CHOC CARDIOGENIQUE

REVASCULARISATION COMPLETE OU DE L'ARTERE COUPABLE?

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Service de cardiologie - Hôpital Militaire de Tunis

Congrès national de cardiologie, Tabarka 2018

Salle Tabarka Jeudi 25 octobre 2018 de 15H40-15H55

Conflits d’intérêts

- **Aucun conflit d’intérêt**

- **L'infarctus du myocarde avec la dysfonction VG qui en résulte est responsable de la majorité des EDCC (états de choc cardiogéniques) ≈80%**

- **Les complications mécaniques**
  - **CIV post IDM ≈ 4%**
  - **Rupture de la paroi libre du VG ≈ 2%**
  - **IM aigue ≈ 7%**

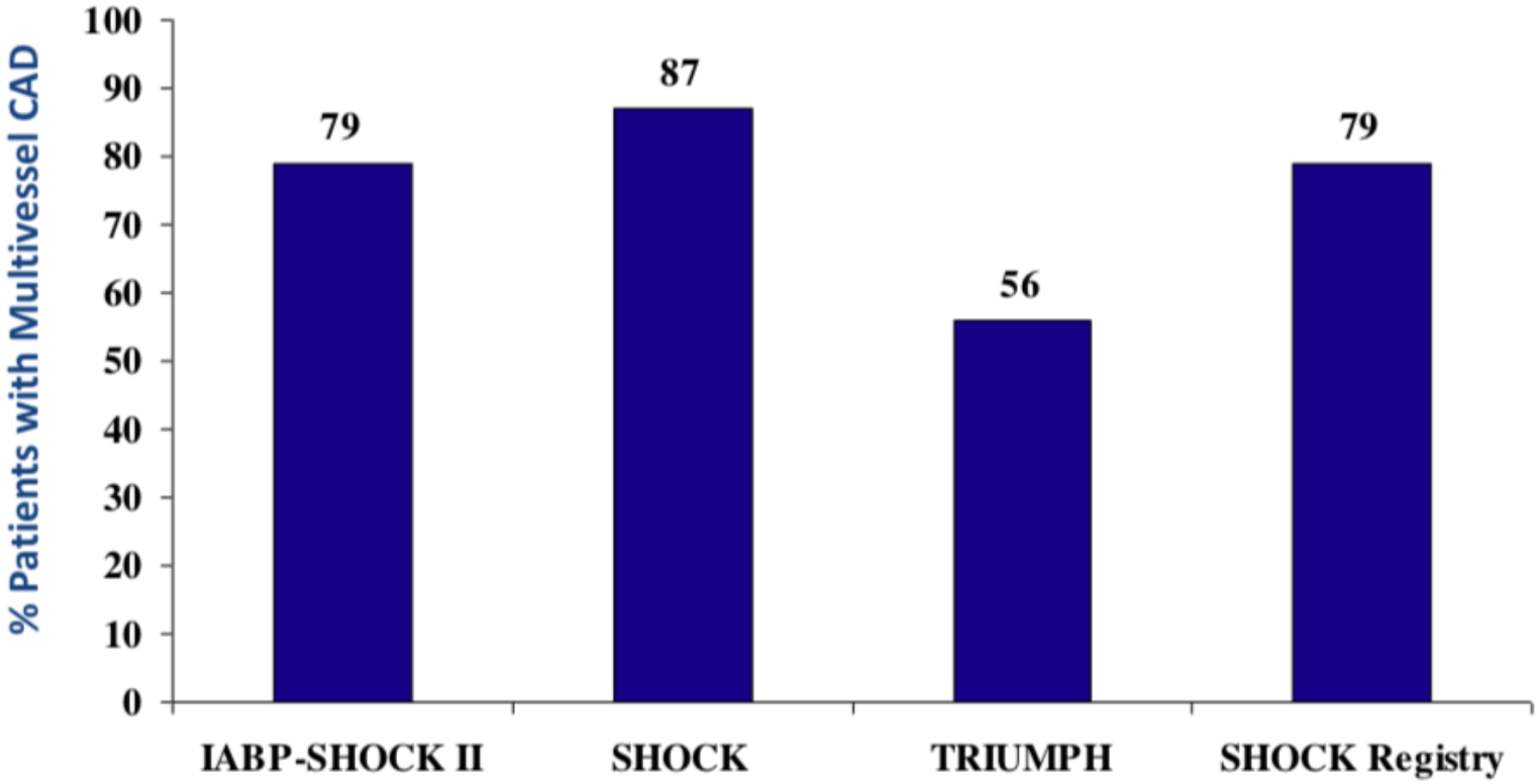
- **L'incidence est restée presque constante 6-8%**

- **L'EDC reste la cause principale de mortalité avec des taux de mortalité 40 – 50% selon les études randomisées et registres**

- **70 – 80% des patients avec IDM compliqué d'EDCC ont une atteinte multitronculaire définie par une sténose/occlusion de plus d'un vaisseau**

Hochman JS, Buller CE, Sleeper LA, Boland J, Dzavik V, Sanborn TA, Godfrey E, White HD, Lim J, LeJemtel T. Cardiogenic shock complicating acute myocardial in- farction—etiologies, management and outcome: a report from the SHOCK Trial Registry. J Am Coll Cardiol 2000;36:1063–1070.

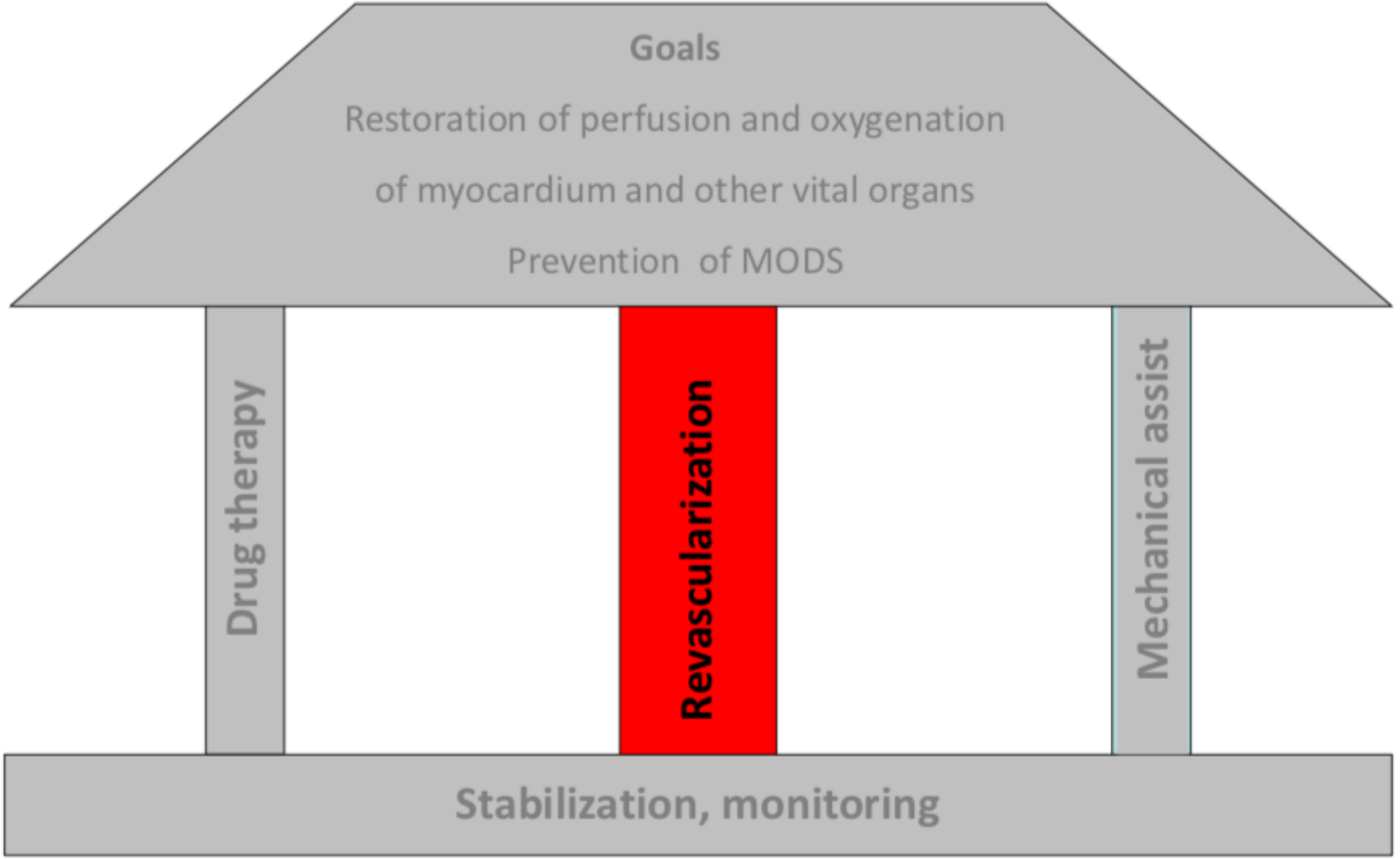
Incidence Multivessel CAD – Cardiogenic Shock



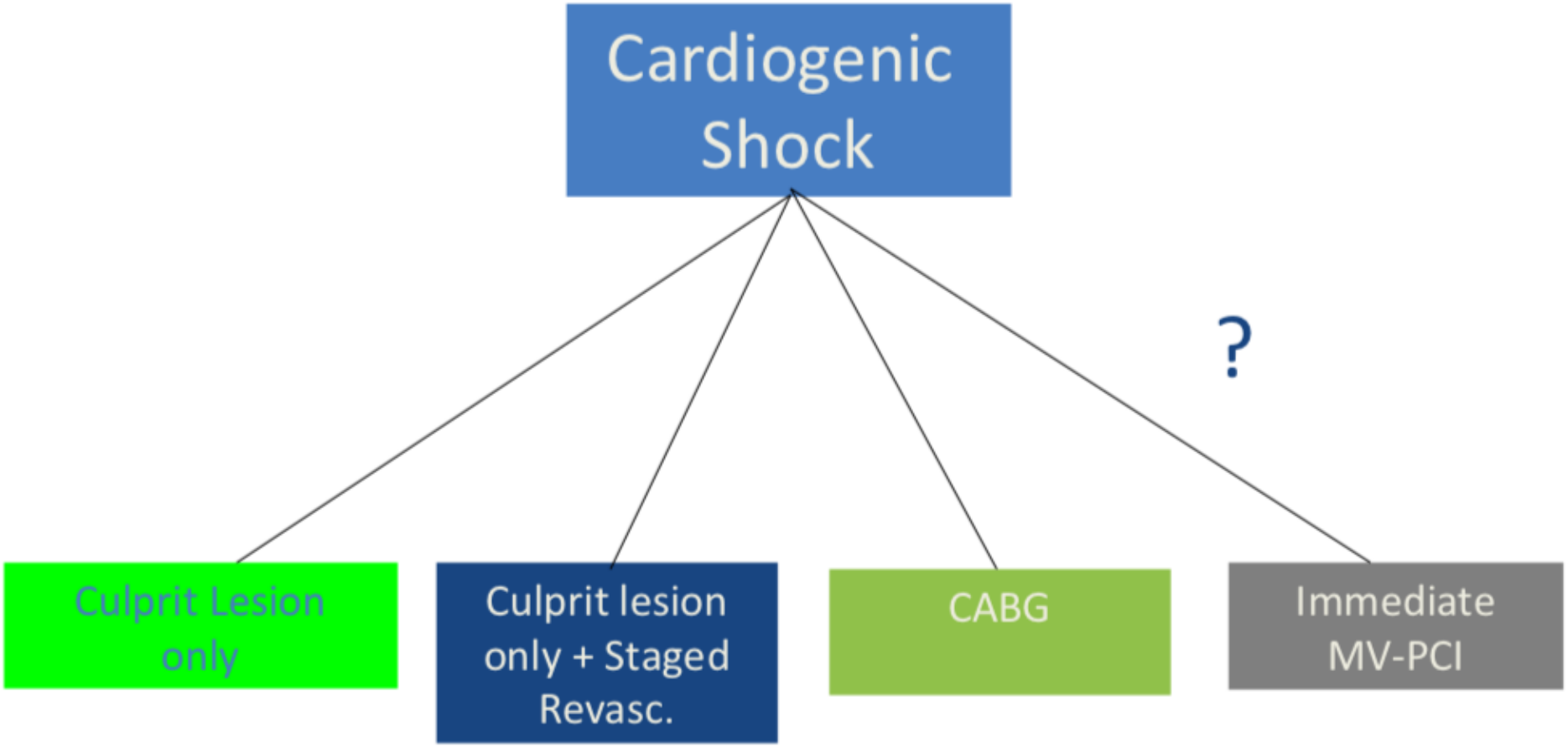
- **Avant la revascularisation précoce, la mortalité intra hospitalière de l'IDM compliqué d'EDCC dépasse les 80%**

- **Après l'avènement de la revascularisation, la mortalité est autour de 27-51% (la mortalité reste élevée).**

- **Les patients se présentant avec une atteinte multitronculaire (75% des patients se présentant avec état de choc) (MVD) – ont une mortalité plus élevée que les monotronculaires.**


Goals
Restoration of perfusion and oxygenation
of myocardium and other vital organs
Prevention of MODS
Drug therapy
Revascularization
Mechanical assist
Stabilization, monitoring

Potential Treatment Strategies



Risk/Benefit Multivessel PCI

Advantages	Disadvantages
Immediate complete revascularization	Increased contrast load → risk of contrast-induced nephropathy
Treatment of remote ischemia	Radiation exposure
Treatment of secondary unstable lesions	Complications of treating additional lesions may induce a "second hit"
Reduced subsequent hospitalization for the patients and with resultant economic benefits	Coronary spasm might overestimate stenosis severity of non-culprit stenoses
Reduction in vascular complications by having all PCI performed during the index intervention through a single access site	Additional revascularization may not reduce ischemia more effectively than by intensive medical therapy following MI
Patient preference/comfort	Increased risk of early/late stent thrombosis (Restenosis) in the prothrombotic and inflammatory milieu in the acute phase
Limit infarct size and preserve left ventricular ejection fraction	
Cardiogenic shock	
Improved hemodynamics	Hemodynamic instability might be worsened by treating additional lesions

- **Les guidelines: l'angioplastie multitronculaire n'est pas contre indiquée chez les patients avec une hémodynamique compromise.**

- **Les guidelines supportent l'idée de l'angioplastie multitronculaire comme une thérapeutique alternative**
  - **EDCC refractaire**
  - **Symptômes persistants**
  - **Patients avec EDCC en présence de plusieurs lésions critiques « coupables »(≥ 90% diameter) ou très instables.**
  - **Ischémie persistante après angioplastie de la lésion supposée coupable**

- **La logique:**
  - **la revascularisation des lésions non coupables qui irriguent de larges territoires va réduire l'ischémie et améliorer la FEVG.**

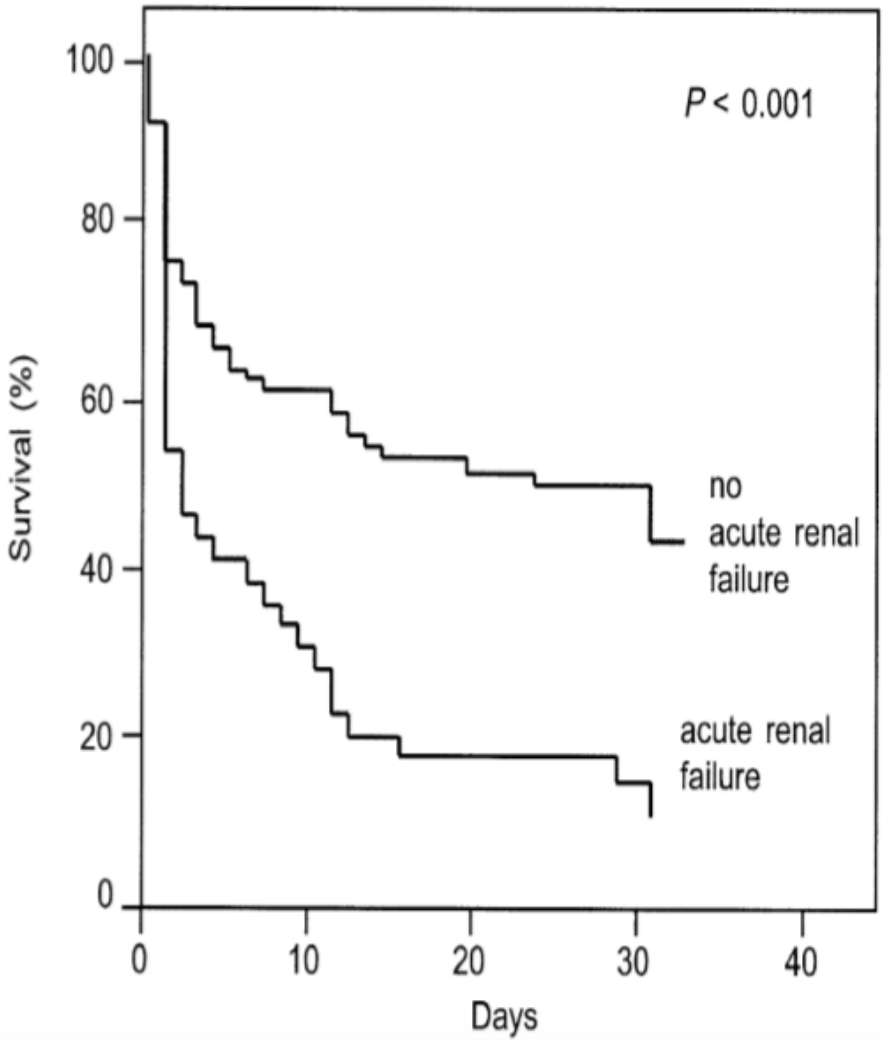
- **Des études anatomo-pathologiques ont démontré que ceux qui décèdent dans les suites d'un IDM compliqué d'un EDCC**

- **Ont souvent des thrombis dans d'autres territoires artériels malgré l'identification de la lésion coupable**

Davies MJ, Thomas A. Thrombosis and acute coronary artery lesions in sudden cardiac ischemic death. N Engl J Med 1984;310:1137–40

Prognosis of Patients Who Develop Acute Renal Failure during the First 24 Hours of Cardiogenic Shock after Myocardial Infarction

Maria Koreny, MD, Georg Delle Karth, MD, Alexander Geppert, MD, Thomas Neunteufl, MD, Ute Priglinger, MD, Gottfried Heinz, MD, Peter Siostrzonek, MD



