2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation

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RESURCOR… encore et toujours !

Logistics of prehospital care

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Recommendations	Class	Level
It is recommended that the prehospital management of STEMI patients is based on regional networks designed to deliver reperfusion therapy expeditiously, and effectively, with efforts made to make primary PCI available to as many patients as possible.	I	B
It is recommended that primary PCI-capable centres deliver a 24/7 service and are able to perform primary PCI without delay.	I	B
It is recommended that patients transferred to a PCI-capable centre for primary PCI bypass the emergency department and CCU/ICCU and are transferred directly to the catheterization laboratory.	I	B
It is recommended that ambulance teams are trained and equipped to identify STEMI (with use of ECG recorders and telemetry as necessary) and administer initial therapy, including fibrinolysis when applicable.	I	C
It is recommended that all hospitals and EMS participating in the care of patients with STEMI record and audit delay times and work to achieve and maintain quality targets.	I	C

What is new in 2017 Guidelines on AMI-STEMI *(continued)*

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2017 NEW / REVISED CONCEPTS

MINOCA AND QUALITY INDICATORS:
- New chapters dedicated to these topics.

STRATEGY SELECTION AND TIME DELAYS:
- Clear definition of first medical contact (FMC).
- Definition of "time 0" to choose reperfusion strategy (i.e. the strategy clock starts at the time of "STEMI diagnosis").
- Selection of PCI over fibrinolysis: when anticipated delay from "STEMI diagnosis" to wire crossing is ≤120 min.
- Maximum delay time from "STEMI diagnosis" to bolus of fibrinolysis agent is set in 10 min.
- "Door-to-Balloon" term eliminated from guidelines.

TIME LIMITS FOR ROUTINE OPENING OF AN IRA:
- 0-12h (Class I); 12-48h (Class IIa); >48h (Class III).

ELECTROCARDIOGRAM AT PRESENTATION:
- Left and right bundle branch block considered equal for recommending urgent angiography if ischaemic symptoms.

TIME TO ANGIOGRAPHY AFTER FIBRINOLYSIS:
- Timeframe is set in 2-24h after successful fibrinolysis.

PATIENTS TAKING ANTICOAGULANTS:
- Acute and chronic management presented.

Atypical electrocardiographic presentations

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Bundle branch block

Criteria that can be used to improve the diagnostic accuracy of STEMI in LBBB:
- Concordant ST-segment elevation ≥1 mm in leads with a positive QRS complex
- Concordant ST-segment depression ≥1 mm in V_1-V_3
- Discordant ST-segment elevation ≥5 mm in leads with a negative QRS complex

The presence of RBBB may confound the diagnosis of STEMI.

Ventricular paced rhythm

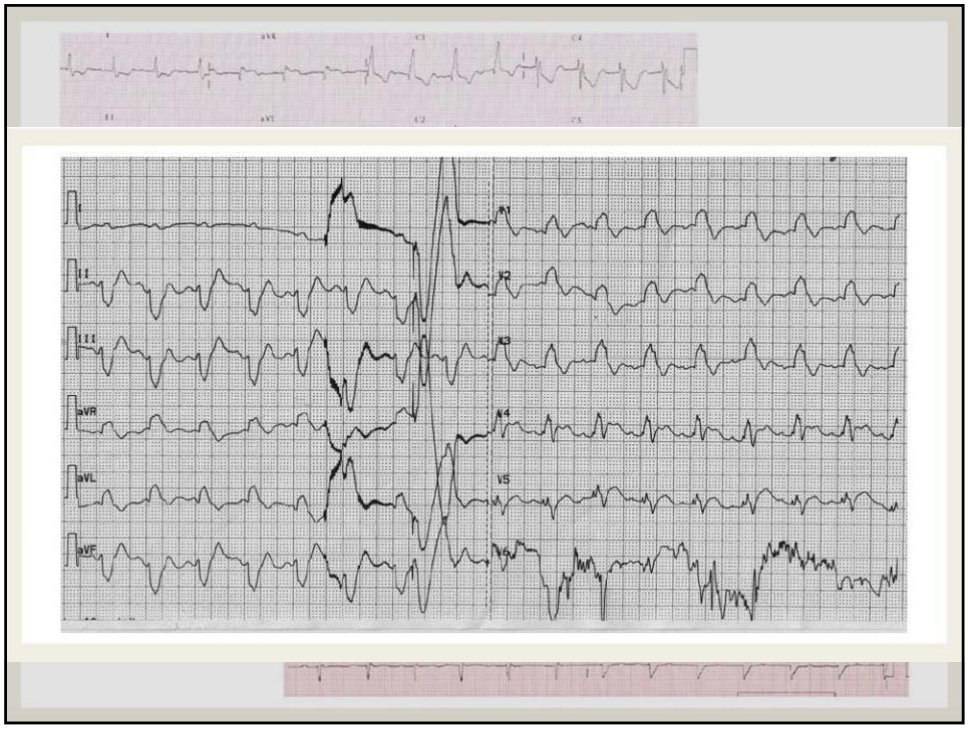
During RV pacing, the ECG also shows LBBB and the above rules also apply for the diagnosis of myocardial infarction during pacing; however, they are less specific.

Isolated posterior myocardial infarction

Isolated ST depression ≥0.5 mm in leads V_1–V_3 and ST-segment elevation (≥0.5 mm) inposterior chest wall leads V_7-V_9

Ischaemia due to left main coronary artery occlusion or multivessel disease

ST depression ≥1 mm in eight or more surface leads, coupled with ST-segment elevationin aVR and/or V_1, suggests left main-, or left main equivalent- coronary obstruction, or severe three vessel ischaemia.



BBD – BBG & STEMI

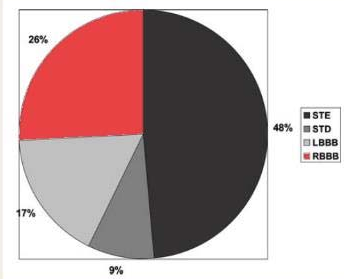


Figure 5 Electrocardiographic findings among patients with acute myocardial infarction caused by the left main coronary artery occlusion.

