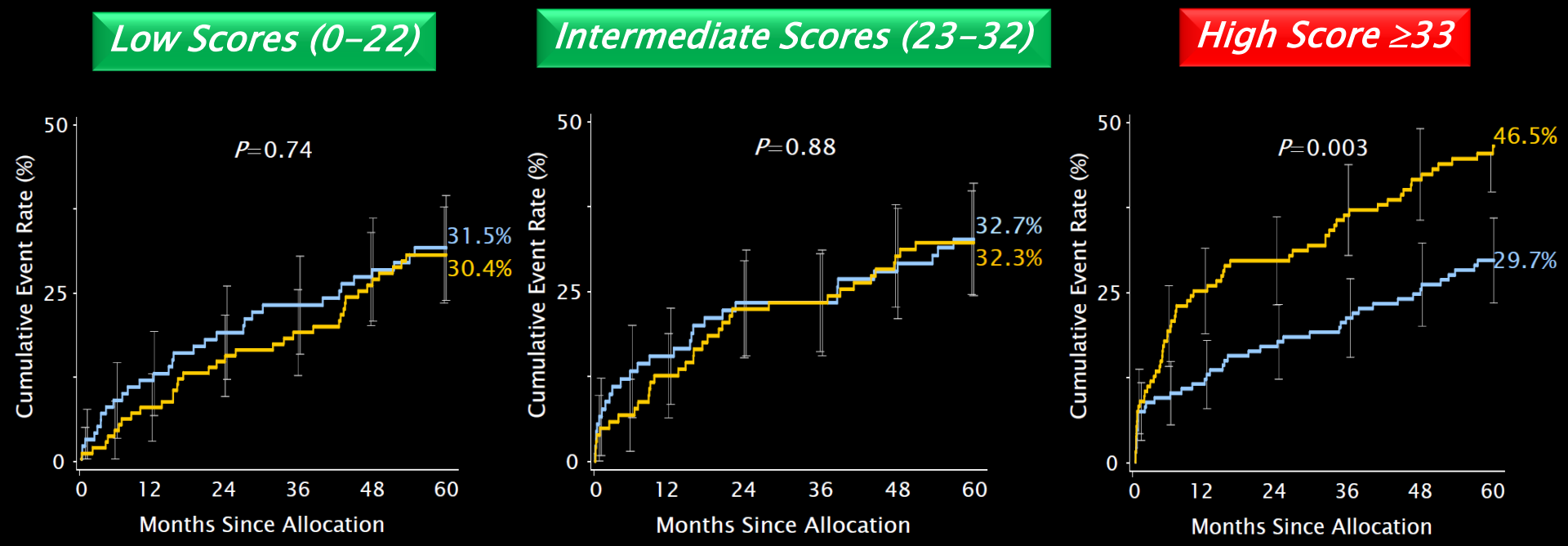
MI

Model	Study name	Odds ratio	Lower limit	Upper limit	p-Value	Events / Total PCI	Events / Total CABG
	LEMANS	0.327	0.033	3.248	0.340	1 / 52	3 / 53
	SYNTAX left main	1.015	0.482	2.136	0.969	15 / 355	14 / 336
	Boudriot et al.	1.010	0.199	5.129	0.990	3 / 100	3 / 101
	PRECOMBAT	1.338	0.297	6.029	0.705	4 / 300	3 / 300
Fixed	Pooled estimate	0.981	0.541	1.781	0.950		
Random	Pooled estimate	0.981	0.541	1.781	0.950		
	I^2 = 0%						

Odds ratio and 95% CI



MACCE to 5 Years by SYNTAX Score Tercile in Patients With Left Main CAD



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

Recommendations according to extent of CAD	CABG		PCI	
	Class[a]	Level[b]	Class[a]	Level[b]
One or two-vessel disease without proximal LAD stenosis.	IIb	C	I	C
One-vessel disease with proximal LAD stenosis.	I	A	I	A
Two-vessel disease with proximal LAD stenosis.	I	B	I	C
Left main disease with a SYNTAX score ≤ 22.	I	B	I	B
Left main disease with a SYNTAX score 23–32.	I	B	IIa	B
Left main disease with a SYNTAX score >32.	I	B	III	B
Three-vessel disease with a SYNTAX score ≤ 22.	I	A	I	B
Three-vessel disease with a SYNTAX score 23–32.	I	A	III	B
Three-vessel disease with a SYNTAX score >32.	I	A	III	B