CHANGE IN RECOMMENDATIONS

2012		2017
Radial access[a]	MATRIX[142]	
DES over BMS	EXAMINATION[150, 151], COMFORTABLE-AMI[149], NORSTENT[152]	
Complete Revascularization[b]	PRAMI[168], DANAMI-3-PRIMULTI[170], CVLPRIT[169], Compare-Acute[171]	
Thrombus Aspiration[c]	TOTAL[139], TASTE[137]	
Bivalirudin	MATRIX[209], HEAT-PPCI[205]	
Enoxaparin	ATOLL[200,201], Meta-analysis[202]	
Early Hospital Discharge[d]	Small trials & observational data[259-262]	
Oxygen when SaO2 <95%	AVOID[64], DETO2X[66]	Oxygen when SaO2 <90%
Dose i.V. TNK-tPA same in all patients	STREAM[121]	Dose i.V. TNK-tPA half in Pts ≥75 years

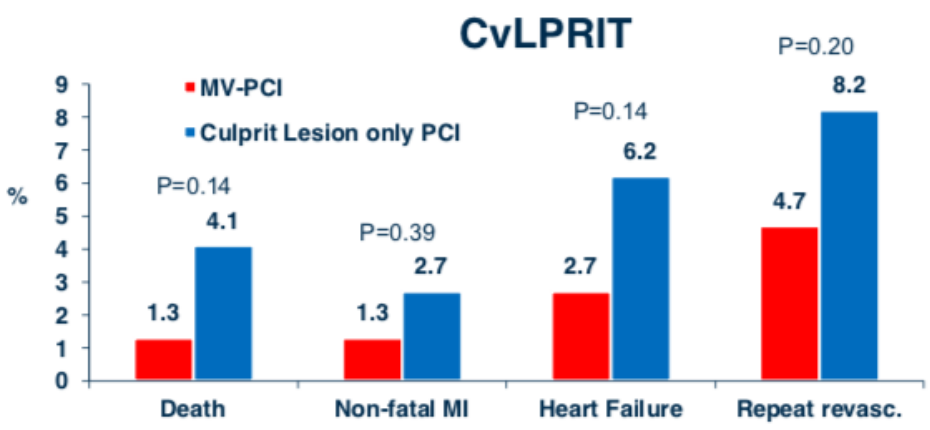
2017 NEW RECOMMENDATIONS

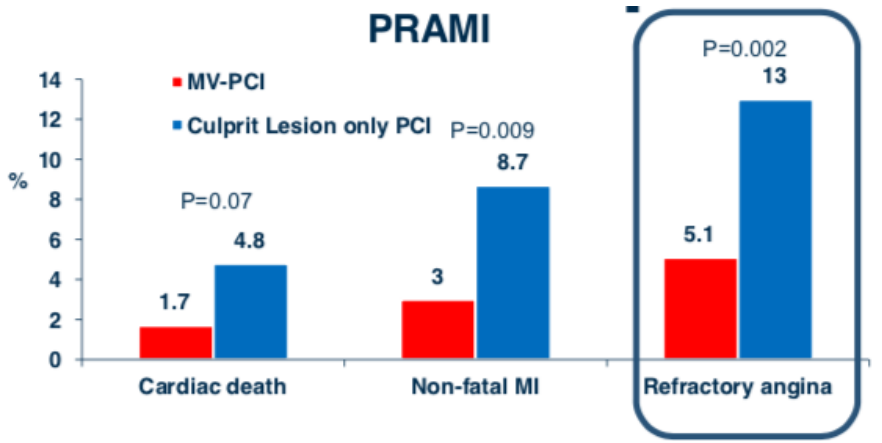
- Additional lipid lowering therapy if LDL >1.8 mmol/L (70 mg/dL) despite on maximum tolerated statins
  IMPROVE-IT[376], FOURIER[382]
- Complete revascularization during index primary PCI in STEMI patients in shock
  Expert opinion

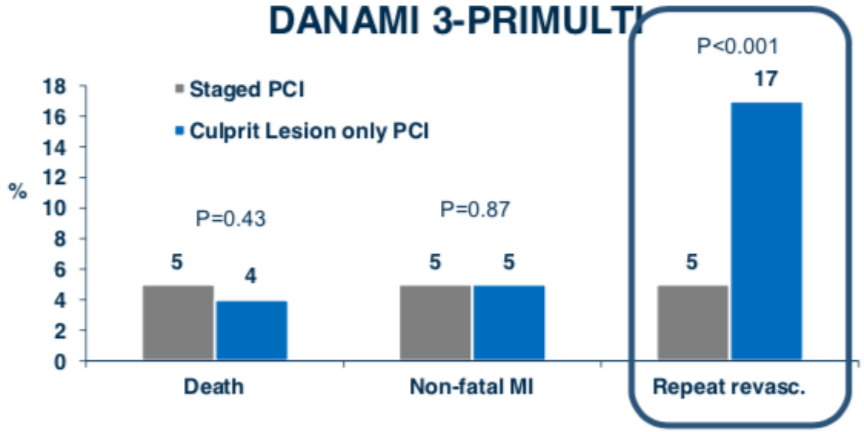
- Cangrelor if $P2Y_{12}$ inhibitors have not been given
  CHAMPION[193]
- Switch to potent $P2Y_{12}$ inhibitors 48 hours after fibrinolysis
  Expert opinion
- Extend Ticagrelor up to 36 months in high-risk patients
  PEGASUS-TIMI 54[333]
- Use of polypill to increase adherence
  FOCUS[322]

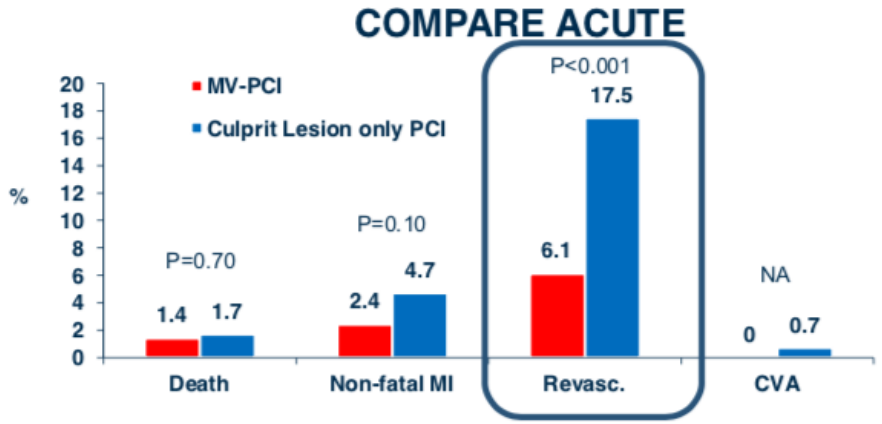
- Routine use of deferred stenting
  DANAMI 3-DEFER[155]

I | IIa | IIb | III


CvLPRIT
MV-PCI
Culprit Lesion only PCI
%
P=0.14
1.3
4.1
P=0.39
1.3
2.7
P=0.14
2.7
6.2
P=0.20
4.7
8.2
Death
Non-fatal MI
Heart Failure
Repeat revasc.


PRAMI
MV-PCI
Culprit Lesion only PCI
%
P=0.07
1.7
4.8
P=0.009
3
8.7
P=0.002
5.1
13
Cardiac death
Non-fatal MI
Refractory angina


DANAMI 3-PRIMULTI
Staged PCI
Culprit Lesion only PCI
%
P=0.43
5
4
P=0.87
5
5
P<0.001
5
17
Death
Non-fatal MI
Repeat revasc.


COMPARE ACUTE
MV-PCI
Culprit Lesion only PCI
%
P=0.70
1.4
1.7
P=0.10
2.4
4.7
P<0.001
6.1
17.5
NA
0
0.7
Death
Non-fatal MI
Revasc.
CVA

Multivessel PCI in ACS?

STEMI, no shock

Wijns et al. Eur Heart J 2010;31:2501-2555

Multivessel PCI in ACS? Guidelines

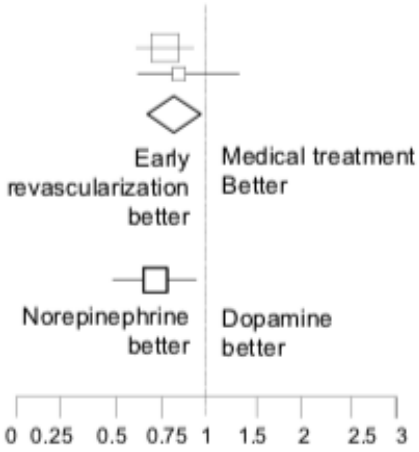
STEMI, no Shock

Multivessel PCI in STEMI?
ESC STEMI Guidelines 2017

STEMI, no shock

Randomized Trials in Cardiogenic Shock

Trial	Follow-up	n/N	n/N	Relative Risk 95% CI	Relative-Risk 95% CI
Revascularization					
SHOCK	1-year	76/152	83/149		0.80 (0.66;0.98)
SMACH	30 days	22/32	18/23		0.87 (0.66;1.29)
Total		103/184	117/172		0.82 (0.70; 0.98)
Catecholamines					
SOAP II (CS Subgroup)	28 days	64/145	50/135		0.75 (0.55;0.93)



Clinical Trials are Extremely Challenging to Perform

Thiele et al. Eur Heart J 2010; 31:1828-1835.

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Catecholamines					
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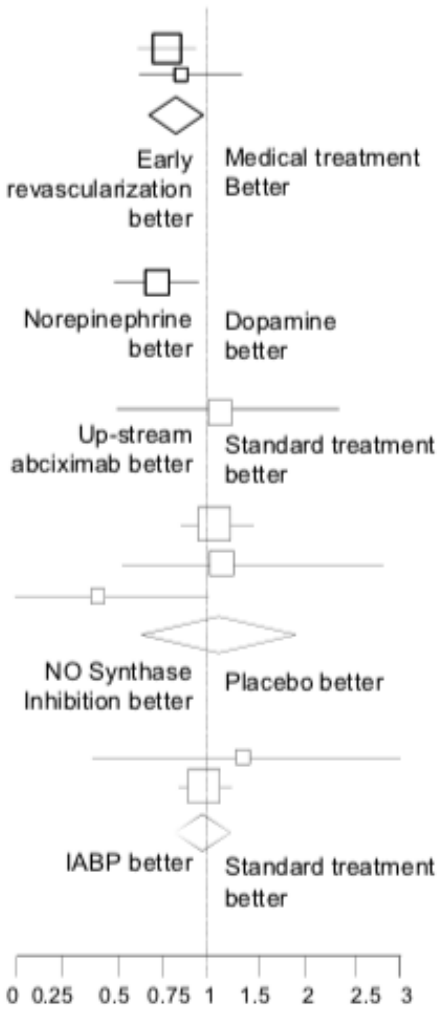
Glycoprotein IIb/IIIa Inhib	In-hospital	15/40	13/40		1.15 (0.59;2.27)
PRAGUE-7					
NO Synthase Inhibitors					
TRIUMPH	30 days	97/201	76/180		1.14 (0.91;1.45)
SHOCK-2	30 days	24/59	7/20		1.16 (0.59;2.69)
Cotter et al	30 days	4/15	10/15		0.40 (0.13;1.05)
Total		125/275	93/215		1.05 (0.85;1.29)
IABP					
IABP-SHOCK I	30 days	7/19	6/21		1.28(0.45;3.72)
IABP-SHOCK II	30 days	119/300	123/298		0.96 (0.79;1.17)
Total		126/319	129/319		0.98 (0.81;1.18)



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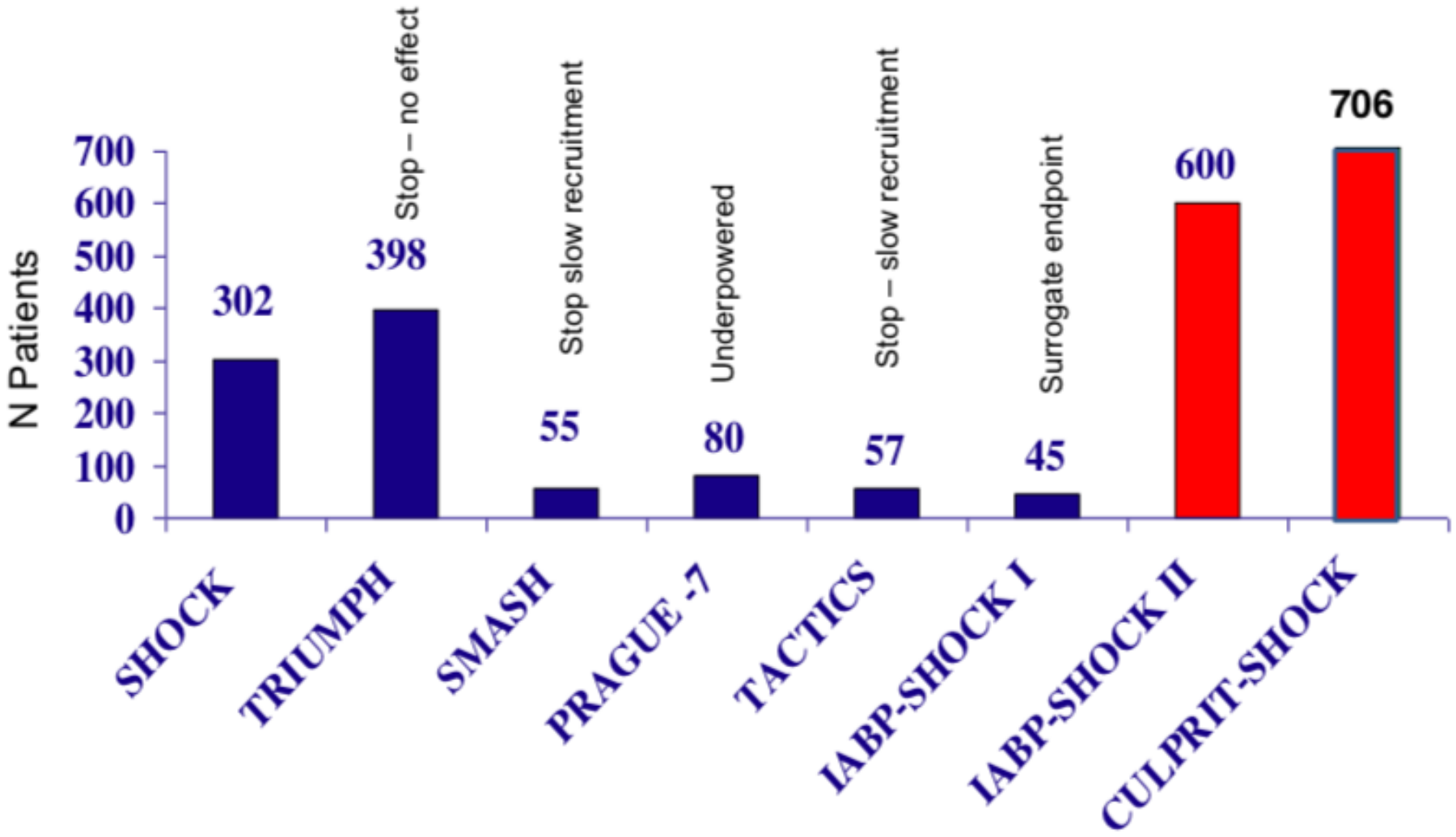
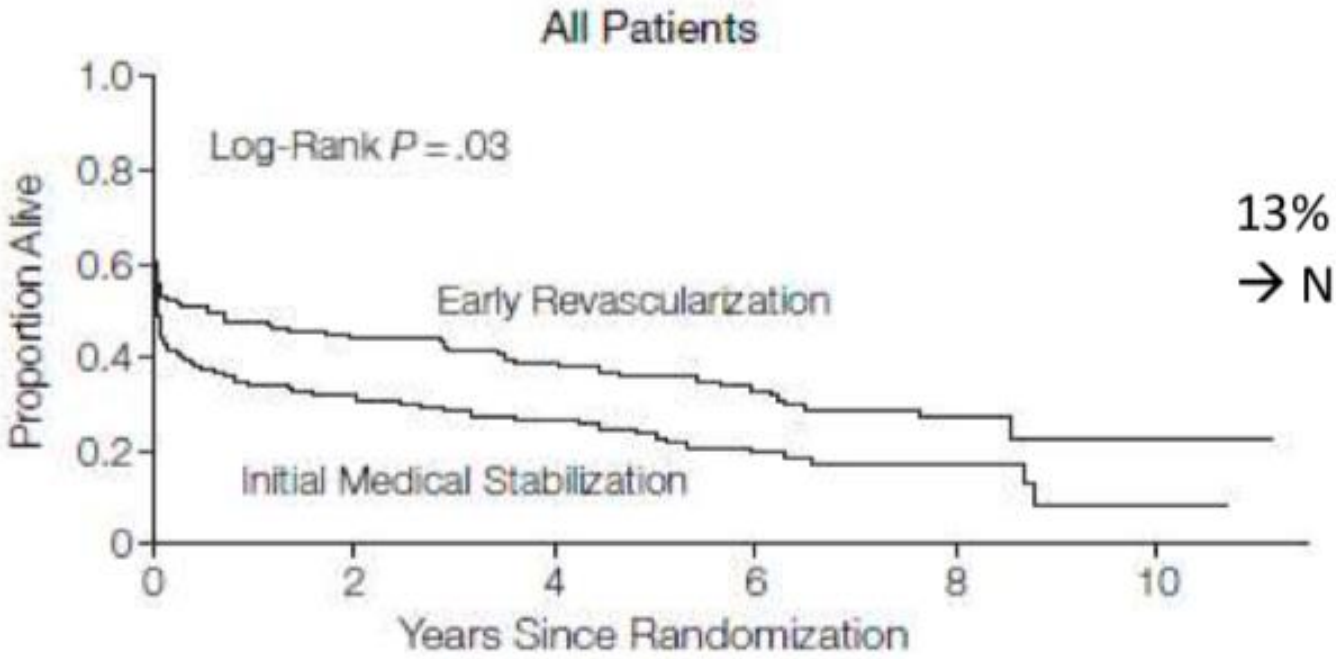
Patient Inclusion in Cardiogenic Shock Trials



Benefit of revascularization

SHOCK trial:

Randomized, n=302 patients with infarction-related cardiogenic shock



13% ARR for mortality
→ NNT <8

Optimal treatment of CS demands early reperfusion!

Hochman et al., JAMA 2006

ETUDES EVALUANT L'ANGIOPLASTIE MULTI TRONCULAIRE CHEZ LES PATIENTS SE PRESENTANT AVEC UN ETAT DE CHOC AVEC ATTEINTE PLURITRONCULAIRE

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Mylotte et al (12)	Prospective nonrandomized	2012	66	≥ 70%	Improved outcomes
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IRA = infarct-related artery, ↑ = increase, ↓ = decrease.