Patients with new or presumably new BBB had the highest :

- incidence of cardiogenic shock
  - → STE 6.7 %
  - → LBBB 15.8 %
  - → RBBB 15.4 %

- in hospital mortality
  - → STE 5.4 %
  - → LBBB 13.2 %
  - → RBBB 18.8 %

Widimski & al. Eur Heart T 2012;33:86–95

What is new in 2017 Guidelines on AMI-STEMI *(continued)*

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Modes of patient presentation, components of ischaemic time and flowchart for reperfusion strategy selection

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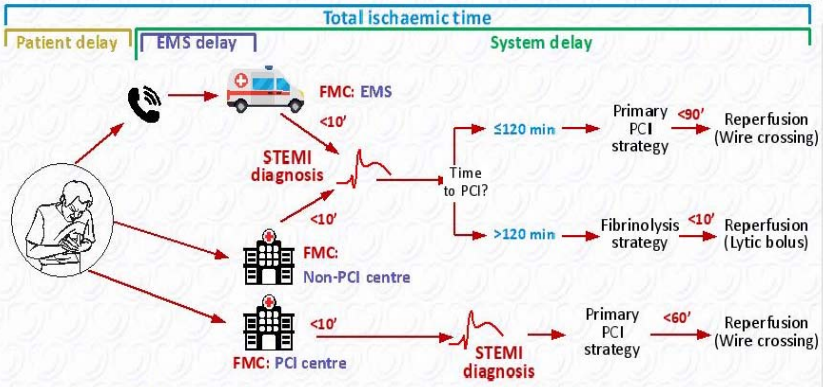
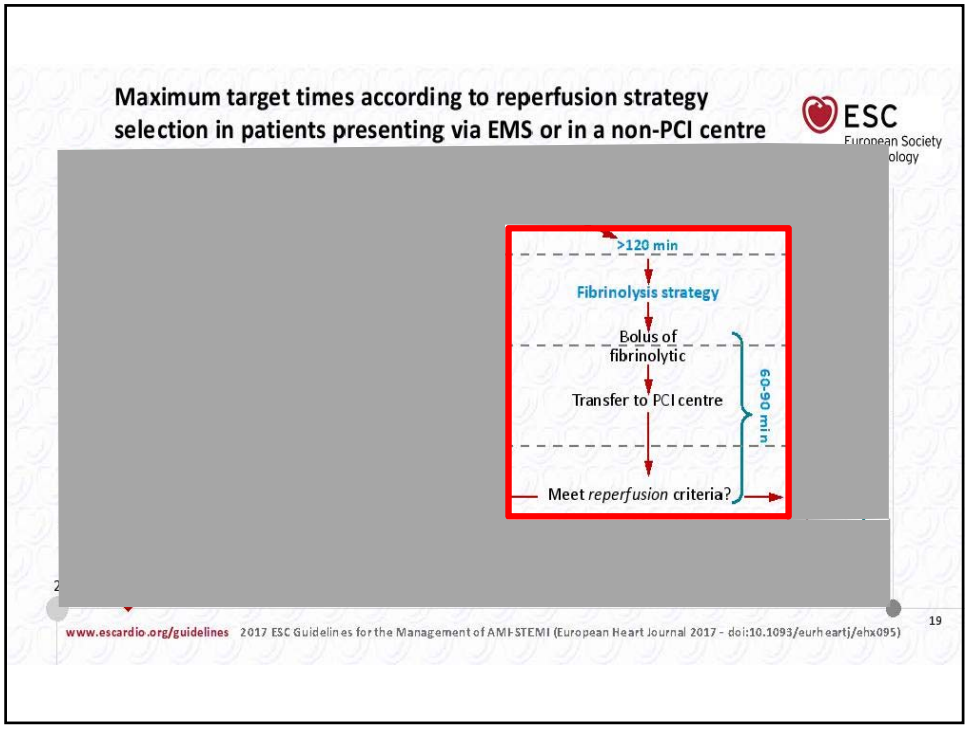
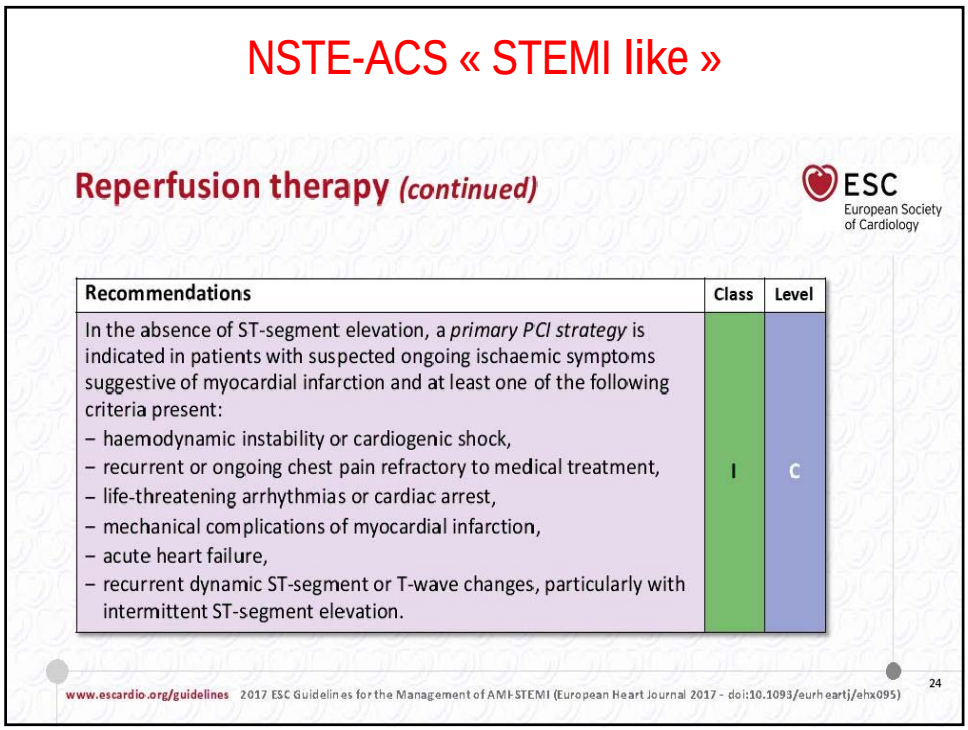
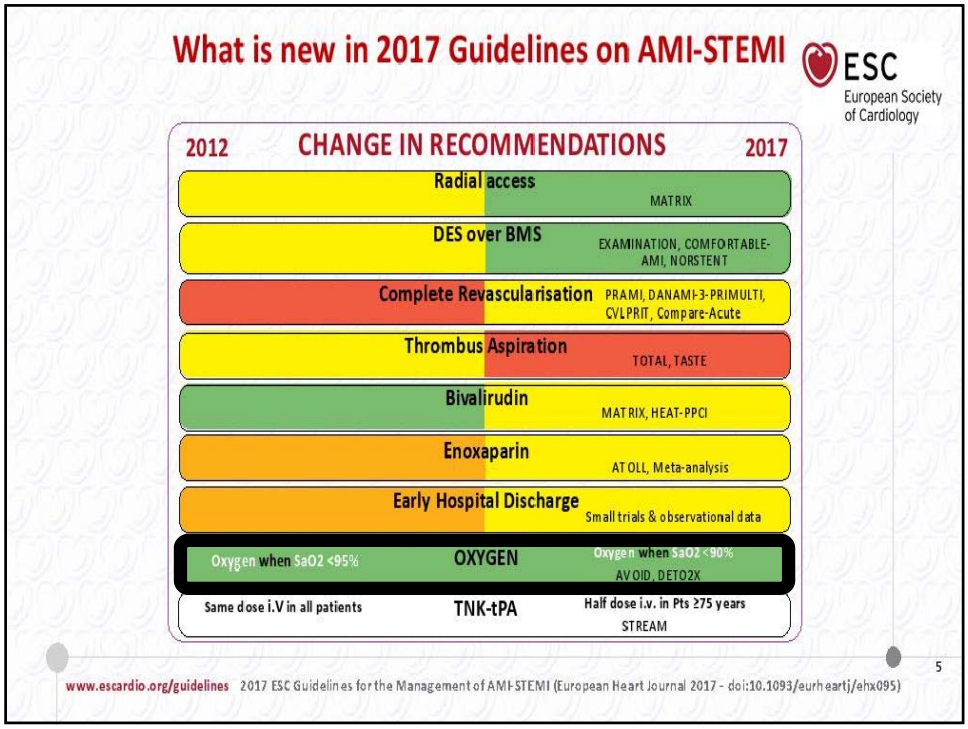