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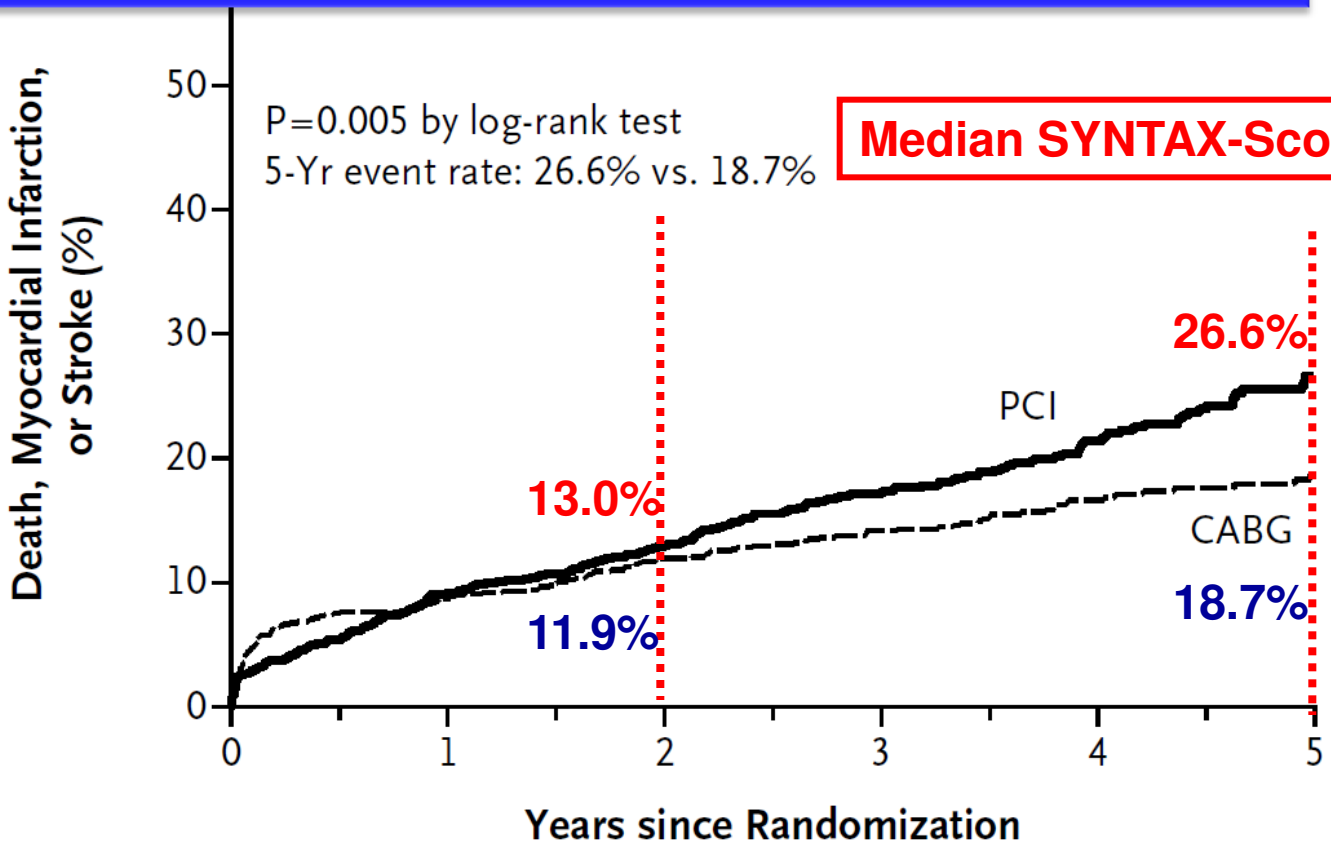
Strategies for Multivessel Revascularization in Patients with Diabetes – the FREEDOM Trial

Farkouh ME et al. *N Engl J Med* 2012; 367:2375-84

Death, MI, or Stroke Through 5 Years



No. at Risk						
PCI	953	848	788	625	416	219
CABG	947	814	758	613	422	221

Specific recommendations in diabetic patients

Recommendations	Class[a]	Level[b]
In patients presenting with STEMI, primary PCI is recommended over fibrinolysis if it can be performed within recommended time limits.	I	A
In patients with NSTE-ACS, an early invasive strategy is recommended over non-invasive management.	I	A
In stable patients with multivessel CAD and/or evidence of ischaemia, revascularization is indicated in order to reduce cardiac adverse events.	I	B
In patients with stable multivessel CAD and an acceptable surgical risk, CABG is recommended over PCI.	I	A
In patients with stable multivessel CAD and SYNTAX score ≤ 22, PCI should be considered as alternative to CABG.	IIa	B
New-generation DES are recommended over BMS.	I	A
Bilateral mammary artery grafting should be considered.	IIa	B
In patients on metformin, renal function should be carefully monitored for 2 to 3 days after coronary angiography/PCI.	I	C

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Revascularization in STEMI

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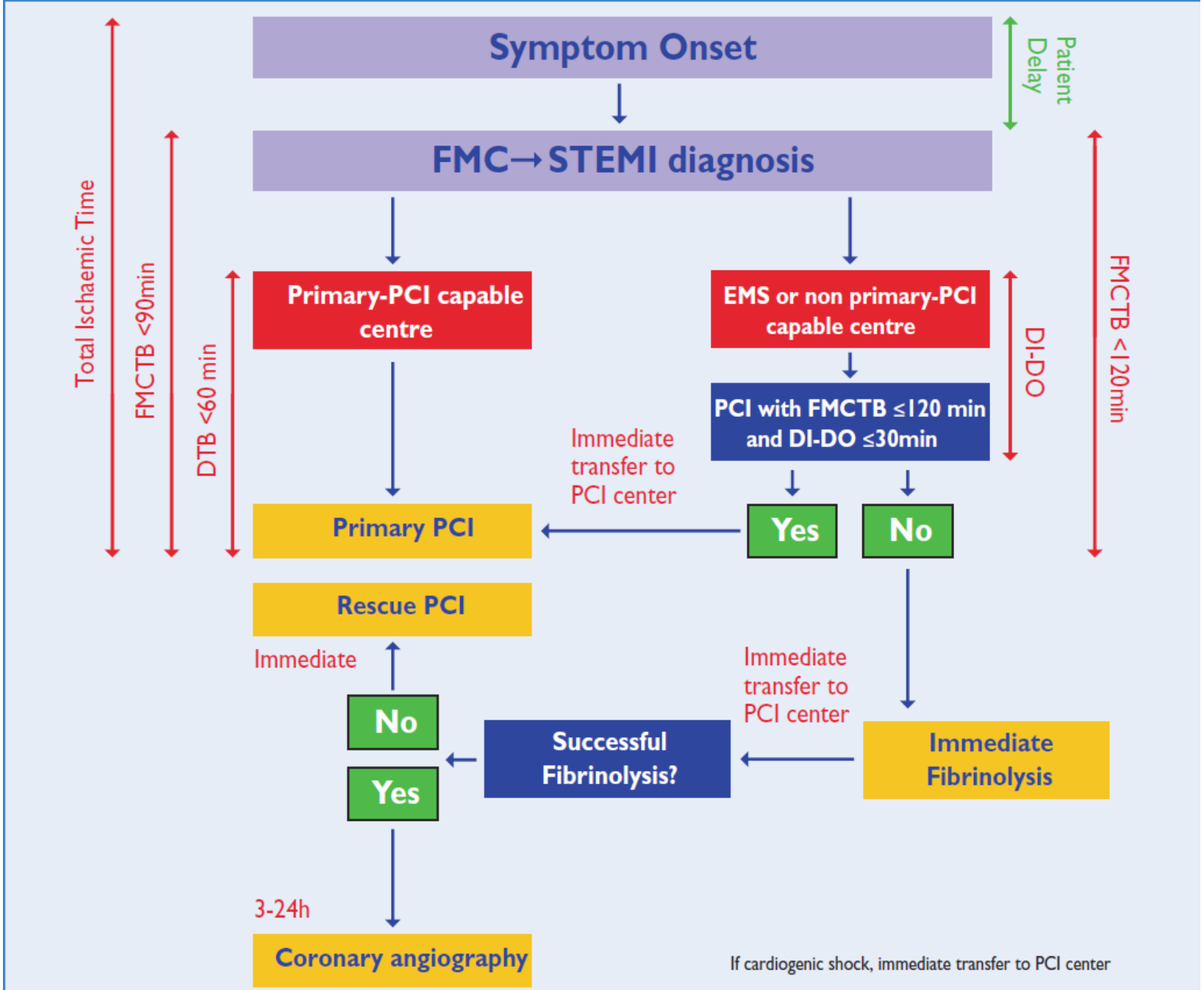