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10. Bauer T, Zeymer U, Hochadel M, et al: Use and outcomes of multives- sel percutaneous coronary intervention in patients with acute myocar- dial infarction complicated by cardiogenic shock (from the EHS-PCI Registry). *Am J Cardiol* 2012; 109:941–946
11. Cavender MA, Rajeswaran J, DiPaola L, et al: Outcomes of culprit versus multivessel PCI in patients with multivessel coronary artery dis- ease presenting with ST-elevation myocardial infarction complicated by shock. *J Invasive Cardiol* 2013; 25:218–224
12. Mylotte D, Morice MC, Eltchaninoff H, et al: Primary percutaneous coronary intervention in patients with acute myocardial infarction, resuscitated cardiac arrest, and cardiogenic shock: The role of pri- mary multivessel revascularization. *JACC Cardiovasc Interv* 2013; 6:115–125
13. Yang JH, Hahn J-Y, Song PS, et al: Percutaneous Coronary Intervention for Nonculprit Vessels in Cardiogenic Shock Complicating ST-Segment Elevation Acute Myocardial Infarction. *Crit Care Med* 2014; 42:17–25

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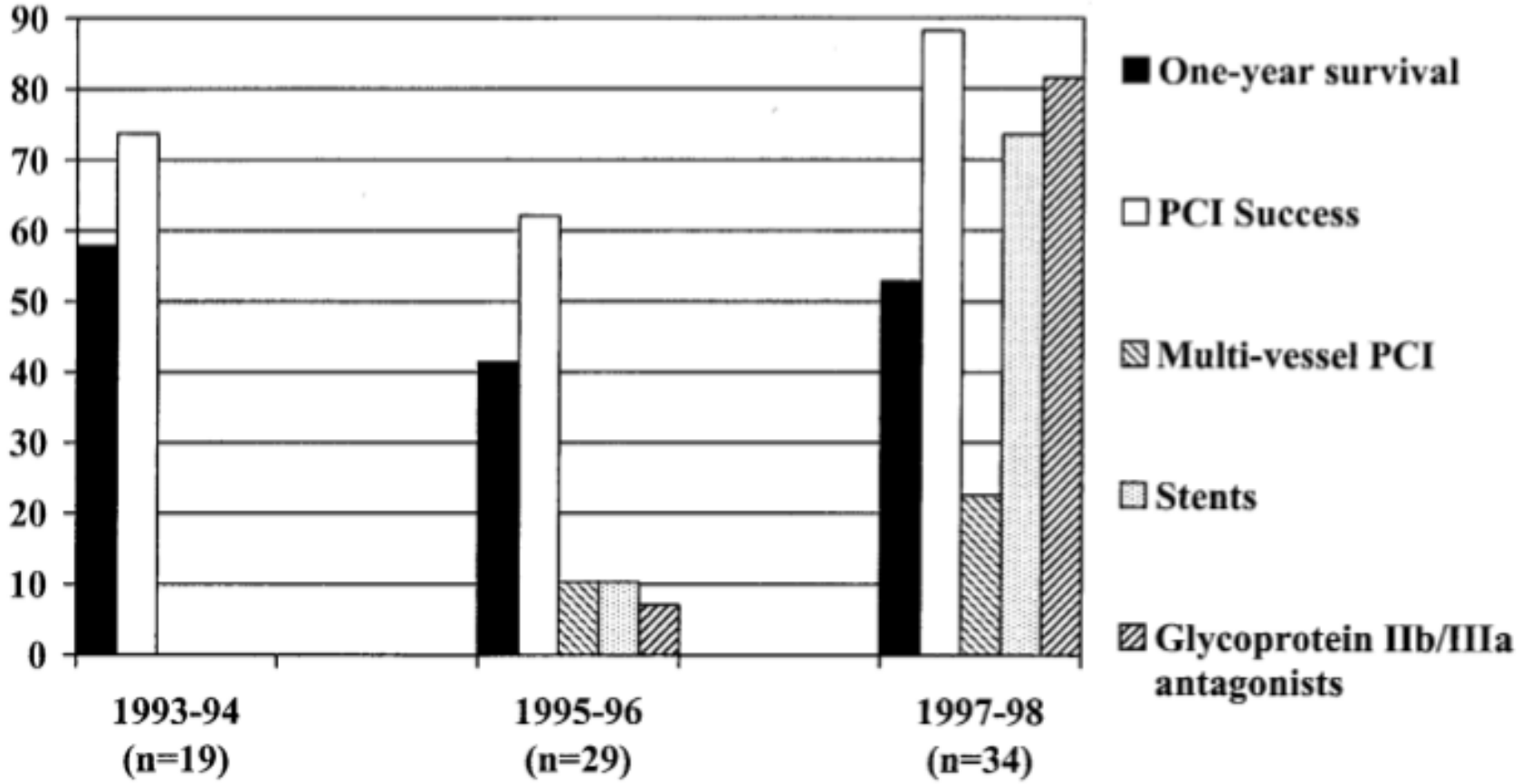
Percutaneous Coronary Intervention for Cardiogenic Shock in the SHOCK Trial

John G. Webb, MD, FACC,* April M. Lowe, MS,† Timothy A. Sanborn, MD, FACC,‡ Harvey D. White, DSc,§ Lynn A. Sleeper, ScD,† Ronald G. Carere, MD, FACC,* Christopher E. Buller, MD, FACC,‖ S. Chiu Wong, MD, FACC,¶ Jean Boland, MD,# Vlad Dzavik, MD,** Mark Porway, MD, FACC,†† Gordon Pate, MB,* Geoffrey Bergman, MD, FACC,¶ Judith S. Hochman, MD, FACC,‡‡ for the SHOCK Investigators

Vancouver and Toronto, Canada; Watertown and Springfield, Massachusetts; Evanston, Illinois; Auckland, New Zealand; New York, New York; and Liege, Belgium



Time trends in the interventional management of cardiogenic shock and one-year survival. A significant increase in the use of multivessel percutaneous coronary intervention (PCI) (P=0.018), stents, and glyco- protein IIb/IIIa antagonists (both <0.001) was observed. One-year survival and PCI success rates were similar over time (p = 0.889 for survival and p = 0.128 for success).

Multivariate Cox Regression Results for One-Year Survival

Parameter	Parameter Estimate	Standard Error	Hazard Ratio (95% CI)	p Value
Age (yrs)	0.077	0.020	2.17 (1.46, 3.22)†	< 0.001
Systolic blood pressure (mm Hg)‡	−0.025	0.010	0.78 (0.65, 0.94)†	0.009
Time from randomization to PCI (h)	0.253	0.108	1.29 (1.04, 1.59)	0.019
Final post-PCI TIMI flow (0/1 vs. 2/3)	2.385	0.614	10.86 (3.26, 36.20)	< 0.001
Multivessel PCI	1.012	0.494	2.75 (1.05, 7.25)	0.040

*Variables with significance $p < 0.05$ are shown ($n = 76$). †The hazard ratios and confidence intervals for age and systolic blood pressure are per 10-year or 10 mm Hg increase, respectively. ‡Measured while on support.

CI = confidence interval; PCI = percutaneous coronary intervention; TIMI = Thrombolysis In Myocardial Infarction.

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Catheterization and Cardiovascular Interventions 78:540–548 (2011)

The Ability to Achieve Complete Revascularization Is Associated with Improved In-hospital Survival in Cardiogenic Shock due to Myocardial Infarction: Manitoba Cardiogenic Shock Registry Investigators

Farrukh Hussain,[1*] MD, Roger K. Philipp,[1] MD, Robin A. Ducas,[2] MD, Jason Elliott,[2] MD, Vladimír Džavík,[3] MD, Davinder S. Jassal,[1] MD, James W. Tam,[1] MD, Daniel Roberts,[4] MD, Philip J. Garber,[1] MD, and John Ducas,[1] MD

Objectives: To identify predictors of survival in a retrospective multicentre cohort of patients with cardiogenic shock undergoing coronary angiography and to address whether complete revascularization is associated with improved survival in this cohort. Background: Early revascularization is the standard of care for cardiogenic shock. Coronary bypass grafting and percutaneous intervention have complimentary roles in achieving this revascularization. Methods: A total of 210 consecutive patients (mean age 66 ± 12 years) at two tertiary centres from 2002 to 2006 inclusive with a diagnosis of cardiogenic shock were evaluated. Univariate and multivariate predictors of in-hospital survival were identified utilizing logistic regression. Results: ST elevation infarction occurred in 67% of patients. Thrombolysis was administered in 34%, PCI was attempted in 62% (88% stented, 76% TIMI 3 flow), CABG was performed in 22% (2.7 grafts, 14 valve procedures), and medical therapy alone was administered to the remainder. The overall survival to discharge was 59% (CABG 68%, PCI 57%, medical 48%). Independent predictors of mortality included complete revascularization ($P = 0.013$, OR = 0.26 (95% CI: 0.09–0.76), hyperlactatemia ($P = 0.046$, OR = 1.14 (95% CI: 1.002–1.3) per mmol increase), baseline renal insufficiency ($P = 0.043$, OR = 3.45, (95% CI: 1.04–11.4), and the presence of anoxic brain injury ($P = 0.008$, OR = 8.22 (95% CI: 1.73–39.1). Within the STEMI with concomitant multivessel coronary disease subgroup of this population ($N = 101$), independent predictors of survival to discharge included complete revascularization ($P = 0.03$, OR = 2.5 (95% CI: 1.1–6.2)) and peak lactate ($P = 0.02$). Conclusions: The ability to achieve complete revascularization may be strongly associated with improved in-hospital survival in patients with cardiogenic shock.

Key words: cardiogenic shock; revascularization; renal insufficiency; lactate

CONCLUSION

In cardiogenic shock, the ability to achieve complete revascularization is independently associated with improved in-hospital survival. Furthermore, predictors of poor in-hospital survival in cardiogenic shock include baseline renal insufficiency, hyperlactatemia, and anoxic brain injury. Further prospective randomized study of complete revascularization achieved by PCI/CABG or both in cardiogenic shock may be warranted but likely difficult to carry out.

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8. Cavender MA, Milford-Beland S, Roe MT, et al: Prevalence, pre- dictors, and in-hospital outcomes of non-infarct artery intervention during primary percutaneous coronary intervention for ST-segment elevation myocardial infarction (from the National Cardiovascular Data Registry). *Am J Cardiol* 2009; 104:507–513
9. Hussain F, Philipp RK, Ducas RA, et al: The ability to achieve com- plete revascularization is associated with improved in-hospital survival in cardiogenic shock due to myocardial infarction: Manitoba cardio- genic SHOCK Registry investigators. *Catheter Cardiovasc Interv* 2011; 78:540–548
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11. Cavender MA, Rajeswaran J, DiPaola L, et al: Outcomes of culprit versus multivessel PCI in patients with multivessel coronary artery dis- ease presenting with ST-elevation myocardial infarction complicated by shock. *J Invasive Cardiol* 2013; 25:218–224
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13. Yang JH, Hahn J-Y, Song PS, et al: Percutaneous Coronary Intervention for Nonculprit Vessels in Cardiogenic Shock Complicating ST-Segment Elevation Acute Myocardial Infarction. *Crit Care Med* 2014; 42:17–25

Primary Percutaneous Coronary Intervention in Patients With Acute Myocardial Infarction, Resuscitated Cardiac Arrest, and Cardiogenic Shock

The Role of Primary Multivessel Revascularization

Objectives This study sought to assess the impact of multivessel (MV) primary percutaneous coronary intervention (PCI) on clinical outcomes in patients with ST-segment elevation myocardial infarction (STEMI) presenting with cardiogenic shock (CS) and resuscitated cardiac arrest (CA).

Background The safety and efficacy of MV primary PCI in patients with STEMI and refractory CS is unknown.

Methods We conducted a multicenter prospective observational study of consecutive STEMI patients presenting to 5 French centers. Patients were classified as having single-vessel (SVD) or multivessel (MVD) coronary disease, and underwent culprit-only or MV primary PCI. Baseline characteristics and 6-month survival were compared.

Results Among 11,530 STEMI patients, 266 had resuscitated CA and CS. Patients with SVD (36.5%) had increased 6-month survival compared to those with MVD (29.6% vs. 42.3%, $p = 0.032$). Baseline characteristics were similar in those with MVD undergoing culprit-only (60.9%) or MV (39.1%) primary PCI. However, 6-month survival was significantly greater in patients who underwent MV PCI (43.9% vs. 20.4%, $p = 0.0017$). This survival advantage was mediated by a reduction in the composite of recurrent CA and death due to shock ($p = 0.024$) in MV PCI patients. In those with MVD, culprit artery PCI success (hazard ratio [HR]: 0.63; 95% confidence interval [CI]: 0.41 to 0.96, $p = 0.030$) and MV primary PCI (HR: 0.57; 95% CI: 0.38 to 0.84, $p = 0.005$) were associated with increased 6-month survival.

Conclusions The results of this study suggest that in STEMI patients with MVD presenting with CS and CA, MV primary PCI may improve clinical outcome. Randomized trials are required to verify these results. (J Am Coll Cardiol Intv 2013;6:115–25)

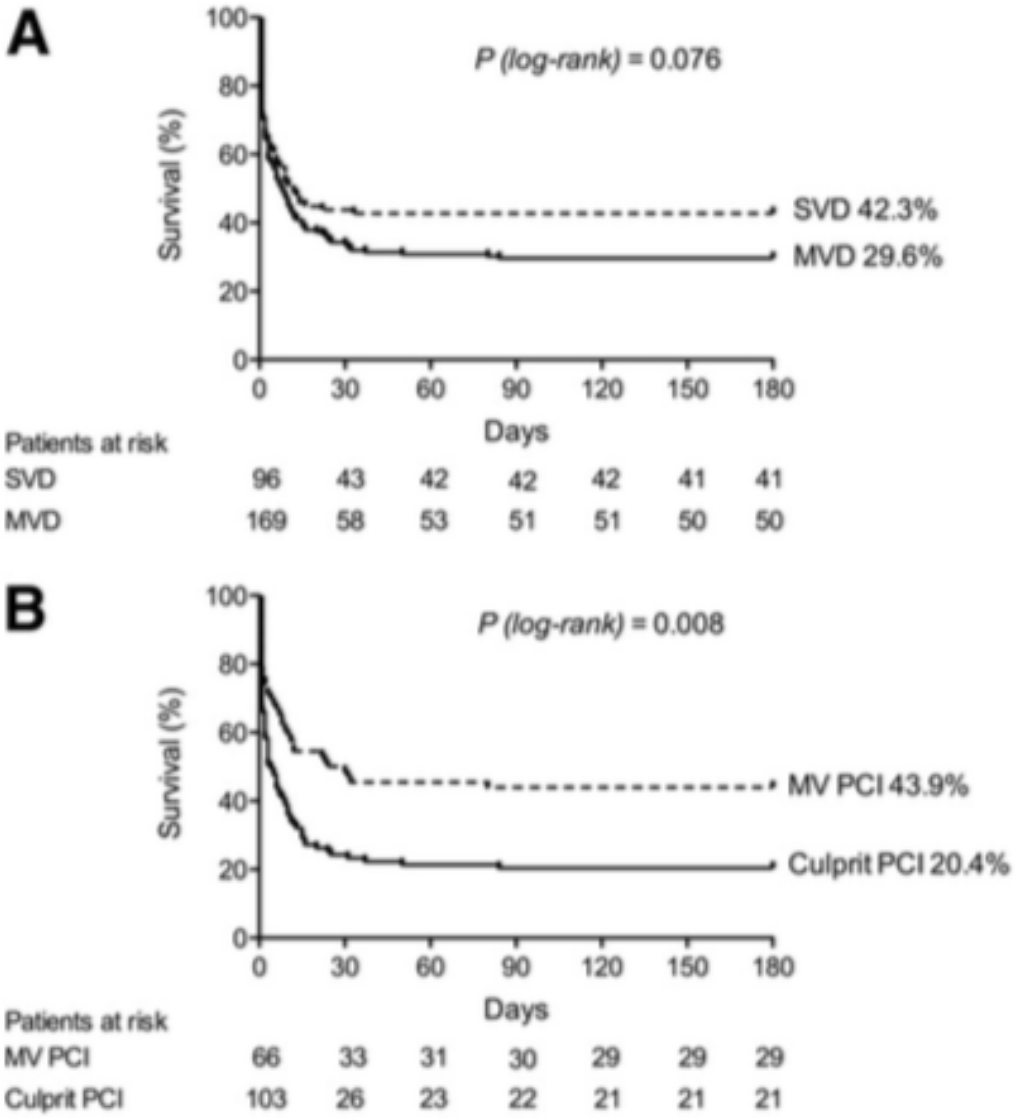


Figure 2. Primary Endpoint at 6 Months

Survival to 6 months in patients with **(A)** single-vessel (SVD) or multivessel (MVD) coronary disease, or **(B)** MVD undergoing culprit-only or MV primary PCI. MV = multivessel; PCI = percutaneous coronary intervention.

Conclusions

The results of this study suggest that in STEMI patients with MVD presenting with CS and cardiac arrest, MV primary PCI may improve clinical outcome. Adequately powered prospective randomized clinical trials are required to verify these results.

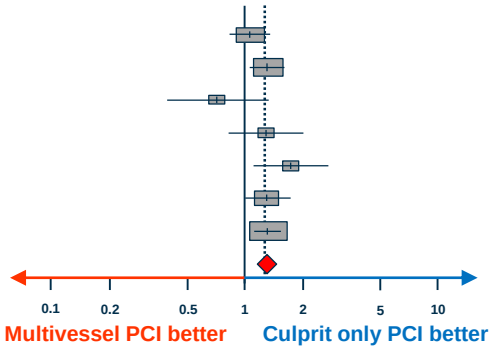
Multivessel PCI in Cardiogenic Shock?