Recommendations	Class	Level
Reperfusion therapy is indicated in all patients with symptoms of ischaemia of ≤12 hours duration and persistent ST-segment elevation.	I	A
A *primary PCI strategy* is recommended over fibrinolysis within indicated time frames.	I	A
If primary PCI cannot be performed timely after STEMI diagnosis, fibrinolytic therapy is recommended within 12 hours of symptom onset in patients without contra-indications.	I	A



NSTE-ACS « STEMI like »





O_2 or not O_2 ?

- High-flow oxygen has been shown to
  - reduce epicardial coronary blood flow
  - increase coronary vascular resistance
  - affect the microcirculation
- The effect of oxygen therapy at the acute phase in normoxic STEMI patients remains debated

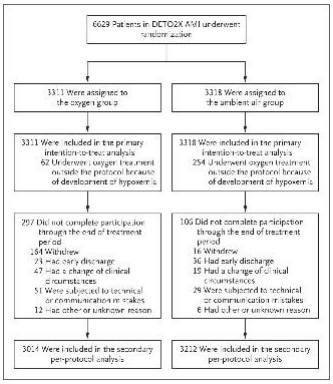
→ AVOID study :441 patients with acute STEMI and SaO_2 > 94% were randomized to receive 0 vs. 8 L/min O_2

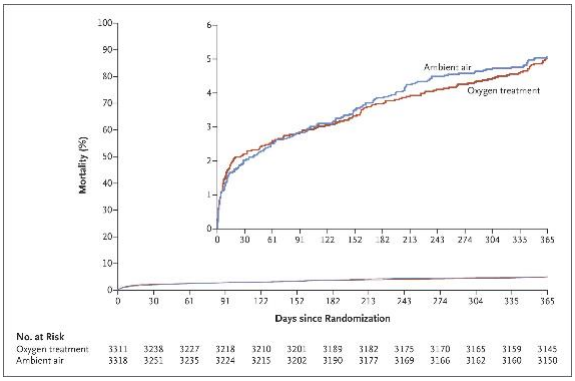
End point	02	No O2	P value
In hospital			
Troponine (Median AUC)	2000	1647	0.08
CK (Median AUC)	60395	50726	0.12
MRI Infarct size (gr)	20.3	13.1	0.04
6 mois			
MACEs	21.9	15.4	0.08

Supplemental oxygen therapy in patients with ST-elevation–myocardial infarction but without hypoxia may increase early myocardial injury and was associated with larger myocardial infarct size.

Ellims & al. Circulation. 2015;131:2143-2150

DETO2X





Hoffmann & al N Engl J Med 2017;377:1240-1249

DETO2X

Table 3. End Points during and after Hospitalization.

Timing and End Point	Oxygen Group (N=3311)	Ambient-Air Group (N=3318)	Hazard Ratio (95% CI)	P Value
365 Days after randomization				
Death from any cause — no. (%)	166 (5.0)	168 (5.1)	0.97 (0.79–1.21)	0.80
Rehospitalization with myocardial infarction — no. (%)	126 (3.8)	111 (3.3)	1.13 (0.88–1.46)	0.33
Composite of death from any cause or rehospitalization with myocardial infarction — no. (%)	275 (8.3)	264 (8.0)	1.03 (0.87–1.22)	0.70
30 Days after randomization				
Death from any cause — no. (%)	73 (2.2)	67 (2.0)	1.07 (0.77–1.50)	0.67
Rehospitalization with myocardial infarction — no. (%)	45 (1.4)	31 (0.9)	1.46 (0.92–2.31)	0.11
Composite of death from any cause or rehospitalization with myocardial infarction — no. (%)	114 (3.4)	95 (2.9)	1.19 (0.91–1.56)	0.21
During hospital stay				
Median highest measured level of highly sensitive troponin T (IQR) — ng/liter*	946.5 (243.0–2884.0)	983.0 (225.0–2931.0)	—	0.97

* Data were available for 3976 (79.4%) of the 5010 patients with confirmed myocardial infarction: 1998 patients (80.4%) in the oxygen group and 1978 patients (78.3%) in the ambient-air group. The P value for the comparison was calculated with the use of a nonparametric Wilcoxon signed-rank test.

Hoffmann & al N Engl J Med 2017;377:1240-1249

Relief of hypoxaemia and symptoms

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Recommendations	Class	Level
Hypoxia		
Oxygen is indicated in patients with hypoxaemia (SaO2 <90% or PaO2 <60 mmHg).	I	C
Routine oxygen is not recommended in patients with SaO2 ≥90%.	III	B
Symptoms		
Titrated i.v. opioids should be considered to relieve pain.	IIa	C
A mild tranquillizer (usually a benzodiazepine) should be considered in very anxious patients.	IIa	C