DI-DO = door-in to door-out time; DTB = door-to-balloon time; EMS = emergency medical service; FMC = first medical contact; FMCTB = first-medical-contact-to-balloon time; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

Primary PCI -Technique -Strategy

Technique		
Stenting is recommended (over balloon angioplasty) for primary PCI.	I	A
New-generation DES are recommended over BMS in primary PCI.	I	A
Radial access should be preferred over femoral access if performed by an experienced radial operator.	IIa	A
Thrombus aspiration may be considered in selected patients	IIb	A

Strategy		
Primary PCI should be limited to the culprit vessel with the exception of cardiogenic shock and persistent ischaemia after PCI of the supposed culprit lesion.	IIa	B
Staged revascularization of non-culprit lesions should be considered in STEMI patients with multivessel disease in case of symptoms or ischaemia within days to weeks after primary PCI.	IIa	B
Immediate revascularization of significant non-culprit lesions during the same procedure as primary PCI of the culprit vessel may be considered in selected patients.	IIb	B
In patients with continuing ischaemia and in whom PCI of the infarct-related artery cannot be performed, CABG should be considered.	IIa	C

Clinical value of intracoronary diagnostic techniques

Recommendations	Class[a]	Level[b]
FFR to identify haemodynamically relevant coronary lesion(s) in stable patients when evidence of ischaemia is not available	I	A
FFR-guided PCI in patients with multivessel disease.	IIa	B
IVUS in selected patients to optimize stent implantation.	IIa	B
IVUS to assess severity and optimize treatment of unprotected left main lesions.	IIa	B
IVUS or OCT to assess mechanisms of stent failure.	IIa	C
OCT in selected patients to optimize stent implantation.	IIb	C

Antithrombotic treatments

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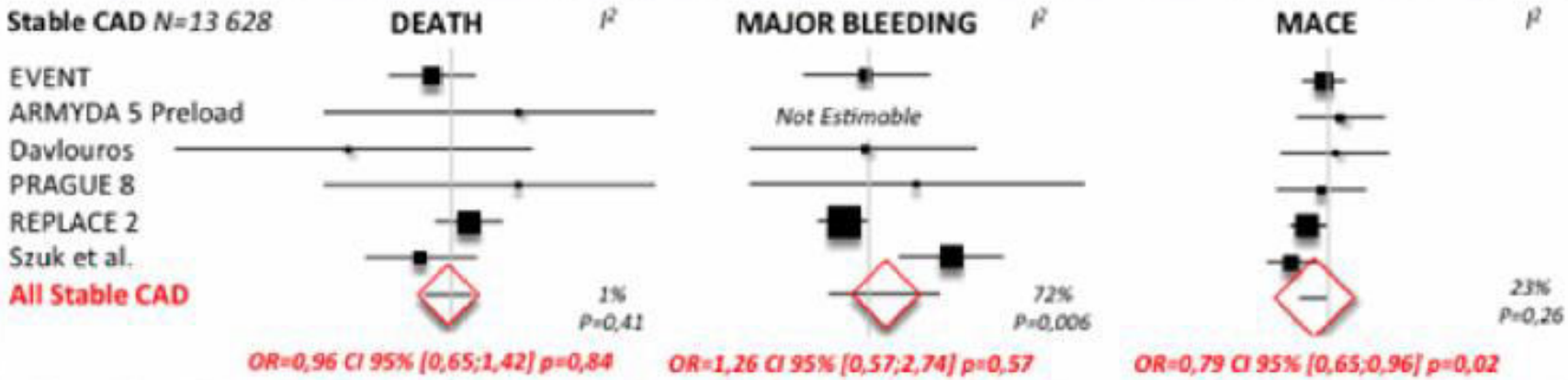
Antithrombotic treatment in SCAD patients undergoing PCI