Metaanalysis Mortality – Registry-Data

	MV-PCI		C-PCI		Short-term follow-up	RR	95%CI
	Events	Total	Events	Total			
IABP-SHOCK II	75	167	119	284		1.07	[0.86-1.33]
ALKK	81	173	201	562		1.31	[1.08-1.33]
KAMIR	13	124	56	386		0.72	[0.41-1.28]
Yang et al.	19	60	68	278		1.29	[0.85-1.98]
Cavender et al.	20	43	42	156		1.73	[1.14-2.61]
EHS-PCI	40	82	95	254		1.30	[0.99-1.71]
NCDR	158	433	737	2654		1.31	[1.14-1.51]
Overall	**406**	**1082**	**1318**	**4574**		**1.26**	**[1.12-1.41]**

Heterogeneity: τ^2=0.007, I^2=31.0%, p=0.19

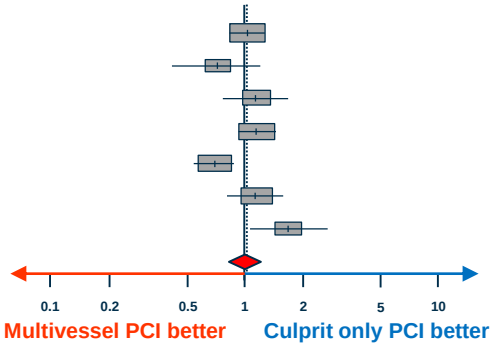
Test for overall effect: p=0.001



	MV-PCI		C-PCI		Long-term follow-up	RR	95%CI
	Events	Total	Events	Total			
IABP-SHOCK II	91	167	149	284		1.04	[0.87-1.24]
KAMIR	16	124	69	386		0.72	[0.43-1.19]
Yang et al.	21	60	85	278		1.14	[0.78-1.69]
Cavender et al.	32	43	101	156		1.15	[0.93-1.42]
Mylotte et al.	37	66	82	103		0.70	[0.56-0.89]
van der Schaaf et al.	22	37	66	124		1.12	[0.82-1.53]
SHOCK	7	9	26	57		1.71	[1.09-2.67]
Overall	**226**	**506**	**578**	**1387**		**1.03**	**[0.85-1.25]**

Heterogeneity: τ^2=0.043, I^2=67.8%, p=0.005

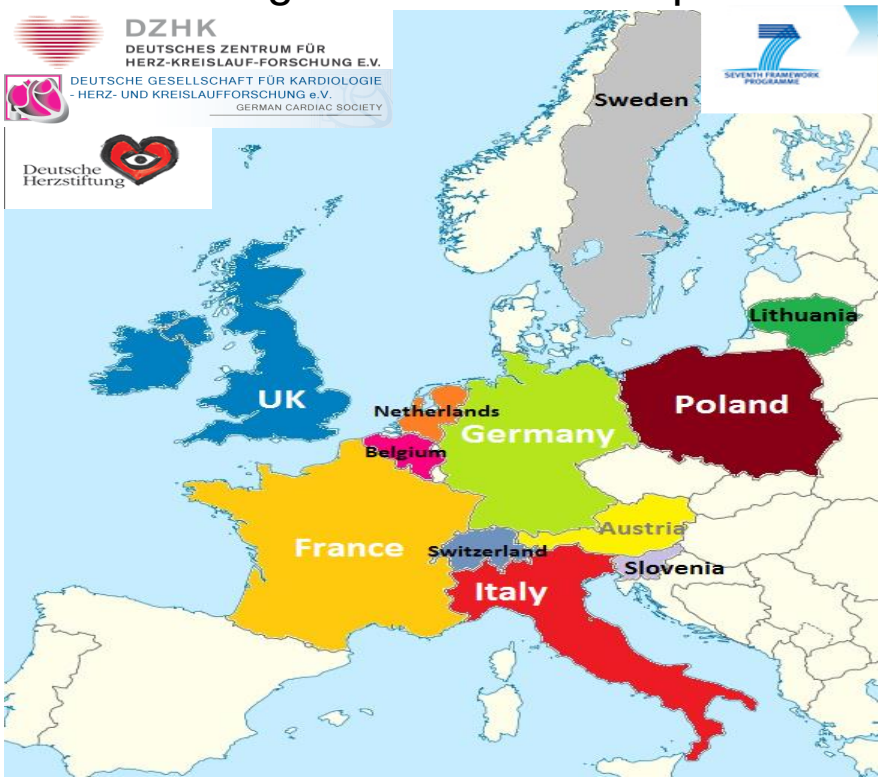
Test for overall effect: p=0.77



de Waha et al. Eur Heart J Acute Cardiovasc Care. 2018;7:28-37

CULPRIT-SHOCK Trial

Investigator-initiated European multicenter trial; 1:1 randomization



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- Gilles Montalescot
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- Holger Thiele
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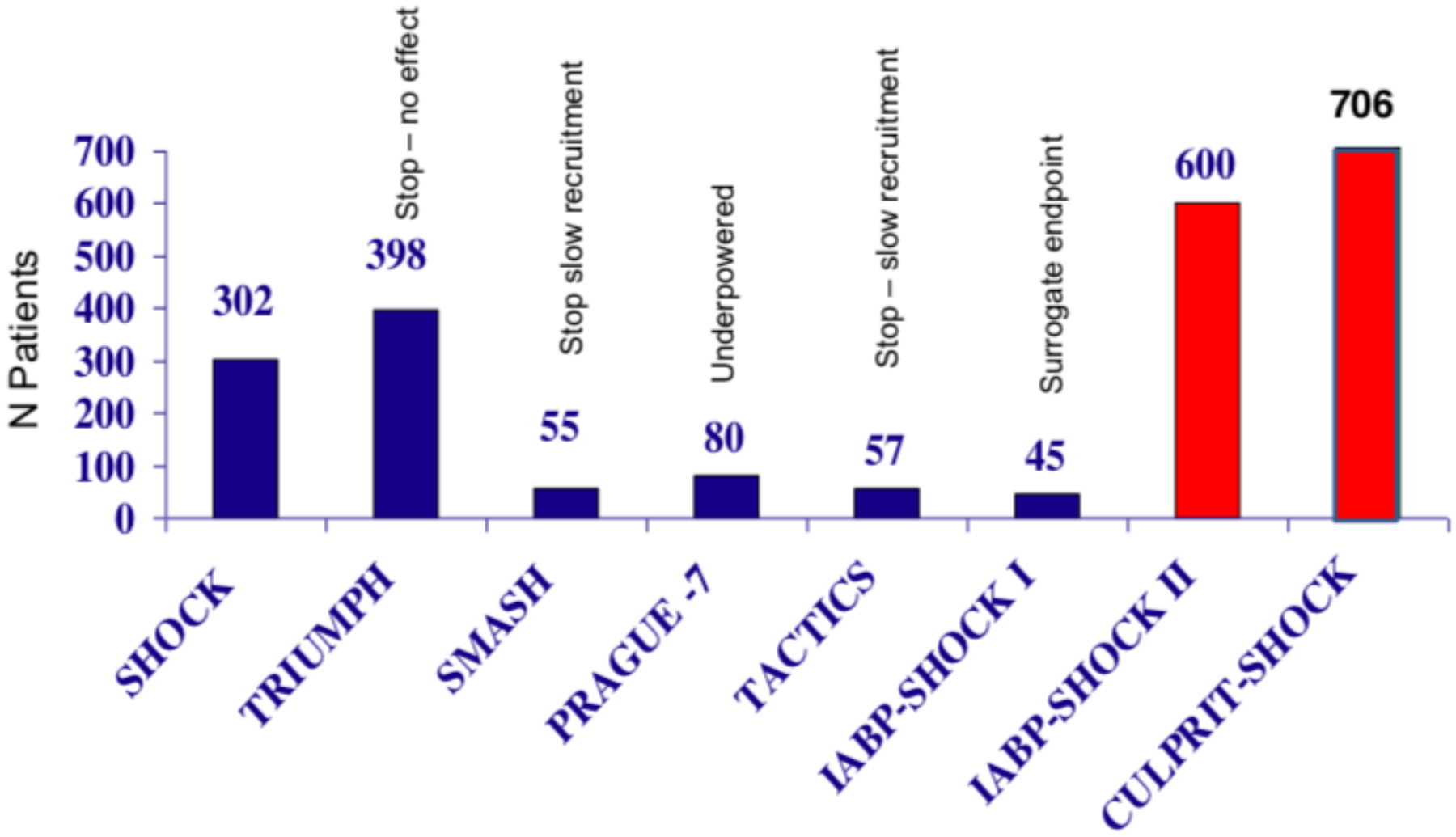
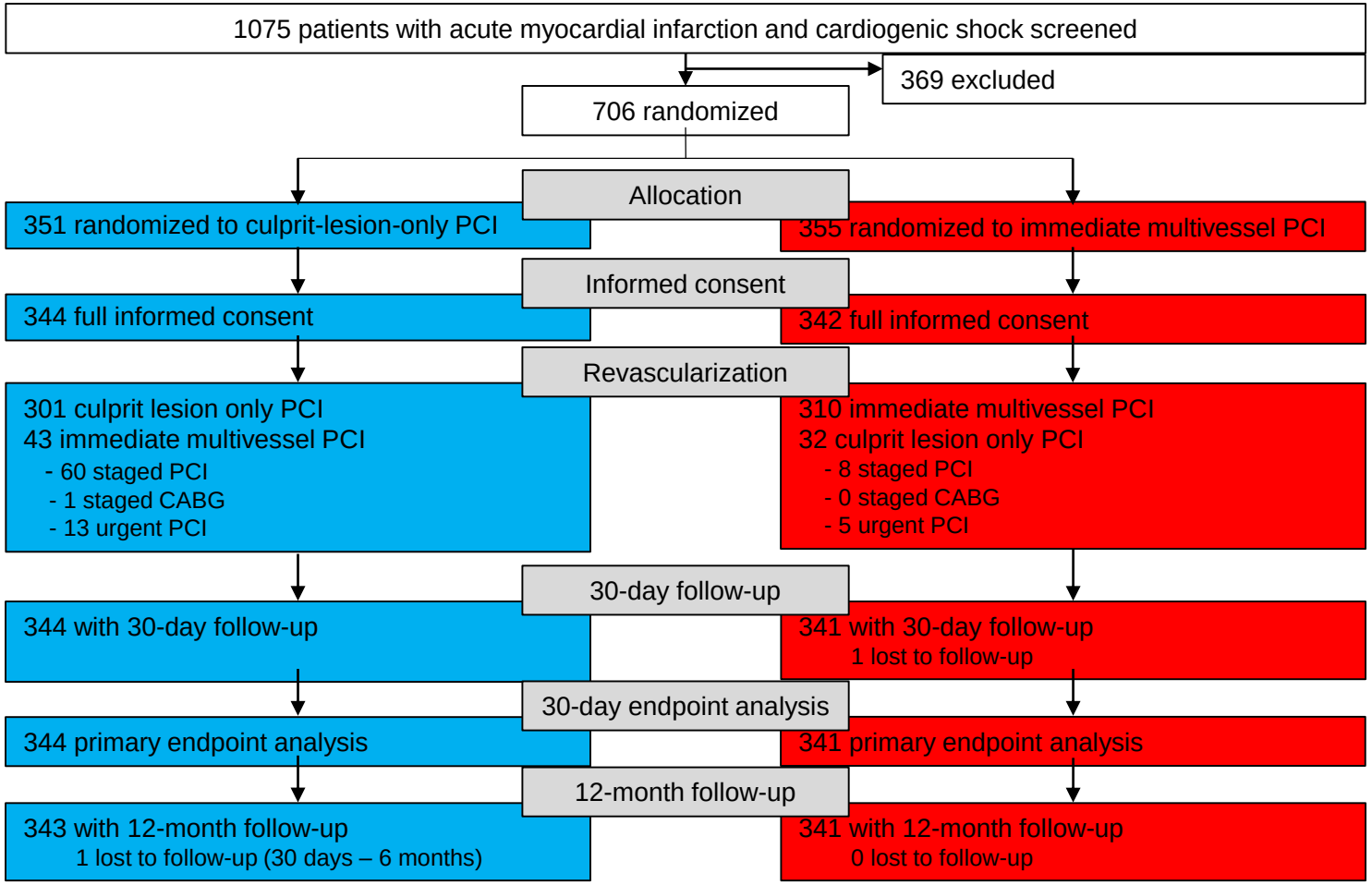
- Janina Stepinska
- Christiaan Vrints
- Marko Noc
- Keith Oldroyd
- Stefan Windecker
- Stefano Savonitto

Thiele et al. Am Heart J. 2016;172:160-169

Patient Inclusion in Cardiogenic Shock Trials



Trial Flow


1075 patients with acute myocardial infarction and cardiogenic shock screened
369 excluded
706 randomized
Allocation
351 randomized to culprit-lesion-only PCI
355 randomized to immediate multivessel PCI
Informed consent
344 full informed consent
342 full informed consent
Revascularization
301 culprit lesion only PCI
43 immediate multivessel PCI
- 60 staged PCI
- 1 staged CABG
- 13 urgent PCI
310 immediate multivessel PCI
32 culprit lesion only PCI
- 8 staged PCI
- 0 staged CABG
- 5 urgent PCI
30-day follow-up
344 with 30-day follow-up
341 with 30-day follow-up
1 lost to follow-up
30-day endpoint analysis
344 primary endpoint analysis
341 primary endpoint analysis
12-month follow-up
343 with 12-month follow-up
1 lost to follow-up (30 days – 6 months)
341 with 12-month follow-up
0 lost to follow-up

Statistical Methodology

Primary Study Endpoint:

- **30-day all-cause mortality or renal replacement therapy**

Secondary Study Endpoints:

- 30-day all-cause mortality
- Renal failure with requirement of renal replacement therapy
- Time to hemodynamic stabilization
- Duration of catecholamine therapy
- Serial creatinine-clearance
- Length of ICU-stay
- SAPS-II score
- Requirement and length of mechanical ventilation
- All-cause death within 6 and 12 months follow-up
- Recurrent infarction within 30-days, 6 and 12 months follow-up
- Death or recurrent infarction at 6 and 12 months follow-up
- Rehospitalization for congestive heart failure within 30 days, 6-, and 12-months follow-up
- Death/recurrent infarction/rehospitalization for congestive heart failure within 30 days, 6-, and 12-months follow-up
- Need for recurrent revascularization (PCI and/or CABG) within 30 days, 6-, and 12-months follow-up
- Peak creatine kinase, creatine kinase-MB

Sample Size:

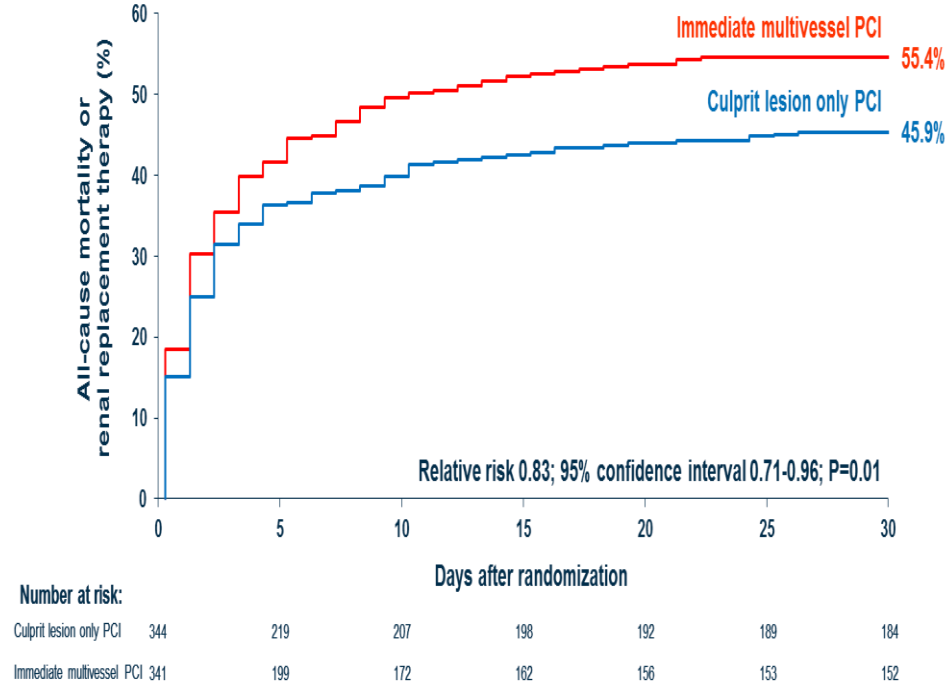
- **Estimated 50% event rate in multivessel PCI versus 38% in culprit lesion only group for primary endpoint**
- **1 interim analysis (50% of patients)**
- 2-sided Chi^2-test; power: 80%, alpha=0.048 for final analysis → **684 patients**
- **To compensate losses in follow-up → 706 patients**