What is new in 2017 Guidelines on AMI-STEMI

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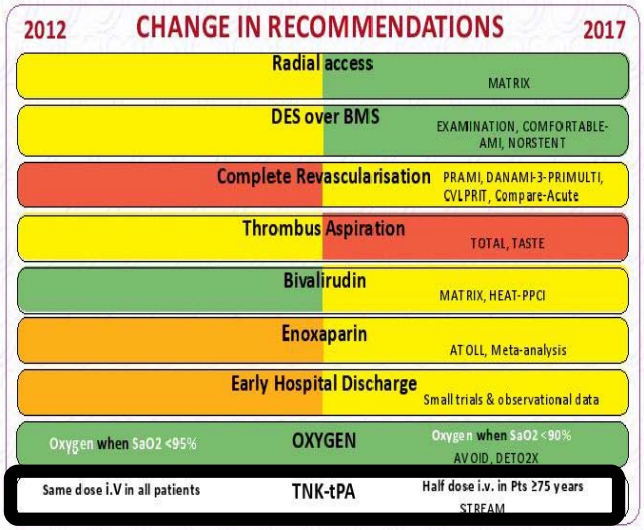
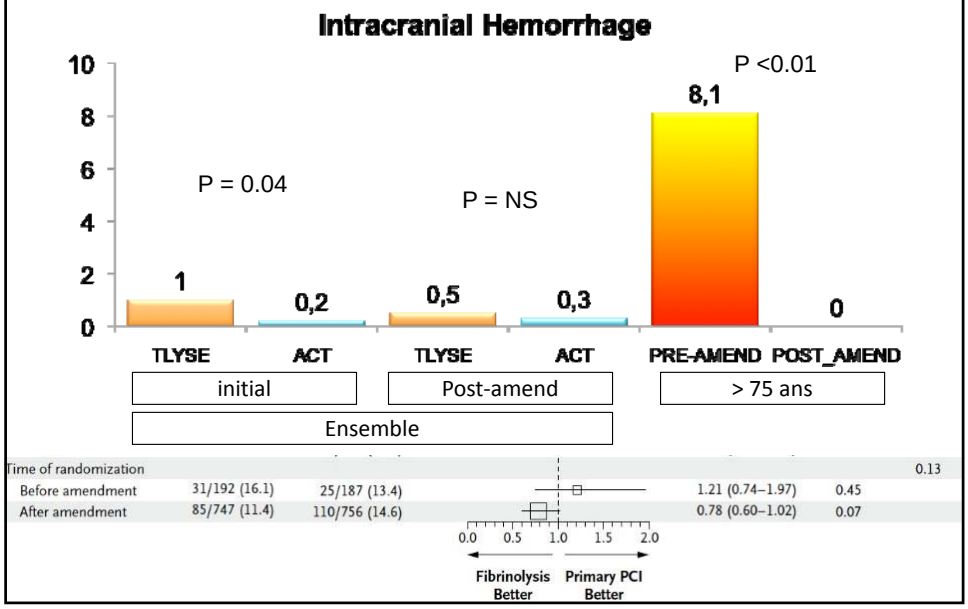
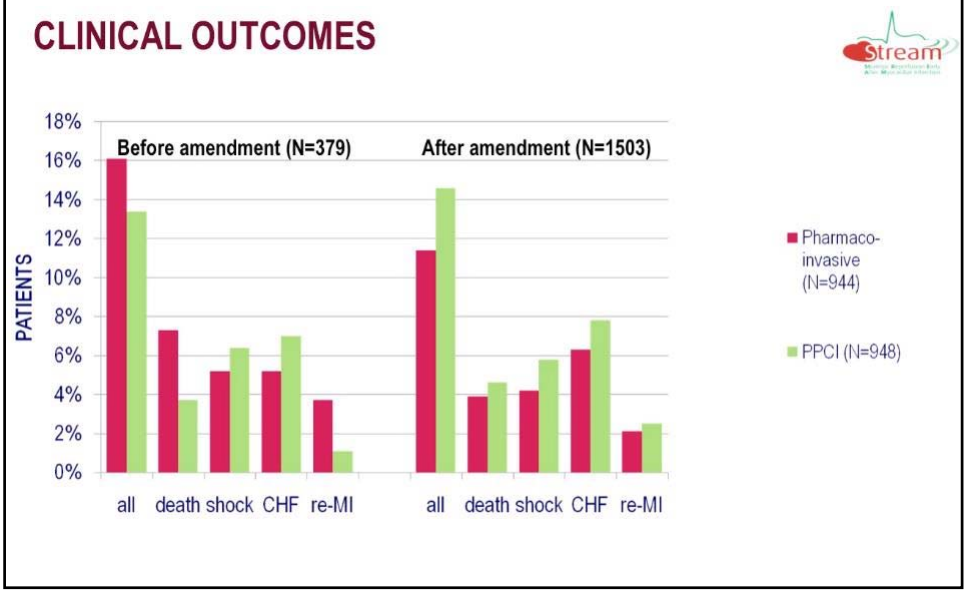


STREAM : Stroke



STREAM : Post Hoc Analysis



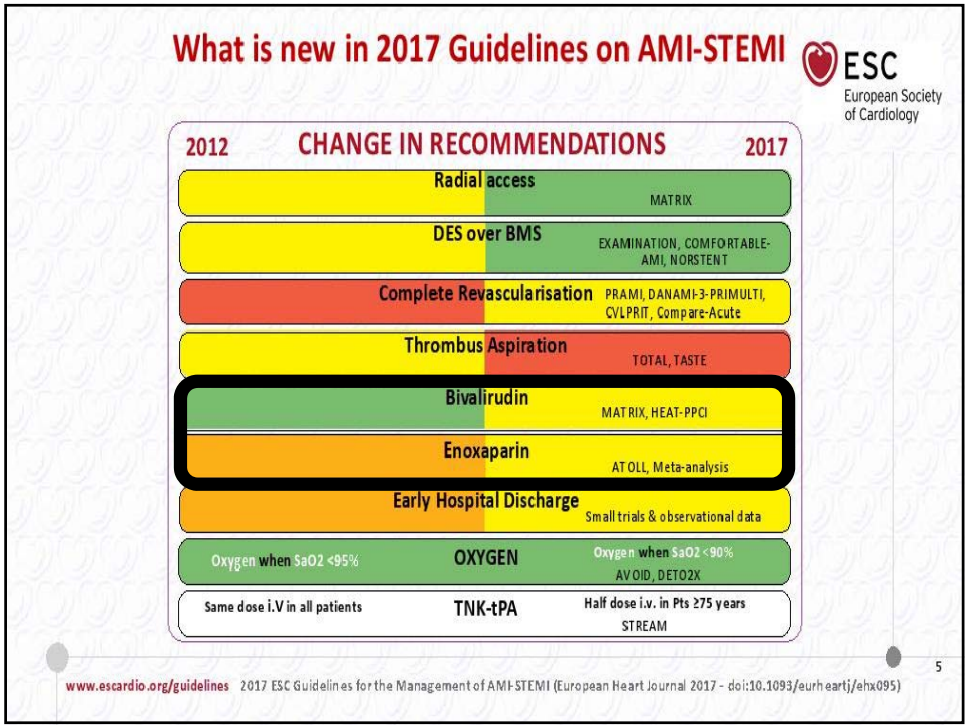
AAP associés à la reperfusion

- PPCI

Antiplatelet therapy		
A potent $P2Y_{12}$ inhibitor (prasugrel or ticagrelor), or clopidogrel if these are not available or are contra-indicated, is recommended before (or at latest at the time of) PCI and maintained over 12 months unless there are contra-indications such as excessive risk of bleeding.	I	A
Aspirin (oral or i.v, if unable to swallow) is recommended as soon as possible for all patients without contra-indications.	I	B
GP IIb/IIIa inhibitors should be considered for bailout if there is evidence of no-reflow or a thrombotic complication.	IIa	C

- TLYSE

Antiplatelet co-therapy with fibrinolysis		
Oral or i.v. aspirin is indicated.	I	B
Clopidogrel is indicated in addition to aspirin.	I	A
but 48 h after fibrinolysis, switch to prasugrel/ticagrelor may be considered in patients who underwent PCI.		