Pre-treatment with antiplatelet therapy		
Treatment with 600 mg clopidogrel is recommended in elective PCI patients once anatomy is known and decision to proceed with PCI preferably 2 hours or more before the procedure.	I	A
Pre-treatment with clopidogrel may be considered in patients with high probability for significant CAD.	IIb	C
In patients on a maintenance dose of 75 mg clopidogrel, a new loading dose of 600 mg or more may be considered once the indication for PCI is confirmed.	IIb	C
Antiplatelet therapy during PCI		
ASA is indicated before elective stenting.	I	B
ASA oral loading dose of 150–300 mg (or 80-150 mg i.v.) is recommended if not pre-treated.	I	C
Clopidogrel (600 mg loading dose or more, 75 mg daily maintenance dose) is recommended for elective stenting.	I	A
Antiplatelet therapy after stenting		
DAPT is indicated for at least 1 month after BMS implantation.	I	A
DAPT is indicated for 6 months after DES implantation.	I	B
Shorter DAPT duration (<6 months) may be considered after DES implantation in patients at high bleeding risk.	IIb	A
Life-long single antiplatelet therapy, usually ASA, is recommended.	I	A
Instruction of patients about the importance of complying with antiplatelet therapy is recommended.	I	C
DAPT may be used for more than 6 months in patients at high ischaemic risk and low bleeding risk.	IIb	C
GP IIb/IIIa antagonists should be considered only for bail-out.	IIa	C
Anticoagulant therapy		
Unfractionated heparin 70–100 U/kg.	I	B
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour for up to 4 hours after the procedure) in case of heparin-induced thrombocytopaenia.	I	C
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour during the procedure) in patients at high bleeding risk.	IIa	A
Enoxaparin i.v. 0.5 mg/kg.	IIa	B

Clopidogrel pretreatment in SCAD



Bellemain-Apaix A et al. for the ACTION group, TCT 2013.

Antithrombotic treatment in SCAD patients undergoing PCI

Pre-treatment with antiplatelet therapy		
Treatment with 600 mg clopidogrel is recommended in elective PCI patients once anatomy is known and decision to proceed with PCI preferably 2 hours or more before the procedure.	I	A
Pre-treatment with clopidogrel may be considered in patients with high probability for significant CAD.	IIb	C
In patients on a maintenance dose of 75 mg clopidogrel, a new loading dose of 600 mg or more may be considered once the indication for PCI is confirmed.	IIb	C
Antiplatelet therapy during PCI		
ASA is indicated before elective stenting.	I	B
ASA oral loading dose of 150–300 mg (or 80-150 mg i.v.) is recommended if not pre-treated.	I	C
Clopidogrel (600 mg loading dose or more, 75 mg daily maintenance dose) is recommended for elective stenting.	I	A
Antiplatelet therapy after stenting		
DAPT is indicated for at least 1 month after BMS implantation.	I	A
DAPT is indicated for 6 months after DES implantation.	I	B
Shorter DAPT duration (<6 months) may be considered after DES implantation in patients at high bleeding risk.	IIb	A
Life-long single antiplatelet therapy, usually ASA, is recommended.	I	A
Instruction of patients about the importance of complying with antiplatelet therapy is recommended.	I	C
DAPT may be used for more than 6 months in patients at high ischaemic risk and low bleeding risk.	IIb	C
GP IIb/IIIa antagonists should be considered only for bail-out.	IIa	C
Anticoagulant therapy		
Unfractionated heparin 70–100 U/kg.	I	B
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour for up to 4 hours after the procedure) in case of heparin-induced thrombocytopaenia.	I	C
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour during the procedure) in patients at high bleeding risk.	IIa	A
Enoxaparin i.v. 0.5 mg/kg.	IIa	B

Antithrombotic treatment in SCAD patients undergoing PCI

Pre-treatment with antiplatelet therapy		
Treatment with 600 mg clopidogrel is recommended in elective PCI patients once anatomy is known and decision to proceed with PCI preferably 2 hours or more before the procedure.	I	A
Pre-treatment with clopidogrel may be considered in patients with high probability for significant CAD.	IIb	C
In patients on a maintenance dose of 75 mg clopidogrel, a new loading dose of 600 mg or more may be considered once the indication for PCI is confirmed.	IIb	C
Antiplatelet therapy during PCI		
ASA is indicated before elective stenting.	I	B
ASA oral loading dose of 150–300 mg (or 80-150 mg i.v.) is recommended if not pre-treated.	I	C
Clopidogrel (600 mg loading dose or more, 75 mg daily maintenance dose) is recommended for elective stenting.	I	A
Antiplatelet therapy after stenting		
DAPT is indicated for at least 1 month after BMS implantation.	I	A
DAPT is indicated for 6 months after DES implantation.	I	B
Shorter DAPT duration (<6 months) may be considered after DES implantation in patients at high bleeding risk.	IIb	A
Life-long single antiplatelet therapy, usually ASA, is recommended.	I	A
Instruction of patients about the importance of complying with antiplatelet therapy is recommended.	I	C
DAPT may be used for more than 6 months in patients at high ischaemic risk and low bleeding risk.	IIb	C
GP IIb/IIIa antagonists should be considered only for bail-out.	IIa	C
Anticoagulant therapy		
Unfractionated heparin 70–100 U/kg.	I	B
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour for up to 4 hours after the procedure) in case of heparin-induced thrombocytopaenia.	I	C
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour during the procedure) in patients at high bleeding risk.	IIa	A
Enoxaparin i.v. 0.5 mg/kg.	IIa	B