Thiele et al. Am Heart J. 2016;172:160-169

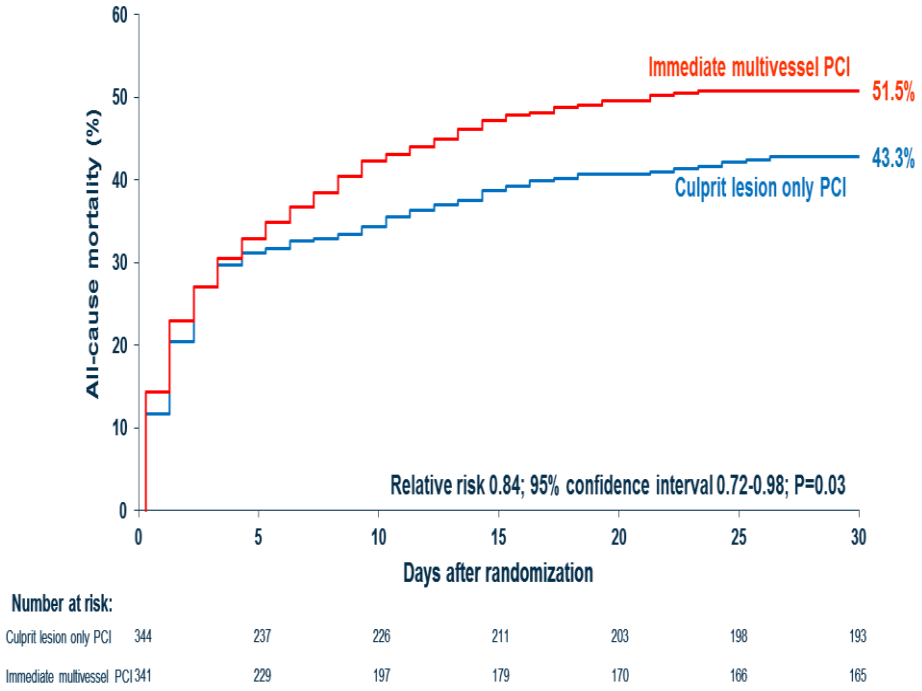
CULPRIT-SHOCK Trial – 30-Day Results

Primary study endpoint – 30 days

All-cause mortality or renal replacement therapy

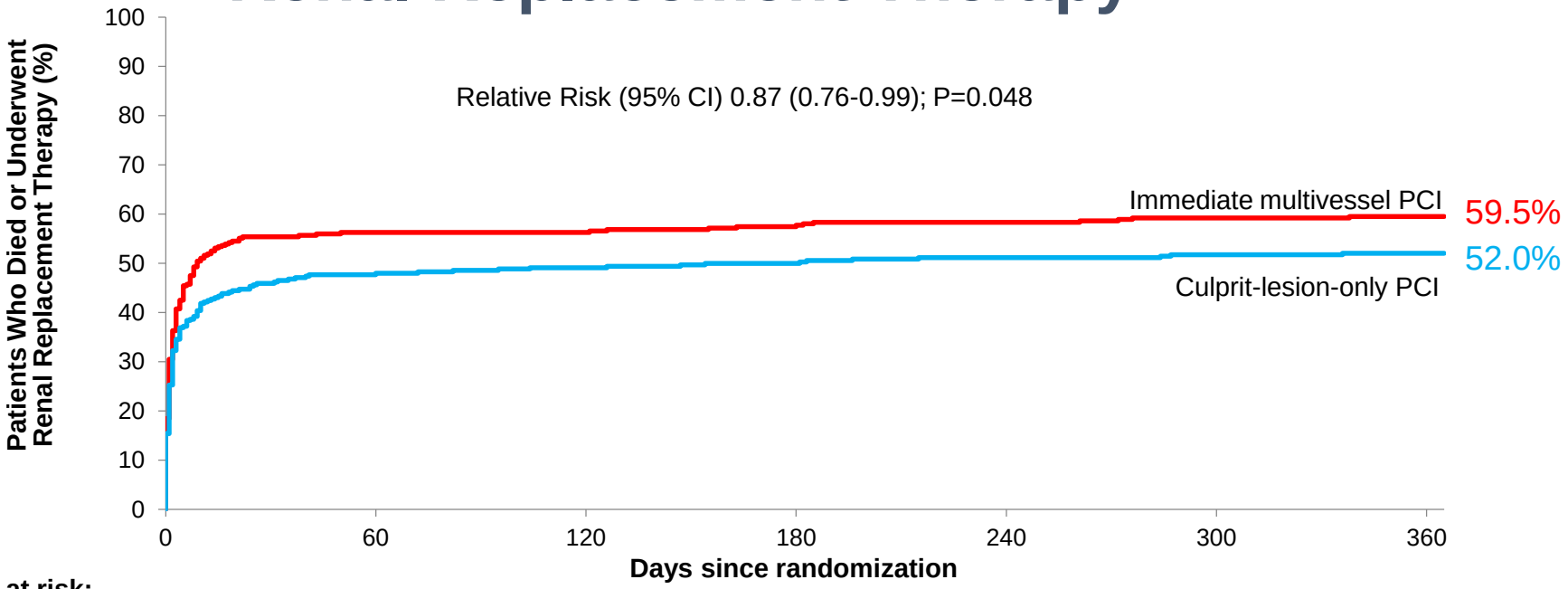


All-cause mortality – 30 days



Thiele et al. NEJM 2017; 377:2419-2432

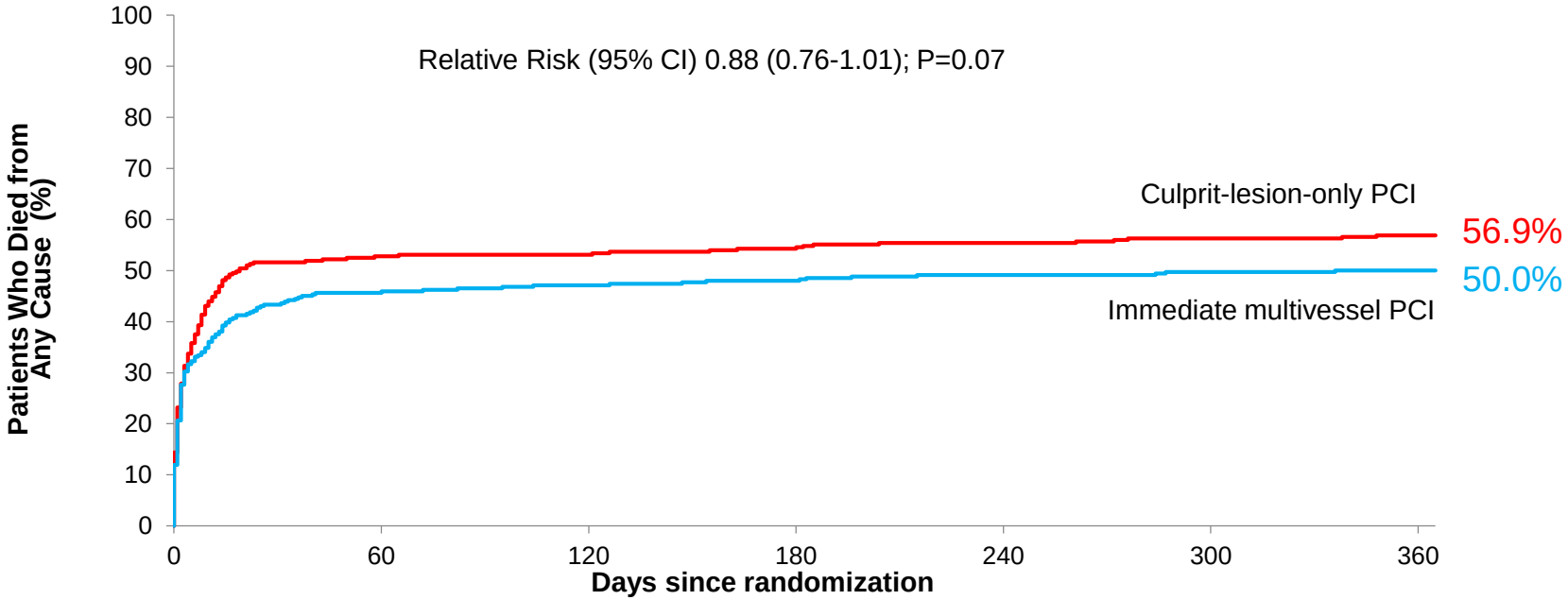
1-Year All-Cause Mortality or Renal Replacement Therapy



Number at risk:

Culprit-lesion-only PCI	344	179	174	171	167	165	142
Immediate multivessel PCI	341	149	149	145	142	139	122

1-Year All-Cause Mortality

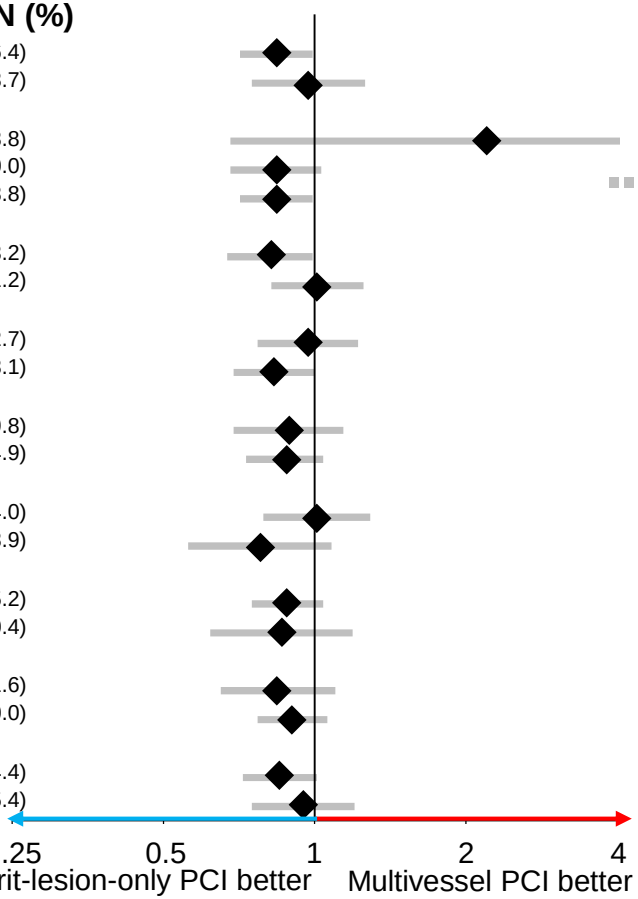


Number at risk:

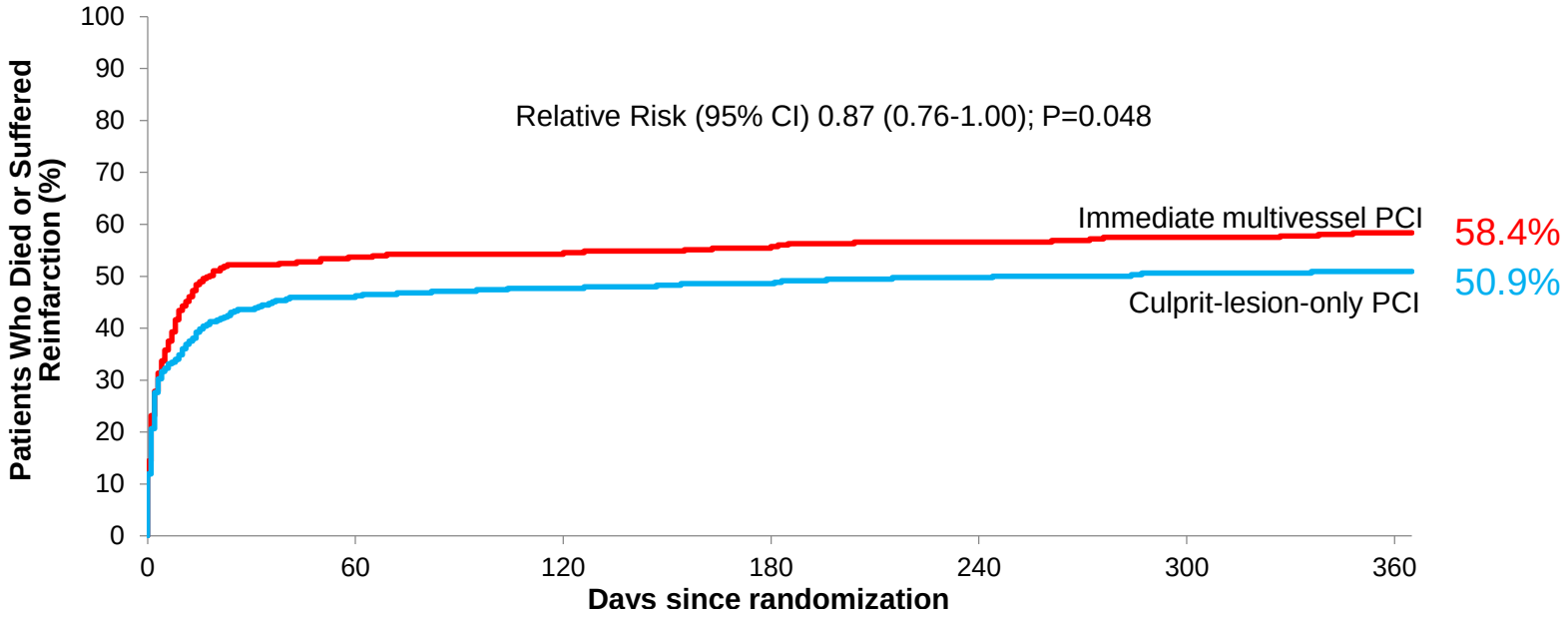
Multivessel PCI	341	161	160	156	152	149	131
Culprit-lesion-only PCI	344	186	181	178	174	172	147

1-Year All-Cause Mortality – Subgroups

Baseline Variable	Culprit-lesion-only PCI	Multivessel PCI	Relative Risk (95% CI)	P for Interaction
	1-year all-cause mortality n/N (%)			
Sex				
Male	122/257 (47.5)	150/266 (56.4)	0.84 (0.71-0.99)	0.42
Female	49/86 (57.0)	44/75 (58.7)	0.97 (0.75-1.26)	
Age				
<50 years	7/17 (41.2)	3/16 (18.8)	2.20 (0.68-7.06)	0.11
50-75 years	89/212 (42.0)	113/226 (50.0)	0.84 (0.68-1.03)	
>75 years	76/115 (66.1)	78/99 (78.8)	0.84 (0.71-0.99)	
Diabetes				
No	102/235 (43.4)	116/218 (53.2)	0.82 (0.67-0.99)	0.22
Yes	63/102 (61.8)	71/116 (61.2)	1.01 (0.82-1.25)	
Hypertension				
No	71/139 (51.1)	68/129 (52.7)	0.97 (0.77-1.22)	0.28
Yes	96/200 (48.0)	119/205 (58.1)	0.83 (0.69-1.00)	
Type of infarction				
NSTEMI	52/98 (53.1)	58/97 (59.8)	0.89 (0.69-1.14)	0.99
STEMI	114/237 (48.1)	128/233 (54.9)	0.88 (0.73-1.04)	
STEMI type				
Anterior infarction	59/108 (54.6)	61/113 (54.0)	1.01 (0.79-1.29)	0.24
Non-anterior infarction	37/97 (38.1)	45/92 (48.9)	0.78 (0.56-1.08)	
Previous infarction				
No	136/279 (48.8)	155/281 (55.2)	0.88 (0.75-1.04)	0.82
Yes	31/60 (51.7)	32/53 (60.4)	0.86 (0.62-1.19)	
Coronary artery disease				
2-vessel disease	53/122 (43.4)	64/124 (51.6)	0.84 (0.65-1.10)	0.78
3-vessel disease	118/218 (54.1)	129/215 (60.0)	0.90 (0.77-1.06)	
Chronic total occlusion				
No	123/265 (46.4)	143/263 (54.4)	0.85 (0.72-1.01)	0.64
Yes	49/79 (62.0)	51/78 (65.4)	0.95 (0.75-1.20)	



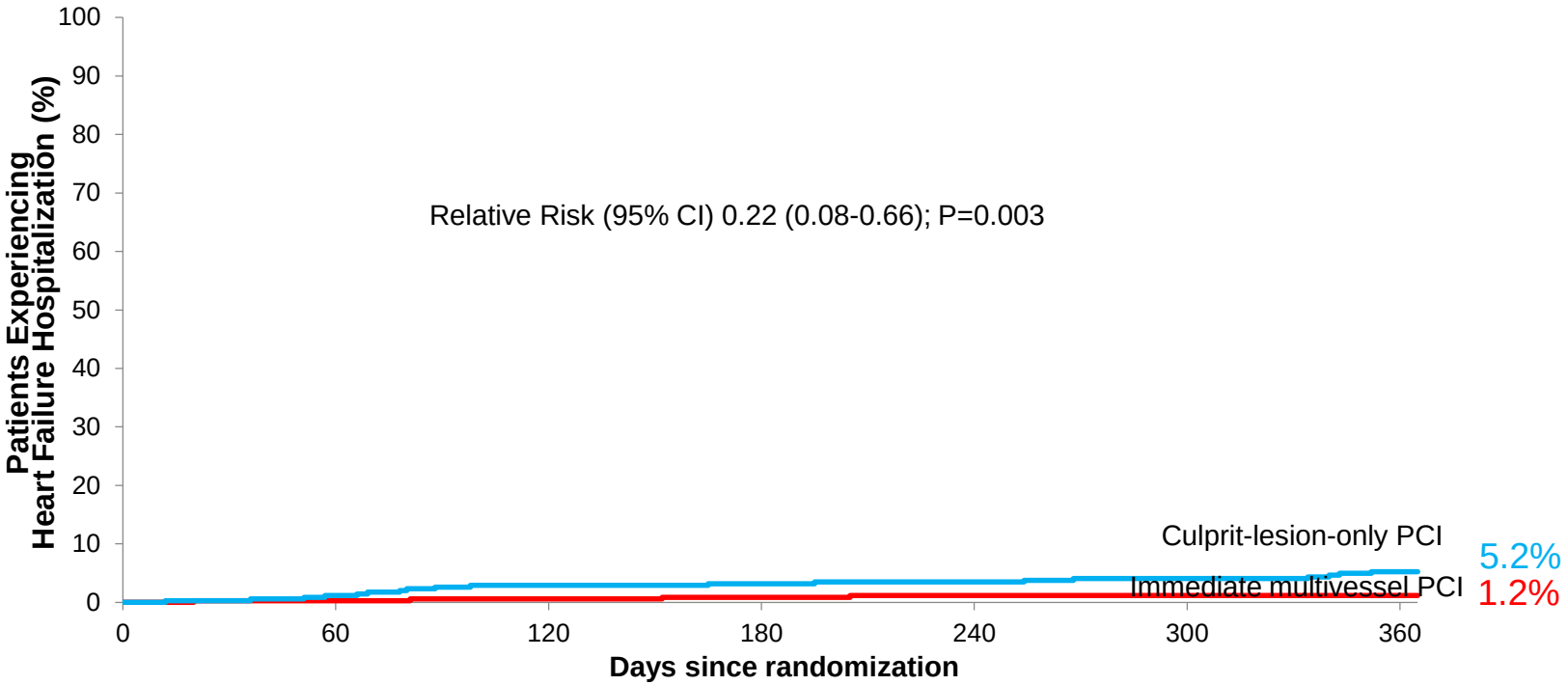
1-Year All-Cause Mortality or Reinfarction



Number at risk:

Multivessel PCI	341	158	156	152	148	145	126
Culprit-lesion-only PCI	344	185	179	176	172	169	145

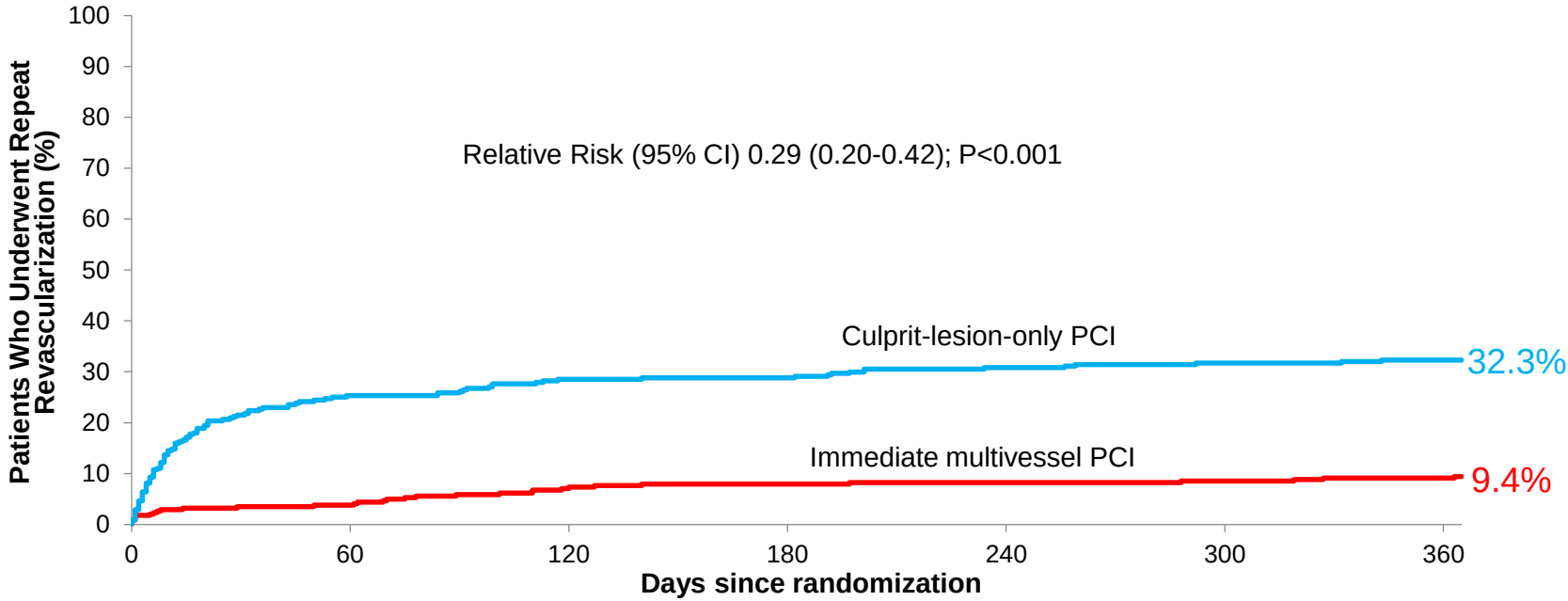
1-Year Rehospitalization Congestive Heart Failure



Number at risk:

Culprit-lesion-only PCI	344	339	333	332	331	329	301
Multivessel PCI	341	340	339	338	337	337	321

1-Year Repeat Revascularization



Number at risk:

Culprit-lesion only PCI	344	256	245	244	237	234	223
Multivessel PCI	341	327	316	313	312	311	293

Multivessel PCI in ACS?