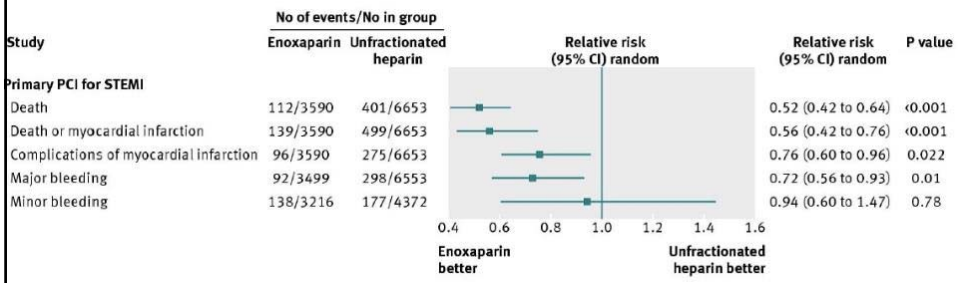
Bivalirudine dans le STEMI : Suite…

(%)		HORIZON 2008 (n=3602)	EUROMAX 2013 (n=2218)	HEAT-PCI 2014 (n=1829)	BRIGHT 2015 (n=2194)	MATRIX 2015 (N=7213)
Nouveau P2Y12		0	50	90	0	55
Anti-GP2b3a						
	Bivalirudine	8	11	13	4	5
	Comparateur	98	69	15	100	25
Voie radiale		0	47	80	79	1:1 Rand
MACE	Biva	5.5	4.6	8.7	5.0	10.3
	Contrôle	5.5	4.0	5.7	4.9	10.9
Hemor.	Biva	5.5	2.6	3.5	4.1	11.0
	Contrôle	8.4	6.0	3.1	12.3	13.6
Acute ST	Biva	1.3	1.6	2.9	0.6	0.6
	Contrôle	0.3	0.5	0.9	0.7	0.4

In patients with an ACS, MACE and net adverse clinical events were not significantly lower with bivalirudin than with UFH. The rate of the composite of urgent TVR, definite ST or thrombosis or net adverse clinical events was not significantly lower with than without post-PCI infusion.

Valgimigli & al. NEJM 2015; 373: 997-1009

ENOXAPARINE PPCI



Mais peu de voies radiales et de nouveau P2Y12…

« A head to head comparison between enoxaparin, UFH, and bivalirudin is needed in the setting of primary percutaneous coronary intervention using contemporary techniques (radial access, last generation of stent, new antiplatelet agents such as prasugrel or ticagrelor)

Silvain J & al. BMJ 2012;344:e553

AC associés à la reperfusion

PPCI

Anticoagulation is recommended for all patients in addition to antiplatelet therapy during primary PCI.	I	C
Routine use of UFH is recommended.	I	C
In patients with heparin-induced thrombocytopenia, bivalirudin is recommended as the anticoagulant agent during primary PCI.	I	C
Routine use of enoxaparin i.v. should be considered.[200–202]	IIa	A
Routine use of bivalirudin should be considered.[209,215]	IIa	A
Fondaparinux is not recommended for primary PCI.[199]	III	B

TLYSE

Anticoagulation co-therapy with fibrinolysis	
Anticoagulation is recommended in patients treated with lytics until revascularization (if performed) or for the duration of hospital stay up to 8 days.[199,224,227–233] The anticoagulant can be: • Enoxaparin i.v. followed by s.c. (preferred over UFH).[227–232] • UFH given as a weight-adjusted i.v. bolus followed by infusion.[224]	I I I

What is new in 2017 Guidelines on AMI-STEMI

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CHANGE IN RECOMMENDATIONS

2012	2017
Radial access	MATRIX
DES over BMS	EXAMINATION, COMFORTABLE-AMI, NORSTENT
Complete Revascularisation	PRAMI, DANAMI-3-PRIMULTI, CVLPRIT, Compare-Acute
Thrombus Aspiration	TOTAL, TASTE
Bivalirudin	MATRIX, HEAT-PPCI
Enoxaparin	ATOLL, Meta-analysis
Early Hospital Discharge	Small trials & observational data
Oxygen when SaO2 <95%	OXYGEN: Oxygen when SaO2 <90% — AVOID, DETO2X
Same dose i.V in all patients	TNK-tPA: Half dose i.v. in Pts ≥75 years — STREAM

5

www.escardio.org/guidelines 2017 ESC Guidelines for the Management of AMI-STEMI (European Heart Journal 2017 - doi:10.1093/eurheartj/ehx095)

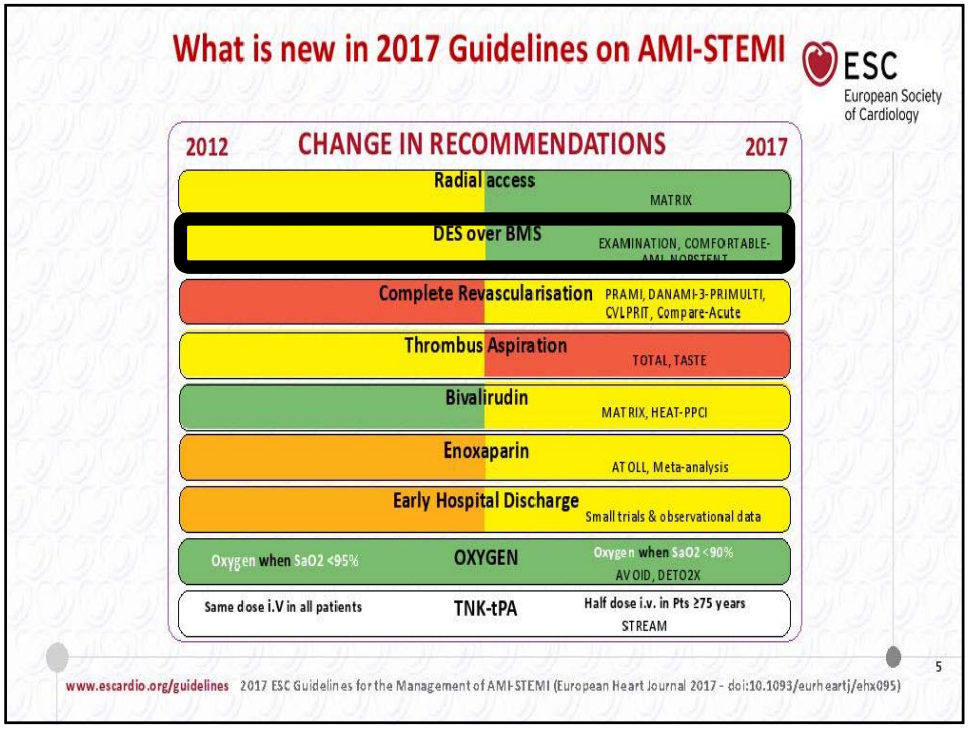
SCA = Voie radiale

- 8404 pts avec SCA randomisés voie radiale : voie fémorale
- 48% ST + / 52% non ST+
- 48% clopidogrel / 35 % ticagrelor ou prasugrel / 17% non pré-TTT

	Radial access (n=4197)	Femoral access (n=4207)	Rate ratio (95% CI)	p value
Adjudicated events				
Coprimary composite of all-cause mortality, myocardial infarction, or stroke	369 (8·8%)	429 (10·3%)	0·85 (0·74–0·99)	0·0307
Coprimary composite of all-cause mortality, myocardial infarction, stroke, or BARC 3 or 5 bleed	410 (9·8%)	486 (11·7%)	0·83 (0·73–0·96)	0·0092
Composite of all-cause mortality, myocardial infarction, stroke, urgent TVR, definite stent thrombosis, or BARC 3 or 5 bleed	419 (10·0%)	491 (11·8%)	0·84 (0·74–0·97)	0·0142
All-cause mortality	66 (1·6%)	91 (2·2%)	0·72 (0·53–0·99)	0·0450

Interpretation In patients with acute coronary syndrome undergoing invasive management, radial as compared with femoral access reduces net adverse clinical events, through a reduction in major bleeding and all-cause mortality.