Antithrombotic therapy in NSTE-ACS patients undergoing PCI

Antiplatelet therapy		
ASA is recommended for all patients without contraindications at an initial oral loading dose of 150–300 mg (or 80–150 mg i.v.), and at a maintenance dose of 75–100 mg daily long-term regardless of treatment strategy.	I	A
A $P2Y_{12}$ inhibitor is recommended in addition to ASA, and maintained over 12 months unless there are contraindications such as excessive risk of bleeding. Options are:	I	A
• Prasugrel (60 mg loading dose, 10 mg daily dose) in patients in whom coronary anatomy is known and who are proceeding to PCI if no contraindication.	I	B
• Ticagrelor (180 mg loading dose, 90 mg twice daily) for patients at moderate-to-high risk of ischaemic events, regardless of initial treatment strategy including those pre-treated with clopidogrel if no contraindication.	I	B
• Clopidogrel (600 mg loading dose, 75 mg daily dose), only when prasugrel or ticagrelor are not available or are contraindicated.	I	B
GP IIb/IIIa antagonists should be considered for bail-out situation or thrombotic complications.	IIa	C
Pre-treatment with prasugrel in patients in whom coronary anatomy is not known is not recommended.	III	B
Pre-treatment with GP IIb/IIIa antagonists in patients in whom coronary anatomy is not known is not recommended.	III	A
Anticoagulant therapy		
Anticoagulation is recommended for all patients in addition to antiplatelet therapy during PCI.	I	A
The anticoagulation is selected according to both ischaemic and bleeding risks, and according to the efficacy–safety profile of the chosen agent.	I	C
Bivalirudin (0.75 mg/kg bolus, followed by 1.75 mg/kg/hour for up to 4 hours after the procedure) is recommended as alternative to UFH plus GP IIb/IIIa receptor inhibitor during PCI.	I	A
UFH is recommended as anticoagulant for PCI if patients cannot receive bivalirudin.	I	C
In patients on fondaparinux (2.5 mg daily s.c.), a single bolus UFH (85 IU/kg, or 60 IU in the case of concomitant use of GP IIb/IIIa receptor inhibitors) is indicated during PCI.	I	B
Enoxaparin should be considered as anticoagulant for PCI in patients pre-treated with subcutaneous enoxaparin.	IIa	B
Discontinuation of anticoagulation should be considered after an invasive procedure unless otherwise indicated.	IIa	C
Crossover of UFH and LMWH is not recommended.	III	B

Antithrombotic therapy in STEMI patients undergoing primary PCI

Recommendations	Class[a]	Level[b]
Antiplatelet therapy		
ASA is recommended for all patients without contraindications at an initial oral loading dose of 150–300 mg (or 80–150 mg i.v.) and at a maintenance dose of 75–100 mg daily long-term regardless of treatment strategy.	I	A
A $P2Y_{12}$ inhibitor is recommended in addition to ASA and maintained over 12 months unless there are contraindications such as excessive risk of bleeding. Options are:	I	A
• Prasugrel (60 mg loading dose, 10 mg daily dose) if no contraindication	I	B
• Ticagrelor (180 mg loading dose, 90 mg twice daily) if no contraindication	I	B
• Clopidogrel (600 mg loading dose, 75 mg daily dose), only when prasugrel or ticagrelor are not available or are contraindicated.	I	B
It is recommended to give $P2Y_{12}$ inhibitors at the time of first medical contact.	I	B
GP IIb/IIIa inhibitors should be considered for bail-out or evidence of no-reflow or a thrombotic complication.	IIa	C
Upstream use of a GP IIb/IIIa inhibitor (vs. in-lab use) may be considered in high-risk patients undergoing transfer for primary PCI.	IIb	B
Anticoagulants		
Anticoagulation is recommended for all patients in addition to antiplatelet therapy during PCI.	I	A
The anticoagulation is selected according to both ischaemic and bleeding risks, and according to the efficacy–safety profile of the chosen agent.	I	C
Unfractionated heparin: 70–100 U/kg i.v. bolus when no GP IIb/IIIa inhibitor is planned 50–70 U/kg i.v. bolus with GPIIb/IIIa inhibitor	I	C
Bivalirudin 0.75 mg/kg i.v. bolus followed by i.v. infusion of 1.75 mg/kg/h for up to 4 hours after the procedure	IIa	A
Enoxaparin i.v. 0.5 mg/kg with or without GP IIb/IIIa inhibitor.	IIa	B

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Antithrombotic therapy in STEMI patients undergoing primary PCI

Recommendations	Class[a]	Level[b]
Antiplatelet therapy		
ASA is recommended for all patients without contraindications at an initial oral loading dose of 150–300 mg (or 80–150 mg i.v.) and at a maintenance dose of 75–100 mg daily long-term regardless of treatment strategy.	I	A
A $P2Y_{12}$ inhibitor is recommended in addition to ASA and maintained over 12 months unless there are contraindications such as excessive risk of bleeding. Options are:	I	A
• Prasugrel (60 mg loading dose, 10 mg daily dose) if no contraindication	I	B
• Ticagrelor (180 mg loading dose, 90 mg twice daily) if no contraindication	I	B
• Clopidogrel (600 mg loading dose, 75 mg daily dose), only when prasugrel or ticagrelor are not available or are contraindicated.	I	B
It is recommended to give $P2Y_{12}$ inhibitors at the time of first medical contact.	I	B
GP IIb/IIIa inhibitors should be considered for bail-out or evidence of no-reflow or a thrombotic complication.	IIa	C
Upstream use of a GP IIb/IIIa inhibitor (vs. in-lab use) may be considered in high-risk patients undergoing transfer for primary PCI.	IIb	B
Anticoagulants		
Anticoagulation is recommended for all patients in addition to antiplatelet therapy during PCI.	I	A
The anticoagulation is selected according to both ischaemic and bleeding risks, and according to the efficacy–safety profile of the chosen agent.	I	C
Unfractionated heparin: 70–100 U/kg i.v. bolus when no GP IIb/IIIa inhibitor is planned 50–70 U/kg i.v. bolus with GPIIb/IIIa inhibitor	I	C
Bivalirudin 0.75 mg/kg i.v. bolus followed by i.v. infusion of 1.75 mg/kg/h for up to 4 hours after the procedure	IIa	A
Enoxaparin i.v. 0.5 mg/kg with or without GP IIb/IIIa inhibitor.	IIa	B

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Antithrombotic therapy in STEMI patients undergoing primary PCI