STEMI, with shock

Wijns et al. Eur Heart J 2010;31:2501-2555

Multivessel PCI in STEMI?
ESC STEMI Guidelines 2017

STEMI, shock

2012

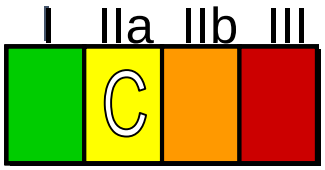
2017

Multivessel PCI in Shock - Guideline Evolution

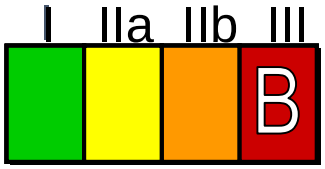
ESC STEMI Guidelines 2017 → Revascularization Guidelines 2018

STEMI (NSTEMI), Cardiogenic Shock

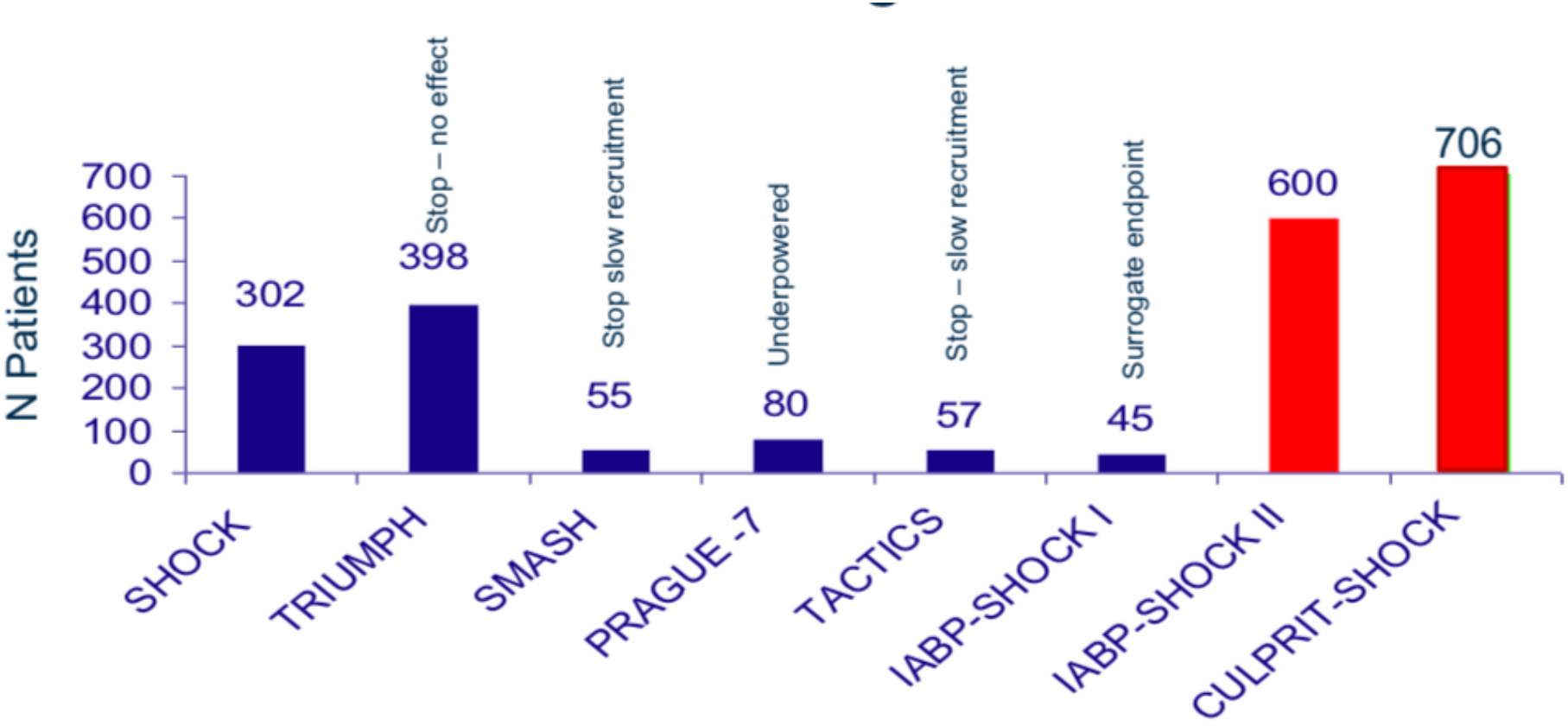
2017



2018



Ibanez et al. Eur Heart J 2018;39:119-177
Neumann et al. Eur Heart J 2018;epub 25.08.2018


N Patients
700
600
500
400
300
200
100
0
302
398
55
80
57
45
600
706
Stop – no effect
Stop slow recruitment
Underpowered
Stop – slow recruitment
Surrogate endpoint
SHOCK
TRIUMPH
SMASH
PRAGUE -7
TACTICS
IABP-SHOCK I
IABP-SHOCK II
CULPRIT-SHOCK

Take home message

- **EDC compliquant un STEMI:**
  – L'angioplastie doit être restreinte de manière routinière à l'artère occluse responsable de l'infarctus (IRA).

- **Mortalité toutes causes et recours à la dialyse moindre à 30 jours avec la stratégie de l'angioplastie de l'artère coupable**

- **Cet effet est observé également à 1 an.**

- **La différence dans la mortalité toutes causes est attenuée avec le temps, mais il n'y a pas une augmentation de la mortalité entre 30 jours et un an de suivi**

- **La stratégie de l'angioplastie de l'artère coupable est possiblement associée à une incidence plus importante d'hospitalisation pour insuffisance cardiaque et plus de revascularisation itérative à un an**

- **L’angioplastie de plusieurs lésions peut se justifier si l’artère responsable est difficile à identifier ou bien incorrectement définie initialement ou bien si plusieurs lésions responsables CULPRIT sont identifiées d’emblée**

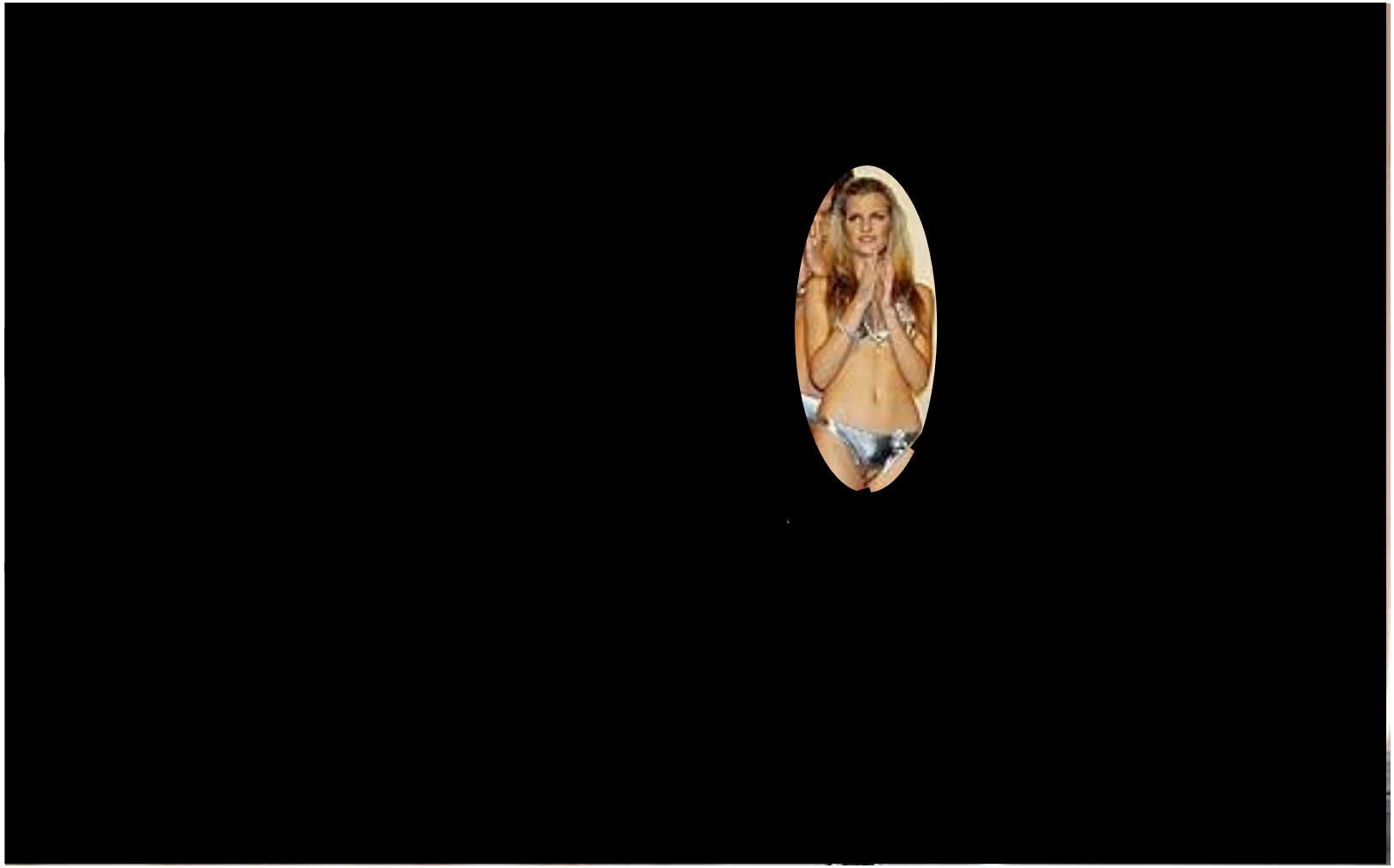
- **L’angioplastie de plusieurs lésions peut être justifiée chez des patients bien sélectionnés avec retard de flux dans un large territoire sur une artère non « coupable »**

- **L’angioplastie différée des autres lésions non coupables peut être une option mais il faut penser attentivement aux risques et bénéfices.**

- **« L'hypothèse selon laquelle la revascularisation complète au cours du choc cardiogénique augmente la mortalité immédiate mais diminue le risque des décès survenant à long terme, n'a plus de raison d'être » explique le Dr H Thiele**

- **la fragilité des patients chez lesquels une procédure invasive prolongée est délétère.**

Is it safer to target one only?



Or all of them at once?


Merci de
votre
attention


Merci pour
votre
attention
CoSAC
Le congrès des
Sociétés Africaines
de Cardiologie
STCCCV
Société Tunisienne
de Cardiologie & de Chirurgie
Cardio-Vasculaire

Summary and Conclusions

- In patients with acute myocardial infarction and cardiogenic shock culprit-lesion-only PCI - with possible staged revascularization - compared with immediate multivessel PCI is associated with a reduction in all-cause death or renal replacement therapy at 30 days.

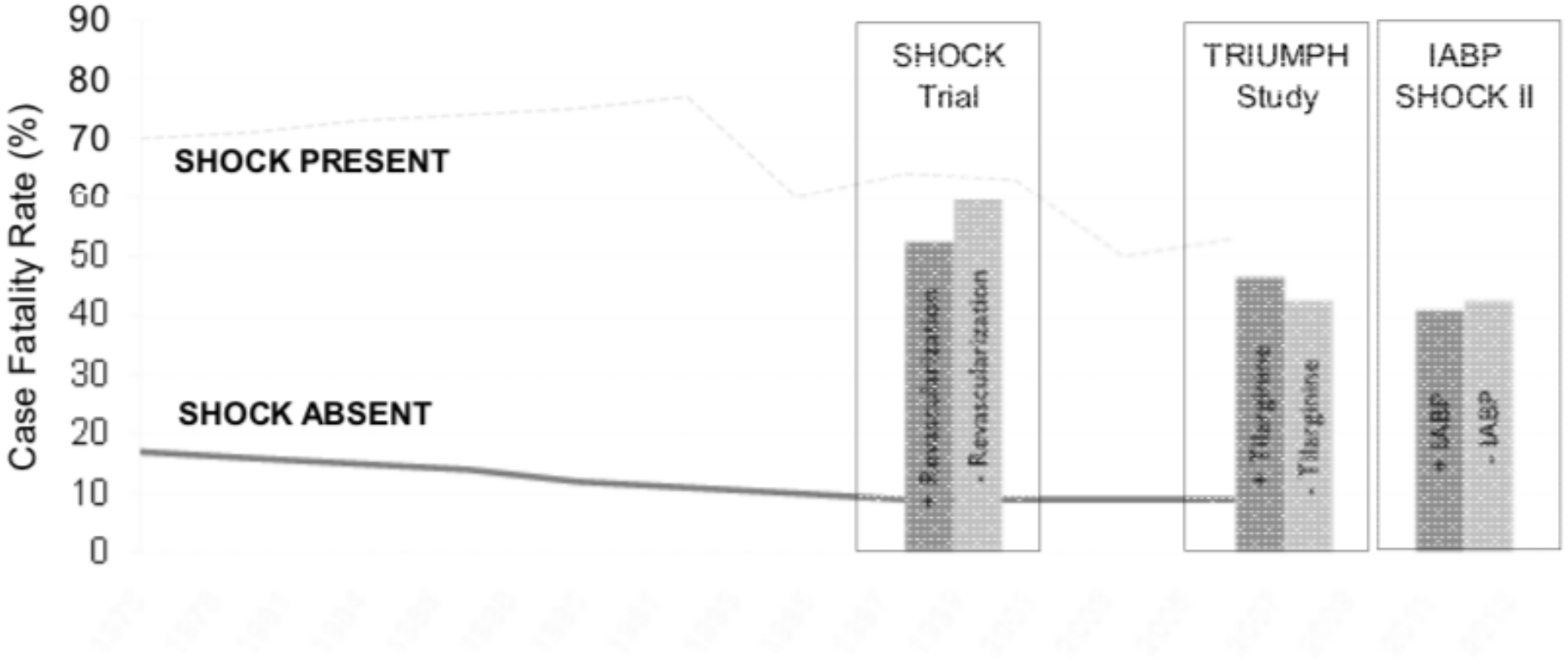
- This effect in the composite endpoint is persistently observed at 12 months follow-up.

- The 30-day difference in all-cause mortality is attenuated over time. However, there is no increase in mortality after 30-days until 1-year follow-up.

- Culprit-lesion-only PCI is possibly associated with a higher incidence of heart failure hospitalizations and more frequent repeat revascularization at 1-year.

- The 1-year results of CULPRIT-SHOCK support the recent change in ESC guideline recommendations.

Cardiogenic Shock: Declining (But Still High) Case Fatality Rate



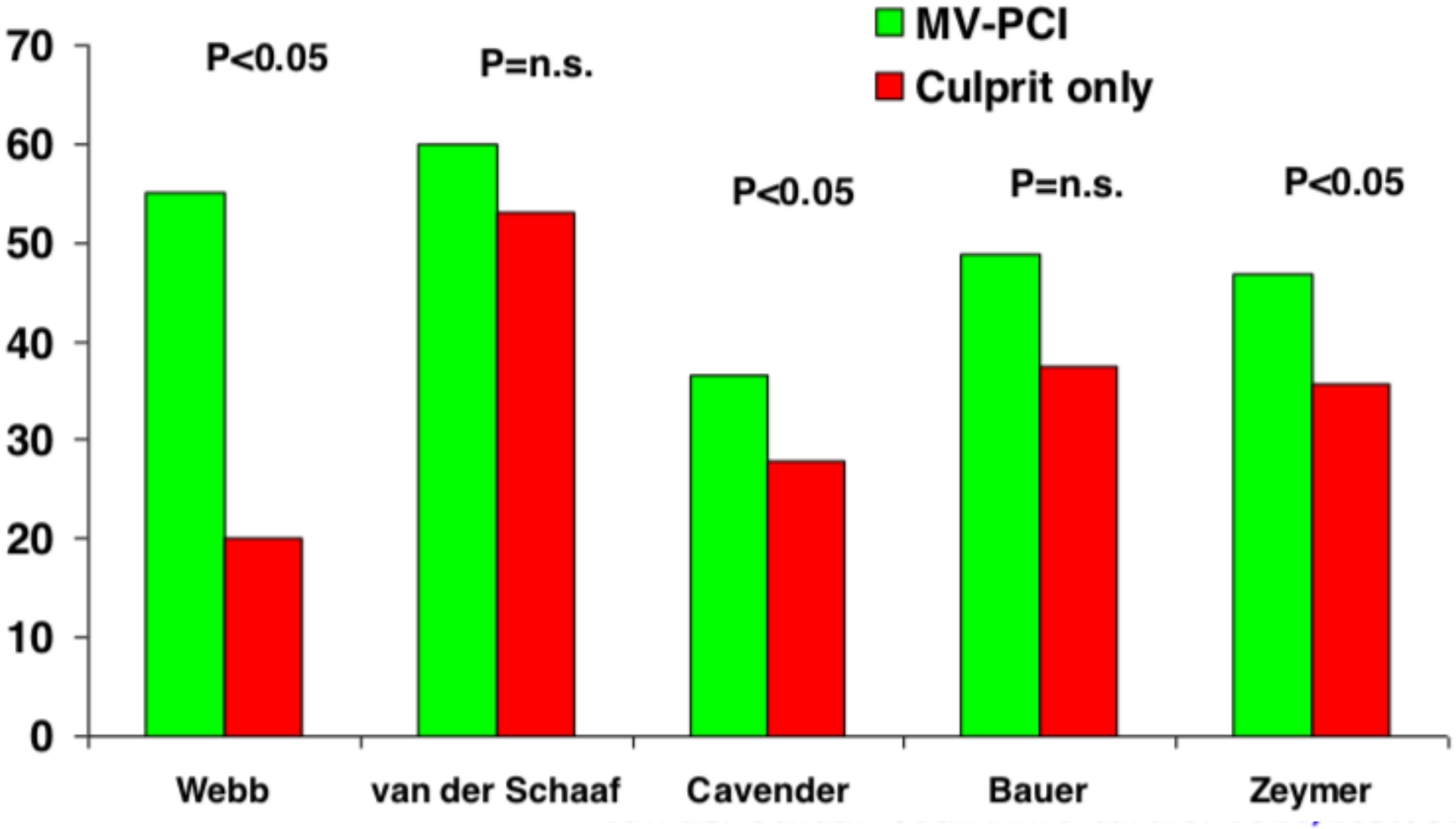
Adapted from Werdan et al. lEuropean Heart Journal (2014) 35, 156–167.
Goldberg et al. Circulation 2009;119: 1211 – 1219.