Valgimigli & al. Lancet 2015; 385: 2465–76



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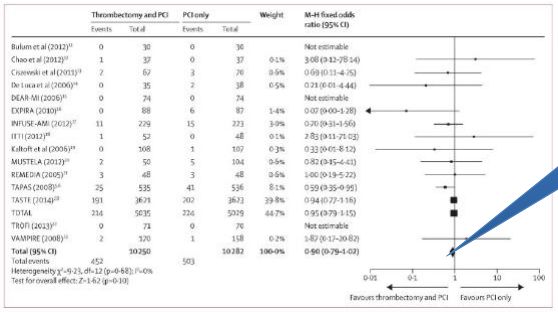
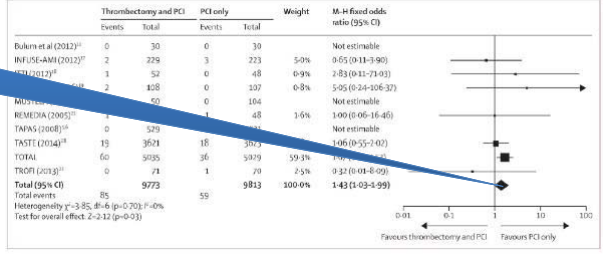
ST + : Méta-analyse Thromboaspiration



† + IDM
10%
P=0.10

AVC
+40%
P=0.01



Jolly & al. Lancet 2016. 387:127–135

What is new in 2017 Guidelines on AMI-STEMI *(continued)*

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2017 NEW RECOMMENDATIONS

- Additional lipid lowering therapy if LDL >1.8 mmol/L (70 mg/dL) despite on maximum tolerated statins. ***IMPROVE-IT, FOURIER***
- Complete revascularization during index primary PCI in STEMI patients in shock. Expert opinion
- Cangrelor if $P2Y_{12}$ inhibitors have not been given. ***CHAMPION***
- Switch to potent $P2Y_{12}$ inhibitors 48 hours after fibrinolysis. Expert opinion
- Extend Ticagrelor up to 36 months in high-risk patients. ***PEGASUS-TIMI 54***
- Use of polypill to increase adherence. ***FOCUS***
- Routine use of deferred stenting. ***DANAMI 3-DEFER***

I
IIa
IIb
III

www.escardio.org/guidelines 2017 ESC Guidelines for the Management of AMI-STEMI (European Heart Journal 2017 - doi:10.1093/eurheartj/ehx095)

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DANAMI 3- DEFER

	Conventional PCI group (n=612)	Deferred stent implantation group (n=603)	Hazard ratio (95% CI)	p value
Composite primary endpoint	109 (18%)	105 (17%)	0·99 (0·75-1·30)	0·92
All-cause death	53 (9%)	44 (7%)	0·83 (0·56-1·20)	0·37
Hospital admission for heart failure	28 (5%)	23 (4%)	0·82 (0·47-1·40)	0·49
Non-fatal myocardial reinfarction	40 (7%)	42 (7%)	1·10 (0·69-1·60)	0·49
Any unplanned target vessel revascularisation	23 (4%)	39 (7%)	1·70 (1·04-2·92)	0·0345
Secondary endpoints				
Cardiac death	26 (4%)	22 (4%)	0·85 (0·48-1·50)	0·58
Target vessel revascularisation by PCI	21 (3%)	32 (5%)	1·50 (0·90-2·70)	0·11
Target vessel revascularisation by coronary artery bypass graft surgery	3 (<1%)	8 (1%)	2·70 (0·71-10·1)	0·15

Data are n (%), unless otherwise specified. PCI=percutaneous coronary intervention.

Table 3: **Clinical outcomes**

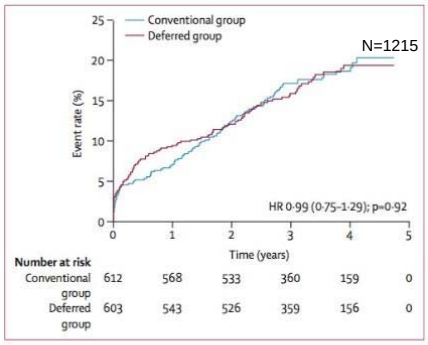

Figure 2: **Event rate of the composite primary endpoints**
From primary percutaneous coronary intervention to 58 months after the index treatment. HR=hazard ratio.

In patients with STEMI, routine deferred stent implantation did not reduce the occurrence of death, heart failure, MI, or repeat revascularisation compared with conventional PCI. Our study does not explain why deferred stent implantation does not improve outcome or whether there might still be a place for this treatment approach in high-risk patients.

Kelbaek & al. Lancet 2016; 387: 2199–206

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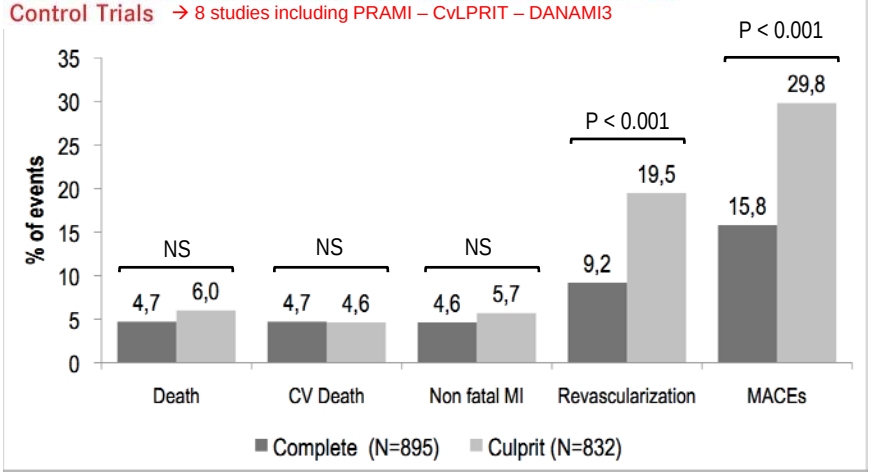
Complete vs. Culprit-only revascularization