Recommendations	Class[a]	Level[b]
Antiplatelet therapy		
ASA is recommended for all patients without contraindications at an initial oral loading dose of 150–300 mg (or 80–150 mg i.v.) and at a maintenance dose of 75–100 mg daily long-term regardless of treatment strategy.	I	A
A $P2Y_{12}$ inhibitor is recommended in addition to ASA and maintained over 12 months unless there are contraindications such as excessive risk of bleeding. Options are:	I	A
• Prasugrel (60 mg loading dose, 10 mg daily dose) if no contraindication	I	B
• Ticagrelor (180 mg loading dose, 90 mg twice daily) if no contraindication	I	B
• Clopidogrel (600 mg loading dose, 75 mg daily dose), only when prasugrel or ticagrelor are not available or are contraindicated.	I	B
It is recommended to give $P2Y_{12}$ inhibitors at the time of first medical contact.	I	B
GP IIb/IIIa inhibitors should be considered for bail-out or evidence of no-reflow or a thrombotic complication.	IIa	C
Upstream use of a GP IIb/IIIa inhibitor (vs. in-lab use) may be considered in high-risk patients undergoing transfer for primary PCI.	IIb	B
Anticoagulants		
Anticoagulation is recommended for all patients in addition to antiplatelet therapy during PCI.	I	A
The anticoagulation is selected according to both ischaemic and bleeding risks, and according to the efficacy–safety profile of the chosen agent.	I	C
Unfractionated heparin: 70–100 U/kg i.v. bolus when no GP IIb/IIIa inhibitor is planned 50–70 U/kg i.v. bolus with GPIIb/IIIa inhibitor	I	C
Bivalirudin 0.75 mg/kg i.v. bolus followed by i.v. infusion of 1.75 mg/kg/h for up to 4 hours after the procedure	IIa	A
Enoxaparin i.v. 0.5 mg/kg with or without GP IIb/IIIa inhibitor.	IIa	B

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Antithrombotic treatment in patients undergoing PCI who require oral anticoagulation

Recommendations	Class[a]	Level[b]
In patients with a firm indication for oral anticoagulation (e.g. atrial fibrillation with CHA_2DS_2-VASc score ≥2, venous thromboembolism, LV thrombus, or mechanical valve prosthesis), oral anticoagulation is recommended in addition to antiplatelet therapy.	I	C
New-generation DES are preferred over BMS among patients requiring oral anticoagulation if bleeding risk is low (HAS-BLED ≤2).	IIa	C
In patients with SCAD and atrial fibrillation with CHA_2DS_2-VASc score ≥2 at low bleeding risk (HAS-BLED ≤2), initial triple therapy of (N)OAC and ASA (75–100 mg/day) and clopidogrel 75 mg/day should be considered for a duration of at least one month after BMS or new-generation DES followed by dual therapy with (N)OAC and aspirin 75–100 mg/day or clopidogrel (75 mg/day) continued up to 12 months.	IIa	C
DAPT should be considered as alternative to initial triple therapy for patients with SCAD and atrial fibrillation with a CHA_2DS_2-VASc score ≤1.	IIa	C
In patients with ACS and atrial fibrillation at low bleeding risk (HAS-BLED≤2), initial triple therapy of (N)OAC and ASA (75–100 mg/day) and clopidogrel 75 mg/day should be considered for a duration of 6 months irrespective of stent type followed by (N)OAC and aspirin 75–100 mg/day or clopidogrel (75 mg/day) continued up to 12 months.	IIa	C
In patients requiring oral anticoagulation at high bleeding risk (HAS BLED ≥3), triple therapy of (N)OAC and ASA (75–100 mg/day) and clopidogrel 75 mg/day should be considered for a duration of one month followed by (N)OAC and aspirin 75–100 mg/day or clopidogrel (75 mg/day) irrespective of clinical setting (SCAD or ACS) and stent type (BMS or new-generation DES).	IIa	C
Dual therapy of (N)OAC and clopidogrel 75 mg/day may be considered as an alternative to initial triple therapy in selected patients.	IIb	B
The use of ticagrelor and prasugrel as part of initial triple therapy is not recommended	III	C