Guidelines on revascularization for cardiogenic shock

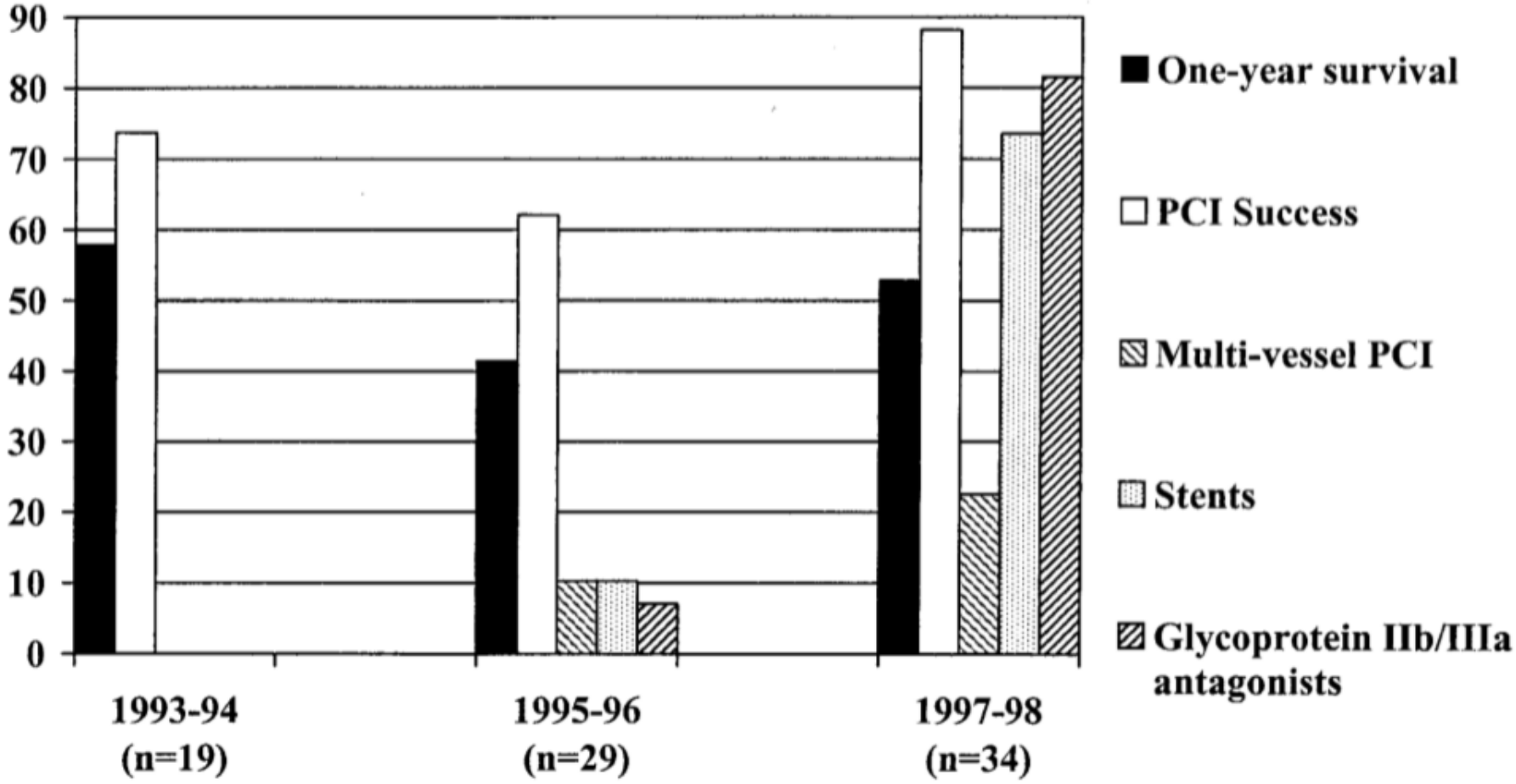
Emergency invasive evaluation is indicated in patients with acute heart failure or cardiogenic shock complicating ACS.	I	B
Emergency PCI is indicated for patients with cardiogenic shock due to STEMI or NSTE-ACS **if coronary anatomy is amenable**.	I	B
Emergency CABG is recommended for patients with cardiogenic shock if the **coronary anatomy is not amenable to PCI**.	I	B

ESC Myocardial Revascularization Guidelines: EHJ (2014) 35, 2541–2619

Multivessel-PCI or Culprit Lesion Only PCI



Cavender et al. Am J Cardiol 2009;104:507-513
Bauer et al. Am J Cardiol 2012;109:941-6
Zeymer et al. Clin Res Cardiol 2012;101 (Suppl):117


90
80
70
60
50
40
30
20
10
0
1993-94
(n=19)
1995-96
(n=29)
1997-98
(n=34)
One-year survival
PCI Success
Multi-vessel PCI
Stents
Glycoprotein IIb/IIIa antagonists

Mortality for multivessel vs. culprit lesion only PCI in cardiogenic shock in registries

Trial	*N*	Mortality multivessel PCI, %	Mortality culprit lesion only PCI, %	Adjusted odds ratio or hazard ratio (95% CI)
Webb *et al.*[18]	74	55	20	2.75 (1.05–7.25)
Van der Schaaf *et al.*[22]	161	60	53	Not reported ($P = 0.05$)
Cavender *et al.*[23]	3087	36.5	27.8	1.5 (1.22–1.95)
Bauer *et al.*[21]	336	48.8	37.4	1.28 (0.72–2.28)
Zeymer *et al.*[25]	735	46.8	35.8	1.5 (1.15–1.84)
Yang *et al.*[26]	338	35.0	30.6	1.06 (0.61–1.86)
Mylotte *et al.*[24]	266	20.4	43.9	0.57 (0.38–0.84)

PCI, percutaneous coronary intervention; CI, confidence interval.

Multivessel PCI in ACS?

STEMI, no shock

STEMI, with shock

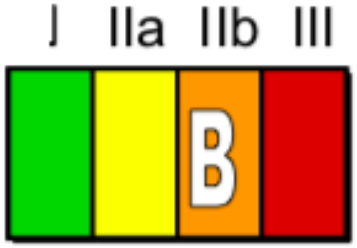
Wijns et al. Eur Heart J 2010;31:2501-2555

Multivessel PCI in ACS? Guidelines

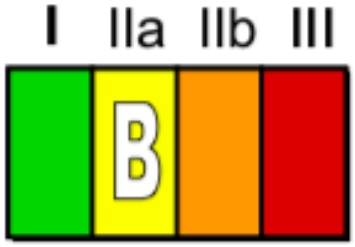
STEMI, no Shock

2012

2014



STEMI, Shock



Multivessel PCI in STEMI?
ESC STEMI Guidelines 2017

STEMI, no shock

STEMI, shock

Multivessel PCI in Cardiogenic Shock

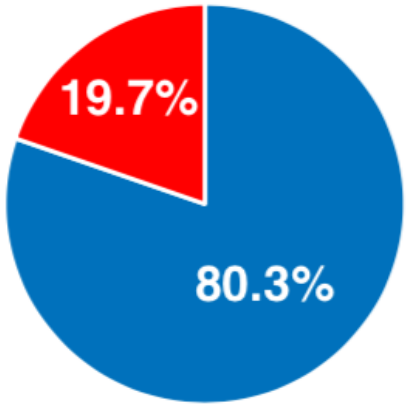
Metaanalysis Mortality – Registry-Data:

- 10 observational studies published between 2003 and 2016

↓

6,051 patients:

IABP-SHOCK II, ALKK, KAMIR, Yang et al., Cavender et al.; Mylotte et al., van der Schaaf et al., EHS-PCI, NCDR, SHOCK



- Culprit only-PCI (n=4,857)
- Multivessel-PCI (n=1,194)

Multivessel PCI in Cardiogenic Shock?

Metaanalysis Mortality – Registry-Data

	MV-PCI		C-PCI		RR	95%CI
	Events	Total	Events	Total		
IABP-SHOCK II	75	167	119	284	1.07	[0.86-1.33]
ALKK	81	173	201	562	1.31	[1.08-1.33]
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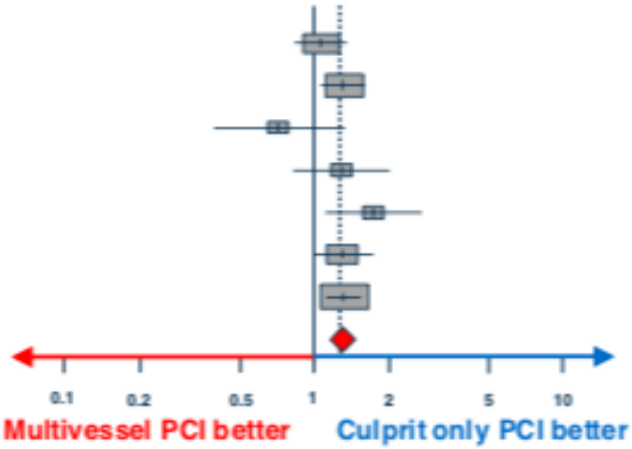
Overall	**406**	**1082**	**1318**	**4574**	**1.26**	**[1.12-1.41]**

Heterogeneity: τ^2=0.007, I^2=31.0%, p=0.19

Test for overall effect: p=0.001



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Overall	**226**	**506**	**578**	**1387**	**1.03**	**[0.85-1.25]**

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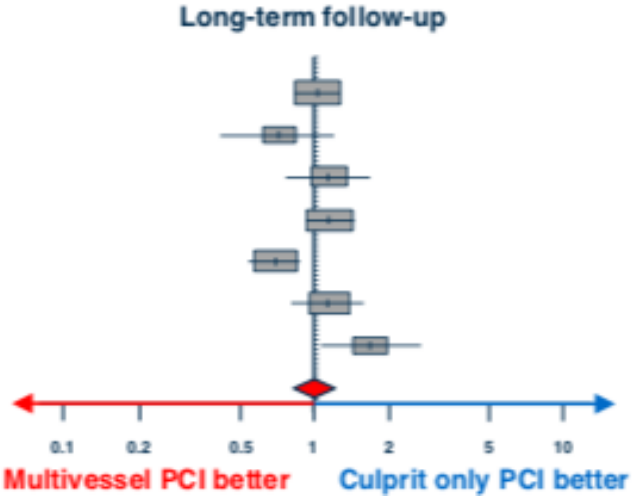

- **Les patients revascularisés au niveau de la seule artère concernée ont un pronostic à un an superposable aux patients ayant eu une « revascularisation complète ».**

- **Tels sont les résultats de l'étude CULPRIT prolongée d'une année présentée cette année au congrès de l'esc et publiés simultanément dans le *NEJM*.**

- **D’où CULPRIT-SHOCK (Culprit Lesion Only PCI vs Multivessel PCI in Cardiogenic Shock) dont les résultats à 30 jours de l’étude initiale montraient *a contrario* une diminution des décès et du recours à l’hémodialyse, quand la revascularisation ne portait que sur l’artère cause de l’infarctus**

Complete versus culprit revascularization

Table 1 Mortality for multivessel vs. culprit lesion only PCI in cardiogenic shock in registries

Trial	*N*	Mortality multivessel PCI, %	Mortality culprit lesion only PCI, %	Adjusted odds ratio or hazard ratio (95% CI)
Webb *et al.*[18]	74	55	20	2.75 (1.05–7.25)
Van der Schaaf *et al.*[22]	161	60	53	Not reported ($P = 0.05$)
Cavender *et al.*[23]	3087	36.5	27.8	1.5 (1.22–1.95)
Bauer *et al.*[21]	336	48.8	37.4	1.28 (0.72–2.28)
Zeymer *et al.*[25]	735	46.8	35.8	1.5 (1.15–1.84)
Yang *et al.*[26]	338	35.0	30.6	1.06 (0.61–1.86)
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PCI, percutaneous coronary intervention; CI, confidence interval.

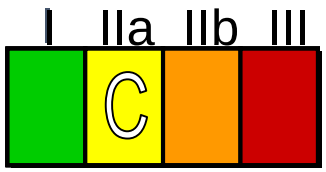
Thiele H, Eur Heart J. 2015 May 21;36(20):1223-30

Multivessel PCI in Shock - Guideline Evolution

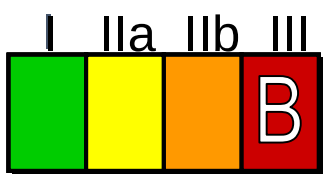
ESC STEMI Guidelines 2017 → Revascularization Guidelines 201

STEMI (NSTEMI), Cardiogenic Shock

2017



2018



Ibanez et al. Eur Heart J 2018;39:119-177
Neumann et al. Eur Heart J 2018;epub 25.08.2018

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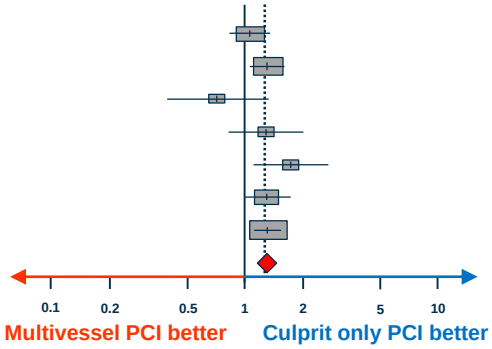

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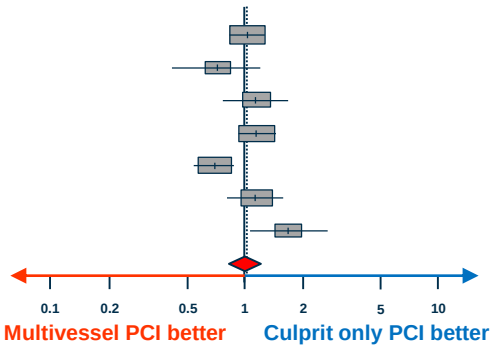


de Waha et al. Eur Heart J Acute Cardiovasc Care. 2018;7:28-37

Statistical Methodology

Primary Study Endpoint:

- **30-day all-cause mortality or renal replacement therapy**

Secondary Study Endpoints:

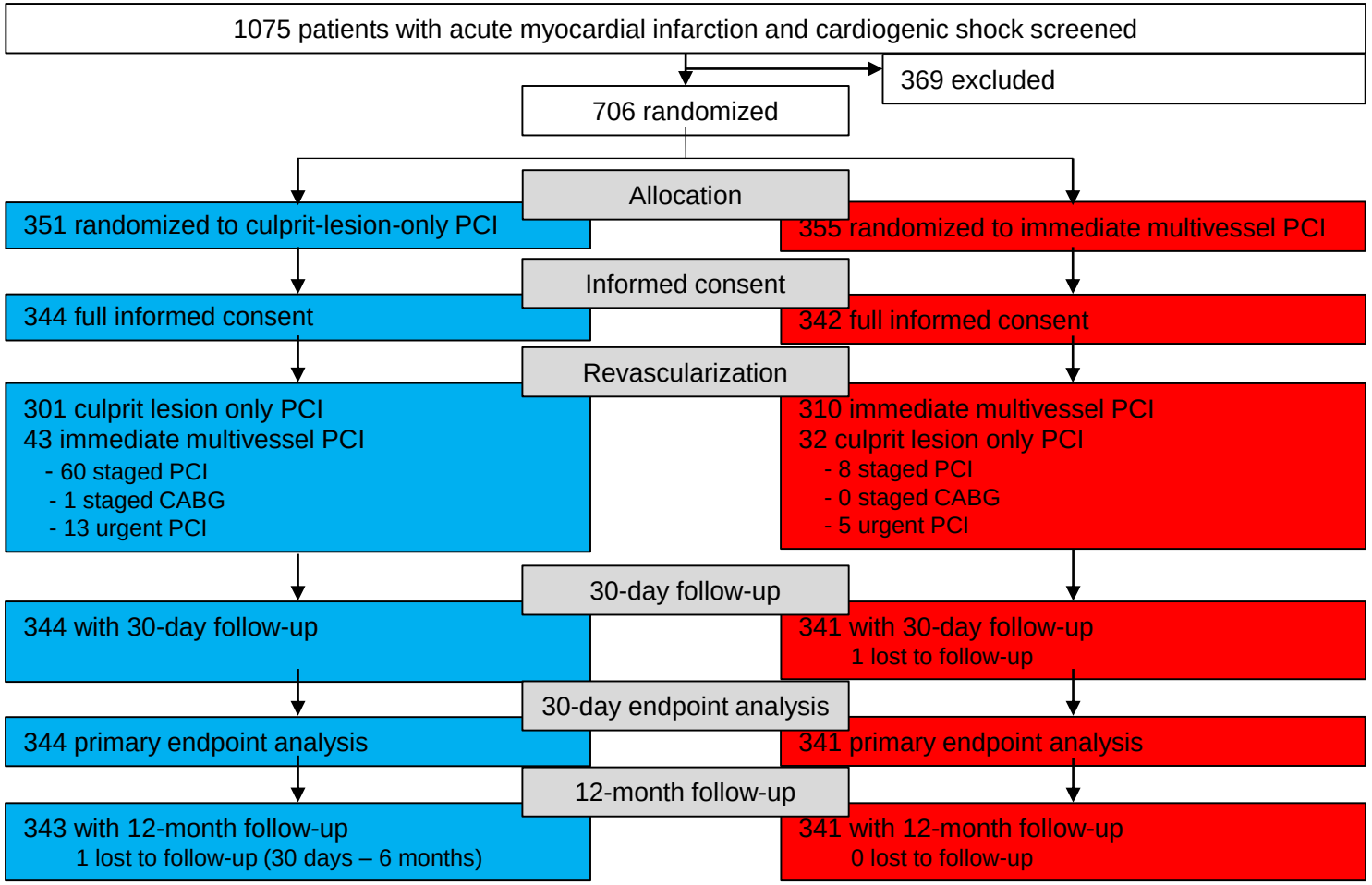
- 30-day all-cause mortality
- Renal failure with requirement of renal replacement therapy
- Time to hemodynamic stabilization
- Duration of catecholamine therapy
- Serial creatinine-clearance
- Length of ICU-stay
- SAPS-II score
- Requirement and length of mechanical ventilation
- All-cause death within 6 and 12 months follow-up
- Recurrent infarction within 30-days, 6 and 12 months follow-up
- Death or recurrent infarction at 6 and 12 months follow-up
- Rehospitalization for congestive heart failure within 30 days, 6-, and 12-months follow-up
- Death/recurrent infarction/rehospitalization for congestive heart failure within 30 days, 6-, and 12-months follow-up
- Need for recurrent revascularization (PCI and/or CABG) within 30 days, 6-, and 12-months follow-up
- Peak creatine kinase, creatine kinase-MB