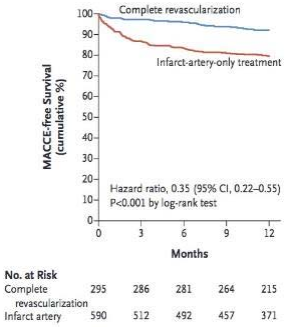
Comparison of Approaches to Revascularization in Patients With Multivessel Coronary Artery Disease Presenting With ST-Segment Elevation Myocardial Infarction: Meta-analyses of Randomized Control Trials → 8 studies including PRAMI – CvLPRIT – DANAMI3



Bajal & al. J Am Heart Assoc. 2015 - doi: 10.1161/JAHA.115.002540

Fractional Flow Reserve–Guided Multivessel Angioplasty in Myocardial Infarction

Pieter C. Smits, M.D., Ph.D., Mohamed Abdel-Wahab, M.D., Franz-Josef Neumann, M.D.,



End Point	Complete Revascularization (N=295)	Infarct-Artery-Only Treatment (N=590)	Hazard Ratio (95% CI)	P Value
Primary				
MACCE*	23 (7.8)	121 (20.5)	0.35 (0.22–0.55)	<0.001
Death from any cause	4 (1.4)	10 (1.7)	0.80 (0.25–2.56)	0.70
Cardiac event	3 (1.0)	6 (1.0)	1.00 (0.25–4.01)	1.00
Myocardial infarction	7 (2.4)	28 (4.7)	0.50 (0.22–1.13)	0.10
Spontaneous event	5 (1.7)	17 (2.9)	0.59 (0.22–1.59)	0.29
Periprocedural event	2 (0.7)	11 (1.9)	0.36 (0.08–1.64)	0.19
Revascularization	18 (6.1)	103 (17.5)	0.32 (0.20–0.54)	<0.001

N Engl J Med 2017;376:1234-44

Management of cardiogenic shock in ST-elevation myocardial infarction *(continued)*

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Recommendations	Class	Level
Fibrinolysis should be considered in patients presenting with cardiogenic shock if a primary PCI strategy is not available within 120 min from STEMI diagnosis and mechanical complications have been ruled out.	IIa	C
Complete revascularization during the index procedure should be considered in patients presenting with cardiogenic shock.	IIa	C
Intra-aortic balloon pumping should be considered in patients with haemodynamic instability/cardiogenic shock due to mechanical complications.	IIa	C
Haemodynamic assessment with pulmonary artery catheter may be considered for confirming diagnosis or guiding therapy.	IIb	B

www.escardio.org/guidelines 2017 ESC Guidelines for the Management of AMI-STEMI (European Heart Journal 2017 - doi:10.1093/eurheartj/ehx095)

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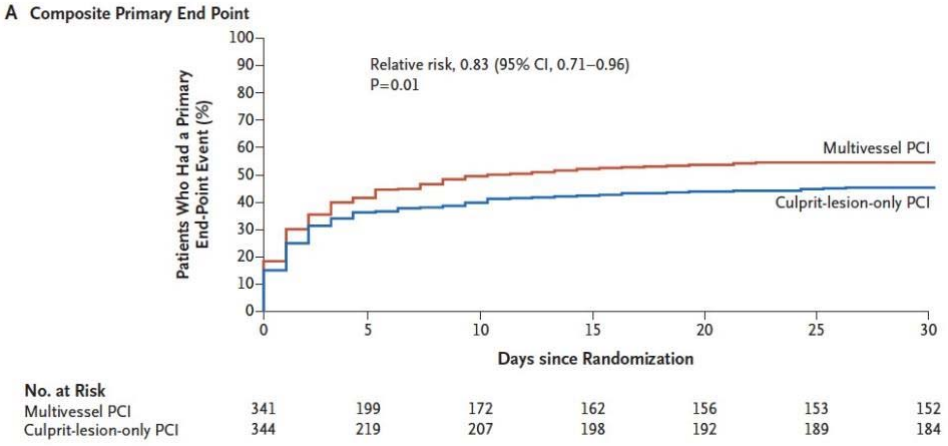
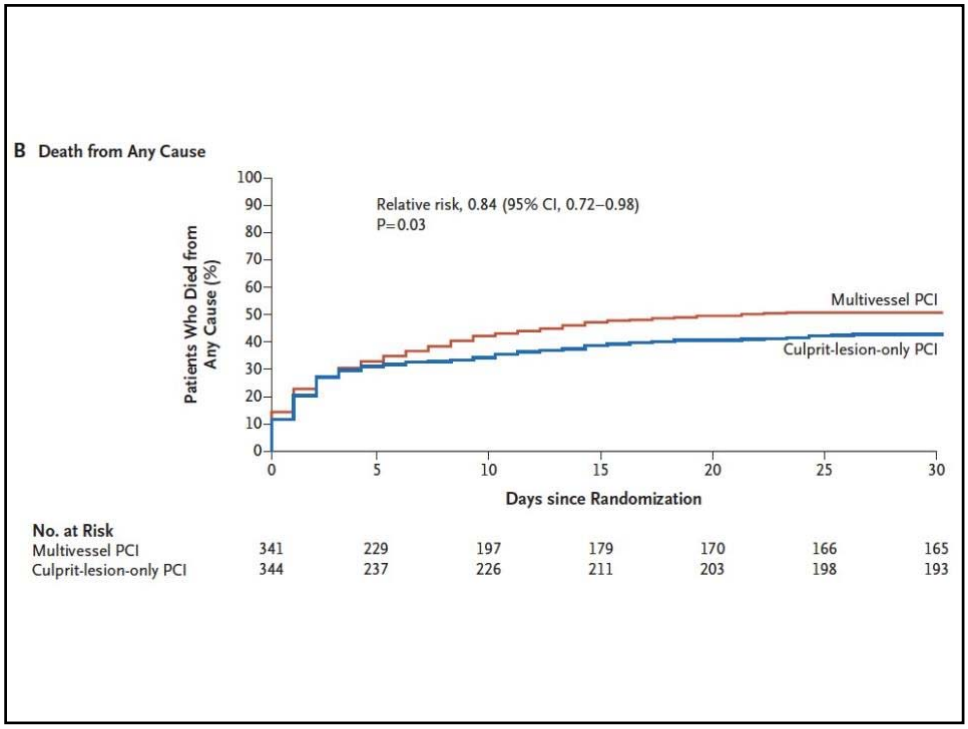
PCI Strategies in Patients with Acute Myocardial Infarction and Cardiogenic Shock