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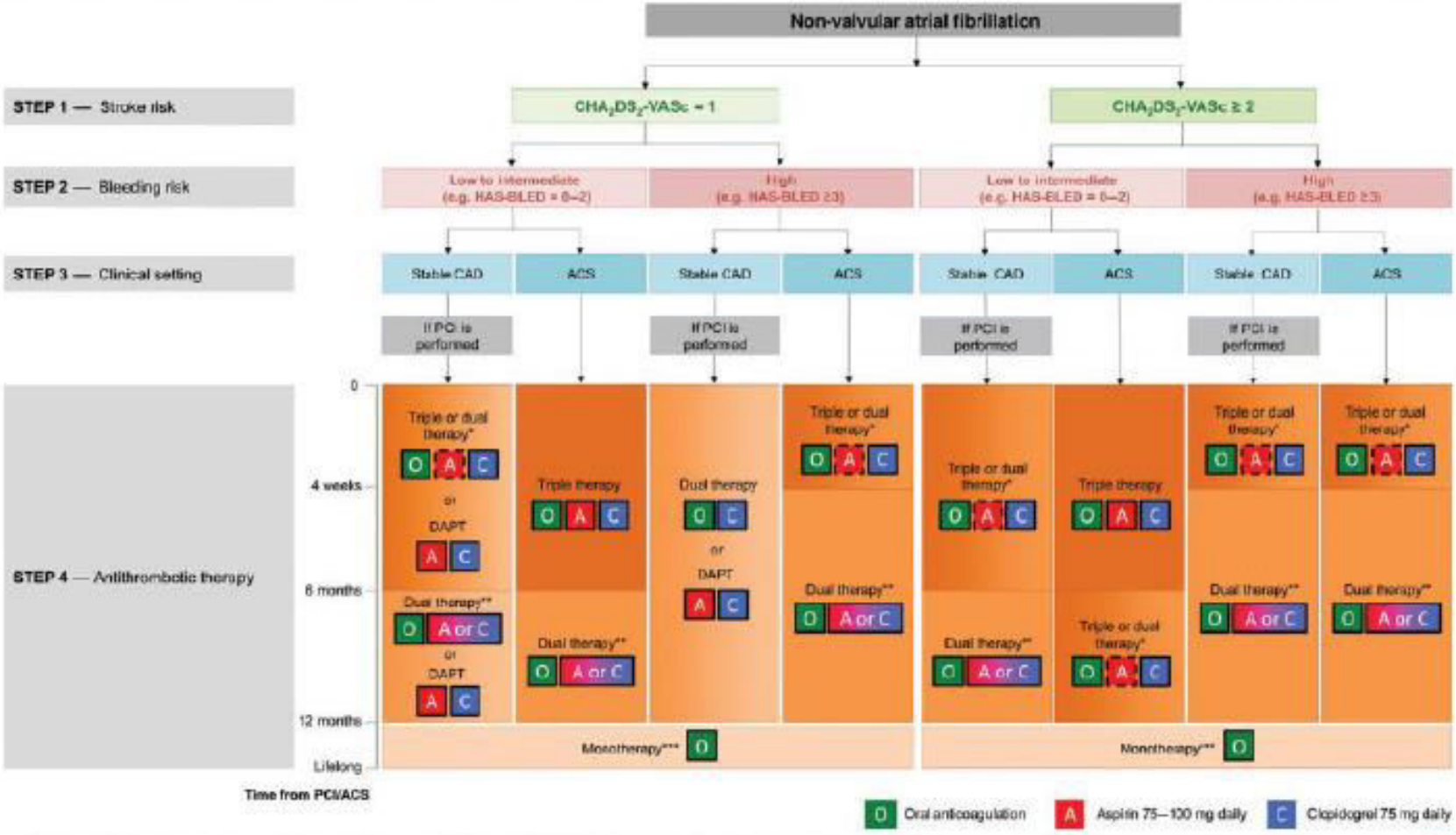
Antithrombotic treatment in patients undergoing PCI who require oral anticoagulation

Recommendations	Class[a]	Level[b]
Anticoagulation therapy after PCI in ACS patient		
In selected patients who receive ASA and clopidogrel, low-dose rivaroxaban (2.5 mg twice daily) may be considered in the setting of PCI for ACS if the patient is at low bleeding risk.	IIb	B
Anticoagulation during PCI in patients on oral anticoagulation		
During primary PCI, use of additional parenteral anticoagulation is recommended, irrespective of the timing of the last dose of (D)OAC.	I	C
During elective PCI, temporary interruption of (D)OAC 48 hours prior to PCI with additional periprocedural intravenous anticoagulant (bivalirudin, enoxaparin lor UHF) is recommended.	I	C
During elective PCI, no additional anticoagulation is needed in VKA-treated patients if the international normalized ratio (INR) is >2.5.	I	C
Periprocedural parenteral anticoagulants (bivalirudin, enoxaparin or UHF) should be discontinued immediately after primary PCI.	IIa	C

Combination strategies of oral anticoagulation (O), aspirin (A) and/or clopidogrel (C)



Volume-outcome relationship

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Training, proficiency and operator/institutional competence

Recommendations	Class[a]	Level[b]
It should be considered that trainees in cardiac surgery perform at least 200 CABG procedures under supervision before being independent.	IIa	C
CABG should be performed with an annual institutional volume of at least 200 CABG cases.	IIa	C
Routine use of the internal mammary artery at a rate >90% is recommended.	I	B
Routine reporting of CABG outcome data to national registries and/or the EACTS database is recommended.	I	C
Physicians training in interventional cardiology should complete formal training according to a 1–2 year curriculum at institutions with at least 800 PCIs per year and an established 24-hour/7-day service for the treatment of patients with ACS.	IIa	C
Physicians training in interventional cardiology should have performed at least 200 PCI procedures as first or only operator with one-third of PCI procedures in emergency or ACS patients under supervision before becoming independent.	IIa	C
National Societies of the ESC should develop recommendations on annual operator and institutional PCI volume. This Task Force recommends, the operator and hospital volumes listed below:	IIa	C
• PCI for ACS should be performed by trained operators with an annual volume of at least 75 procedures at institutions performing at least 400 PCI per year with an established 24-hour/7-day service for the treatment of patients with ACS. • PCI for SCAD should be performed by trained operators with an annual volume of at least 75 procedures at institutions performing at least 200 PCI per year. • Institutions with an annual volume of fewer than 400 PCI should consider collaboration in networks with high-volume institutions (more than 400 PCI per year), with shared written protocols and exchange of operators and support staff.	IIa	C
Non-emergency high-risk PCI procedures, such as distal LM disease, complex bifurcation stenosis, single remaining patent coronary artery, and complex chronic total occlusions, should be performed by adequately experienced operators at centres that have access to circulatory support and intensive care treatment, and preferentially have cardiovascular surgery on-site.	IIa	C

Training, proficiency and operator/institutional competence

Recommendations	Class[a]	Level[b]
It should be considered that trainees in cardiac surgery perform at least 200 CABG procedures under supervision before being independent.	IIa	C
CABG should be performed with an annual institutional volume of at least 200 CABG cases.	IIa	C
Routine use of the internal mammary artery at a rate >90% is recommended.	I	B
Routine reporting of CABG outcome data to national registries and/or the EACTS database is recommended.	I	C
Physicians training in interventional cardiology should complete formal training according to a 1–2 year curriculum at institutions with at least 800 PCIs per year and an established 24-hour/7-day service for the treatment of patients with ACS.	IIa	C
Physicians training in interventional cardiology should have performed at least 200 PCI procedures as first or only operator with one-third of PCI procedures in emergency or ACS patients under supervision before becoming independent.	IIa	C
National Societies of the ESC should develop recommendations on annual operator and institutional PCI volume. This Task Force recommends, the operator and hospital volumes listed below:	**IIa**	**C**
• PCI for ACS should be performed by trained operators with an annual volume of at least 75 procedures at institutions performing at least 400 PCI per year with an established 24-hour/7-day service for the treatment of patients with ACS. • PCI for SCAD should be performed by trained operators with an annual volume of at least 75 procedures at institutions performing at least 200 PCI per year. • Institutions with an annual volume of fewer than 400 PCI should consider collaboration in networks with high-volume institutions (more than 400 PCI per year), with shared written protocols and exchange of operators and support staff.	**IIa**	**C**
Non-emergency high-risk PCI procedures, such as distal LM disease, complex bifurcation stenosis, single remaining patent coronary artery, and complex chronic total occlusions, should be performed by adequately experienced operators at centres that have access to circulatory support and intensive care treatment, and preferentially have cardiovascular surgery on-site.	**IIa**	**C**

Summary of novel aspects

- **Guideline informed by systematic review of RCTs on revascularization Rx**
- **Emphasis on risk stratification**
  - Guide to calculate SYNTAX score
  - STS score for short-term and SYNTAX (II) score for long-term risk assessment
- **Timing of revascularization according to clinical status**
  - ≤2 weeks: CCS III-IV and high-risk anatomy
  - ≤6 weeks: other patients
- **Recommendation for type of revascularization (PCI vs CABG)**
  - PCI alternative to CABG
    - One or two-vessel CAD with proximal LAD lesions
    - Left main CAD with SYNTAX score <32
    - Three-vessel CAD with SYNTAX score ≤22
  - PCI not recommended
    - Left main CAD with SS >32 and three-vessel CAD with SS>22
  - CABG preferred over PCI in diabetic patients with multivessel disease

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Summary of novel aspects

- **Recommendation for STEMI and cardiogenic shock**
  - DES assume a Class IA indication (over BMS)
  - Thrombus aspiration is reserved to selected patients
  - Staged revascularization of non-culprit lesions emphasized
- **Procedural aspects of revascularization**
  - Bilateral IMA grafting in patients <70 years of age
  - New-generation DES are indicated in all patient and lesion subsets
  - IVUS and OCT are useful to guide stent implantation in selected patients
- **Antithrombotic treatment**
  - DAPT duration 6 months for DES and shorter in patients at high bleeding risk
  - Pretreatment with prasugrel is not useful in patients with NSTE-ACS
  - Bivalirudin not superior to UFH in STEMI patients undergoing primary PCI
- **Volume-outcome relationship**
  - Miminal operator/institutional proficiency and training requirements

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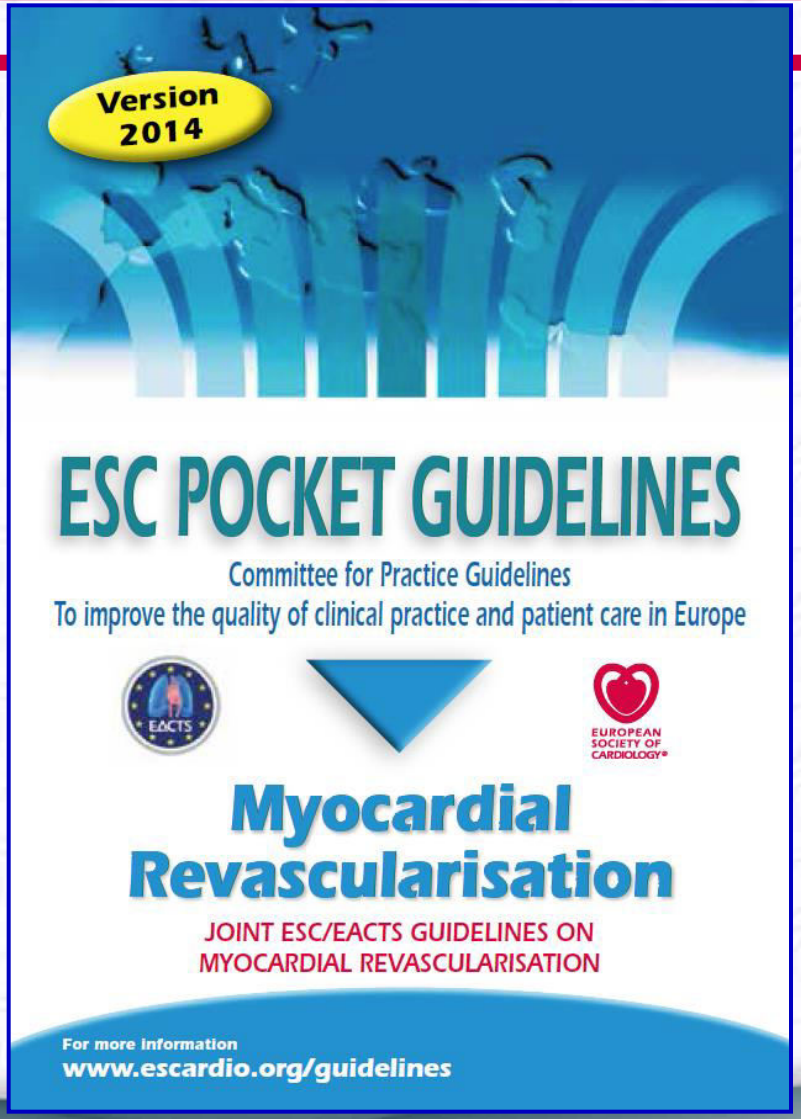
Pocket Guidelines



ESC Pocket Guidelines

2014 ESC/EACTS Guidelines on myocardial revascularization*

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)

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