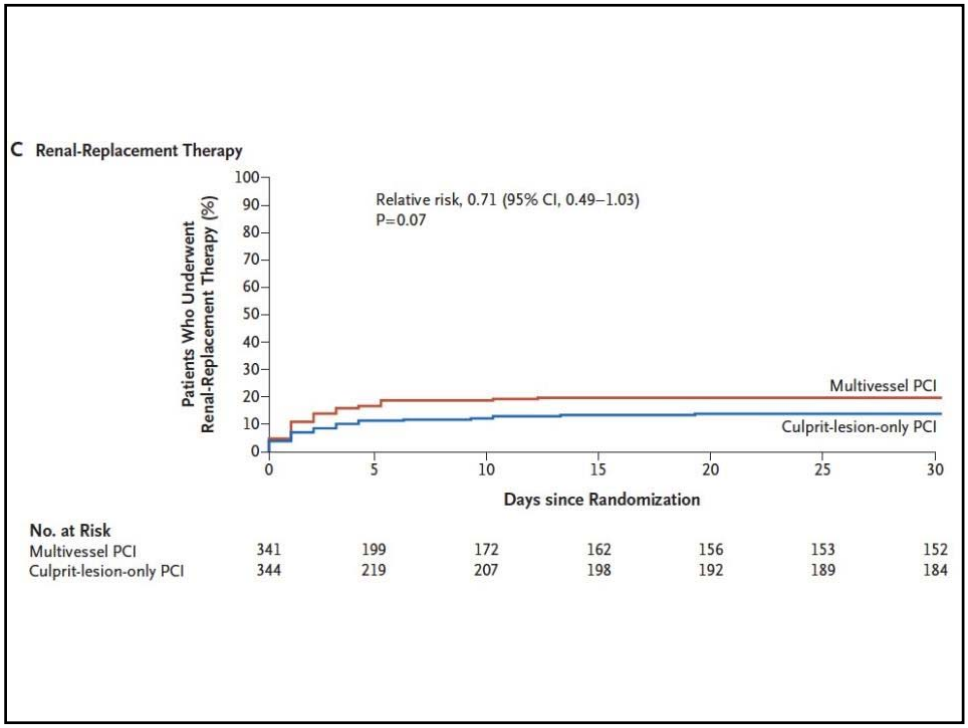
H. Thiele, I. Akin, M. Sandri, G. Fuernau, S. de Waha, R. Meyer-Saraei, P. Nordbeck, T. Geisler, U. Landmesser, C. Skurk, A. Fach, H. Lapp, J.J. Piek, M. Noc, T. Goslar, S.B. Felix, L.S. Maier, J. Stepinska, K. Oldroyd, P. Serpytis, G. Montalescot, O. Barthelemy, K. Huber, S. Windecker, S. Savonitto, P. Torremante, C. Vrints, S. Schneider, S. Desch, and U. Zeymer, for the CULPRIT-SHOCK Investigators*

CONCLUSIONS

Among patients who had multivessel coronary artery disease and acute myocardial infarction with cardiogenic shock, the 30-day risk of a composite of death or severe renal failure leading to renal-replacement therapy was lower among those who initially underwent PCI of the culprit lesion only than among those who underwent immediate multivessel PCI. (Funded by the European Union 7th Framework Program and others; CULPRIT-SHOCK ClinicalTrials.gov number, NCT01927549.)




B Death from Any Cause
Relative risk, 0.84 (95% CI, 0.72–0.98)
P=0.03
Patients Who Died from Any Cause (%)
Multivessel PCI
Culprit-lesion-only PCI
Days since Randomization
No. at Risk
Multivessel PCI 341 229 197 179 170 166 165
Culprit-lesion-only PCI 344 237 226 211 203 198 193


C Renal-Replacement Therapy
Relative risk, 0.71 (95% CI, 0.49–1.03)
P=0.07
Patients Who Underwent Renal-Replacement Therapy (%)
Multivessel PCI
Culprit-lesion-only PCI
Days since Randomization
No. at Risk
Multivessel PCI 341 199 172 162 156 153 152
Culprit-lesion-only PCI 344 219 207 198 192 189 184

End Point	Complete Revascularization (N=295)	Infarct-Artery-Only Treatment (N=590)	Hazard Ratio (95% CI)	P Value
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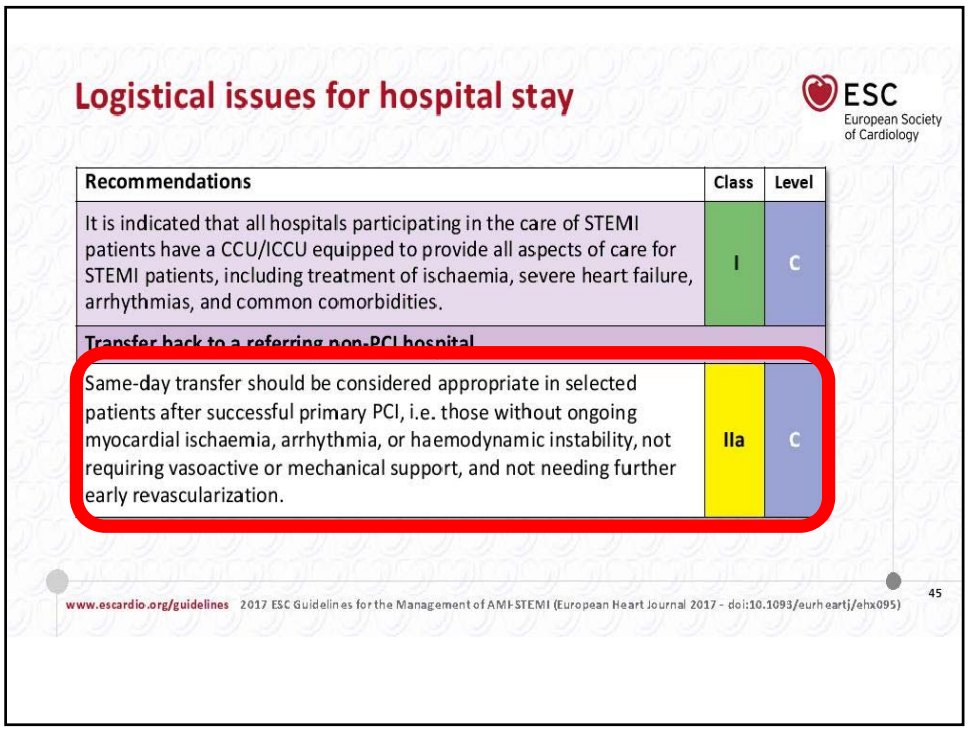

Logistical issues for hospital stay *(continued)*

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Recommendations	Class	Level
Monitoring		
It is indicated that all STEMI patients have ECG monitoring for a minimum of 24 hours.	I	C
Length of stay in the CCU		
It is indicated that patients with successful reperfusion therapy and uncomplicated clinical course are kept in the CCU/ICCU for a minimum of 24 hours whenever possible, after which they may be moved to a step-down monitored bed for an additional 24-48 hours.	I	C
Hospital discharge		
Early discharge (within 48-72 hours) should be considered appropriate in selected low-risk patients if early rehabilitation and adequate follow-up are arranged.	IIa	A

www.escardio.org/guidelines 2017 ESC Guidelines for the Management of AMI-STEMI (European Heart Journal 2017 - doi:10.1093/eurheartj/ehx095)

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Conclusion