Sample Size:

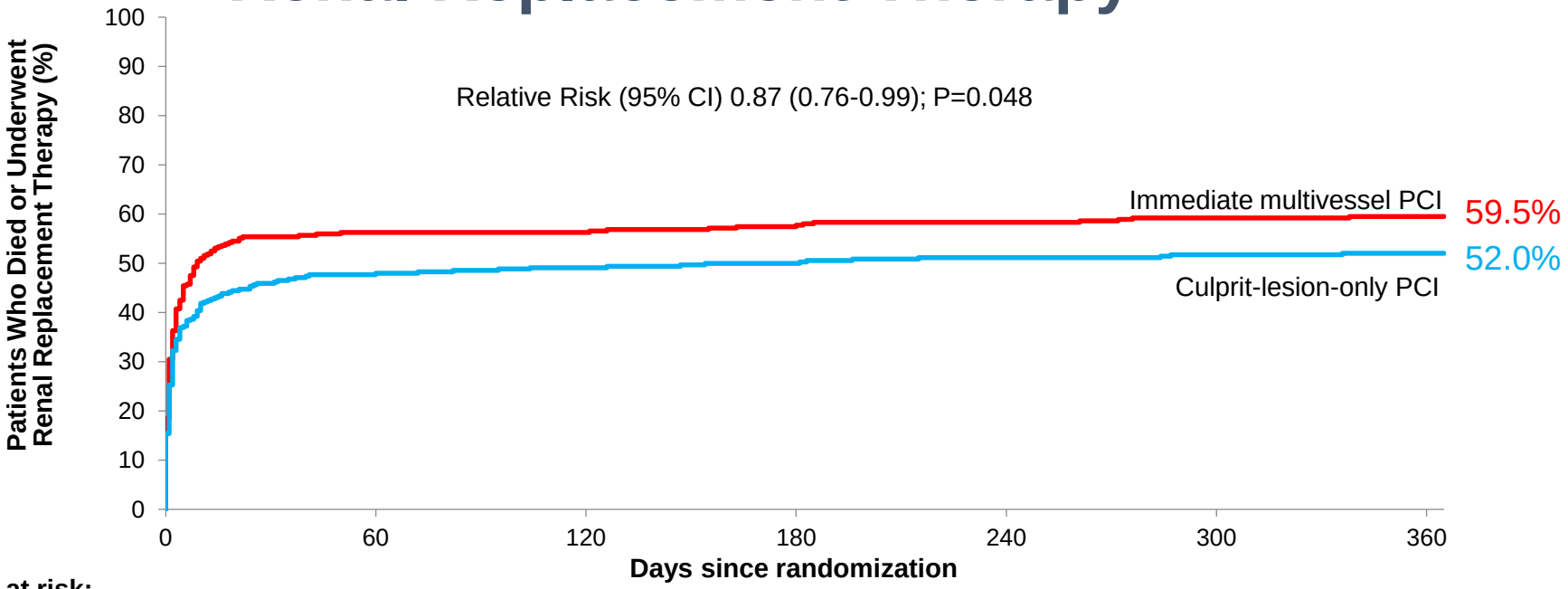
- **Estimated 50% event rate in multivessel PCI versus 38% in culprit lesion only group for primary endpoint**
- **1 interim analysis (50% of patients)**
- 2-sided Chi^2-test; power: 80%, alpha=0.048 for final analysis → **684 patients**
- **To compensate losses in follow-up → 706 patients**

Thiele et al. Am Heart J. 2016;172:160-169

Trial Flow


1075 patients with acute myocardial infarction and cardiogenic shock screened
369 excluded
706 randomized
Allocation
351 randomized to culprit-lesion-only PCI
355 randomized to immediate multivessel PCI
Informed consent
344 full informed consent
342 full informed consent
Revascularization
301 culprit lesion only PCI
43 immediate multivessel PCI
- 60 staged PCI
- 1 staged CABG
- 13 urgent PCI
310 immediate multivessel PCI
32 culprit lesion only PCI
- 8 staged PCI
- 0 staged CABG
- 5 urgent PCI
30-day follow-up
344 with 30-day follow-up
341 with 30-day follow-up
1 lost to follow-up
30-day endpoint analysis
344 primary endpoint analysis
341 primary endpoint analysis
12-month follow-up
343 with 12-month follow-up
1 lost to follow-up (30 days – 6 months)
341 with 12-month follow-up
0 lost to follow-up

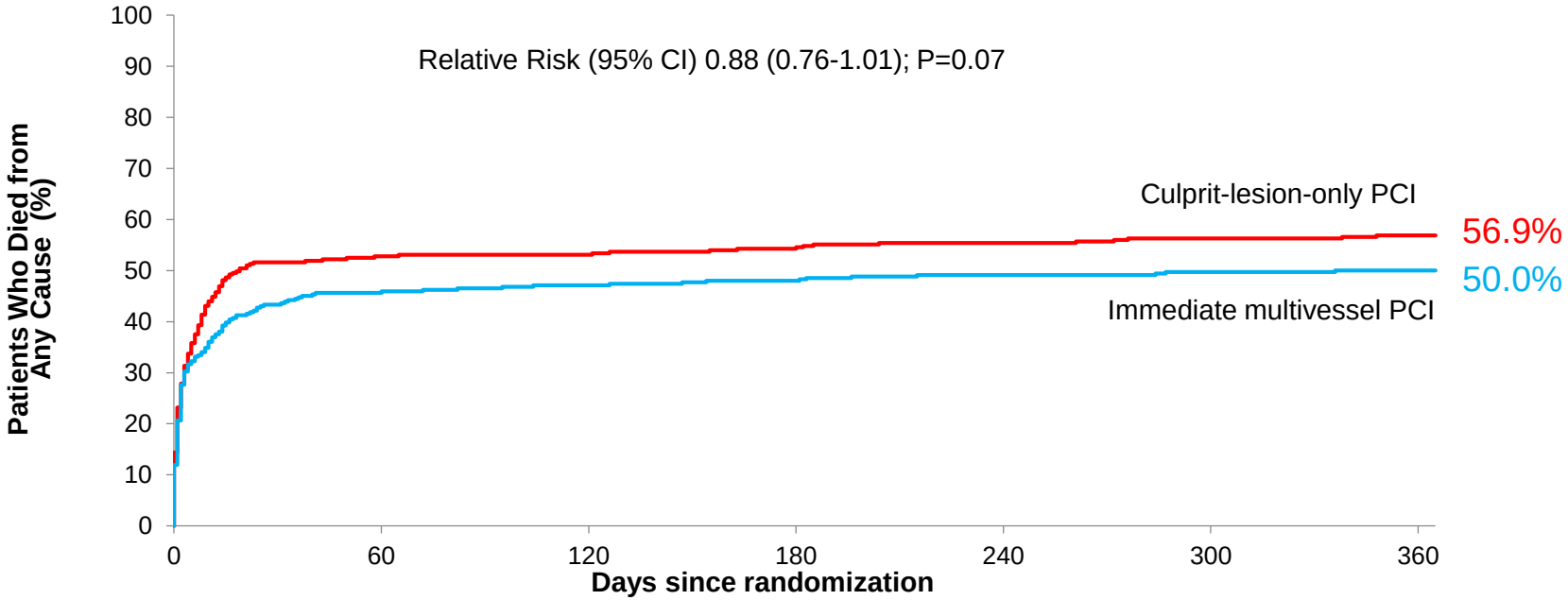
1-Year All-Cause Mortality or Renal Replacement Therapy



Number at risk:

Culprit-lesion-only PCI	344	179	174	171	167	165	142
Immediate multivessel PCI	341	149	149	145	142	139	122

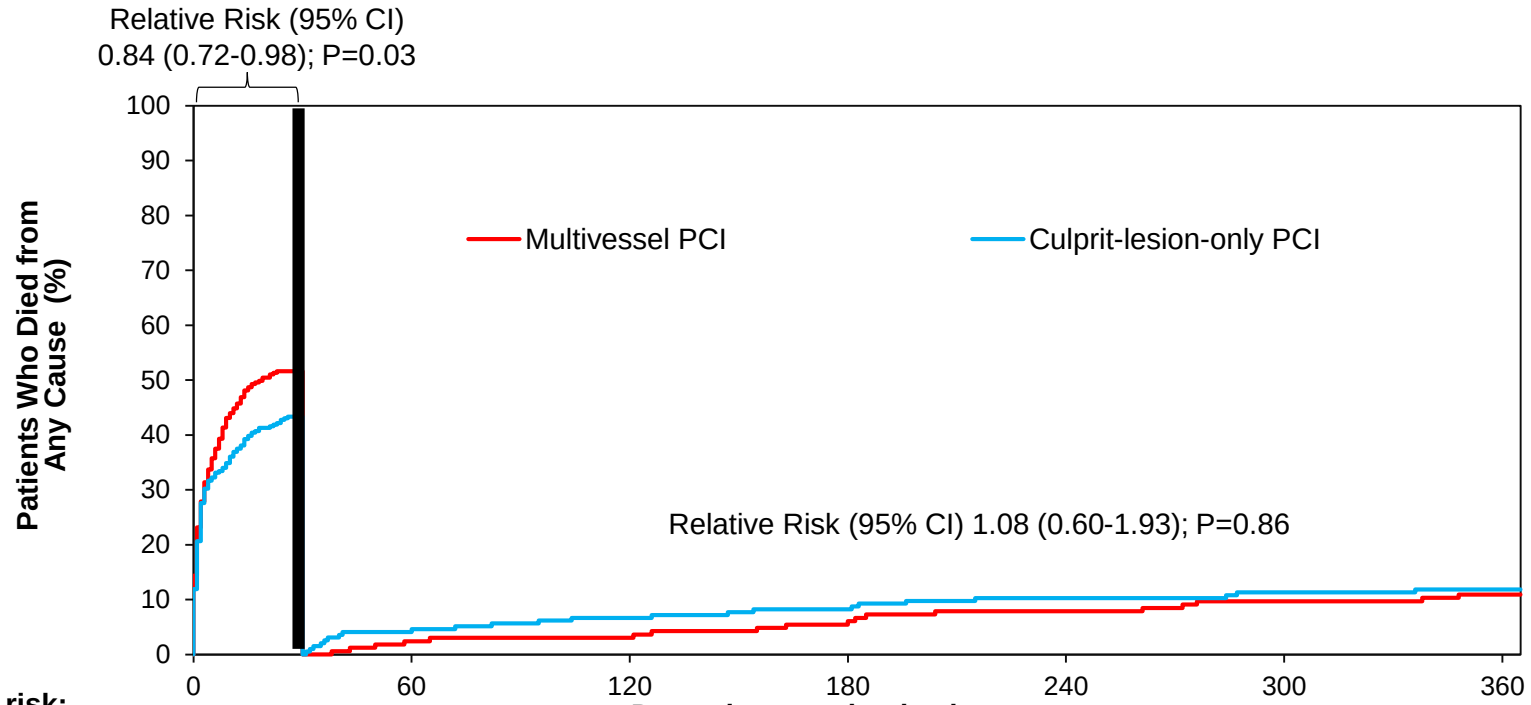
1-Year All-Cause Mortality



Number at risk:

Multivessel PCI	341	161	160	156	152	149	131
Culprit-lesion-only PCI	344	186	181	178	174	172	147

1-Year All-Cause Mortality – Landmark Analysis

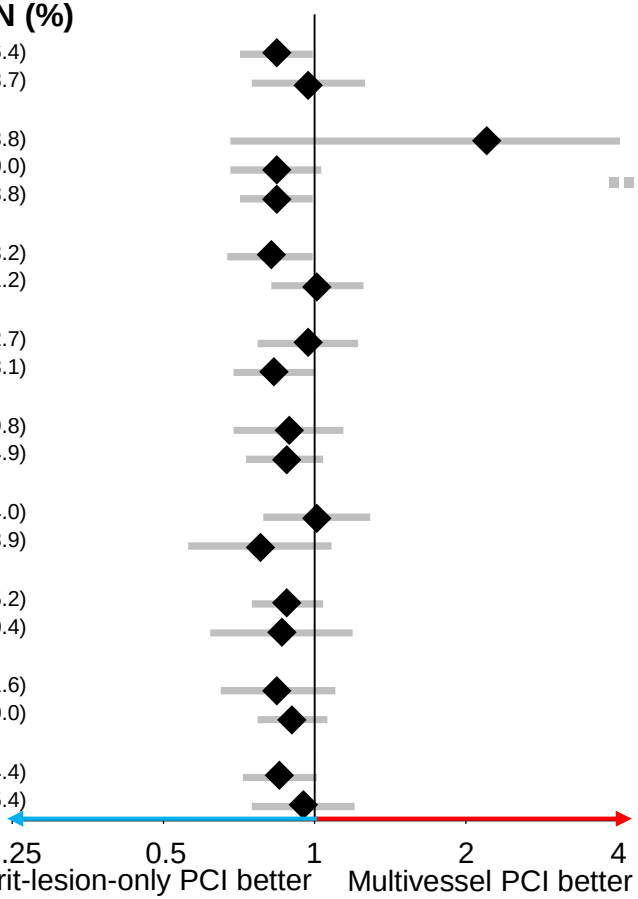


Number at risk:

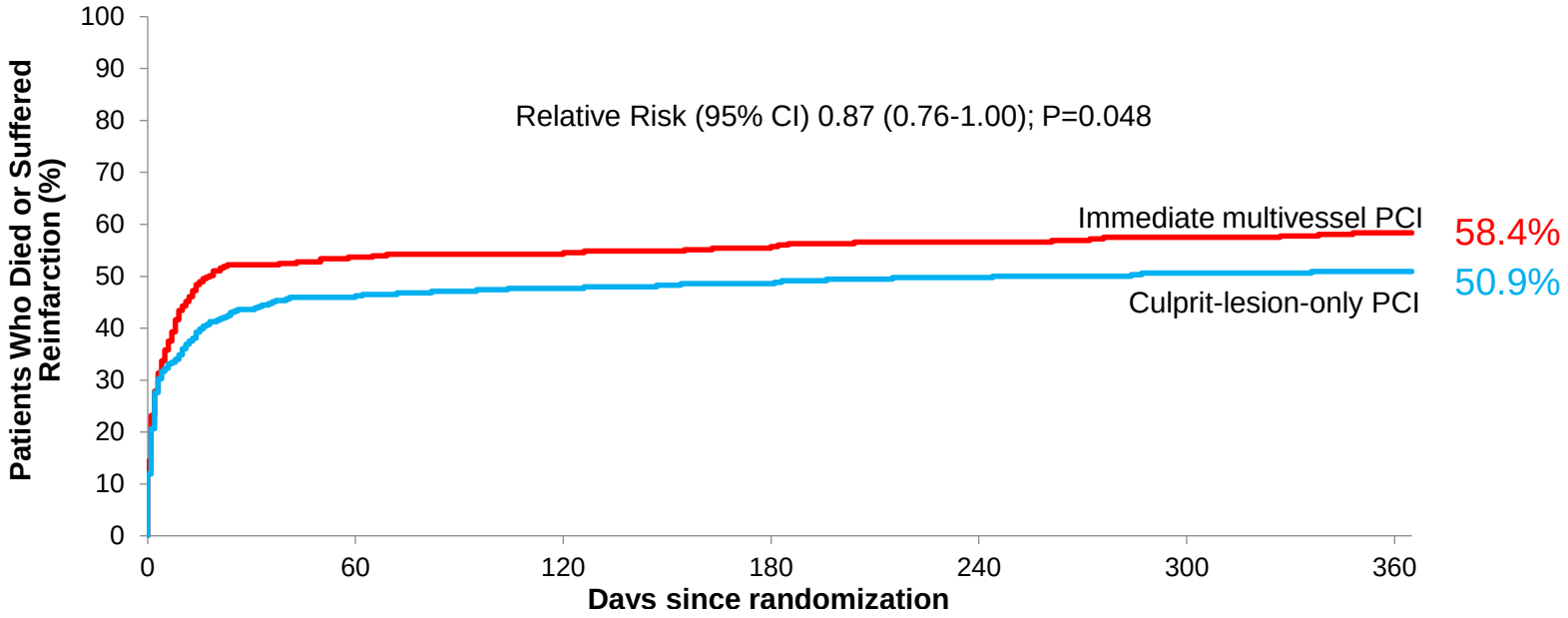
Multivessel PCI	165	161	160	156	152	149	131
Culprit-lesion-only PCI	195	186	181	178	174	172	147

1-Year All-Cause Mortality – Subgroups

Baseline Variable	Culprit-lesion-only PCI	Multivessel PCI	Relative Risk (95% CI)	P for Interaction
	1-year all-cause mortality n/N (%)			
Sex				
Male	122/257 (47.5)	150/266 (56.4)	0.84 (0.71-0.99)	0.42
Female	49/86 (57.0)	44/75 (58.7)	0.97 (0.75-1.26)	
Age				
<50 years	7/17 (41.2)	3/16 (18.8)	2.20 (0.68-7.06)	0.11
50-75 years	89/212 (42.0)	113/226 (50.0)	0.84 (0.68-1.03)	
>75 years	76/115 (66.1)	78/99 (78.8)	0.84 (0.71-0.99)	
Diabetes				
No	102/235 (43.4)	116/218 (53.2)	0.82 (0.67-0.99)	0.22
Yes	63/102 (61.8)	71/116 (61.2)	1.01 (0.82-1.25)	
Hypertension				
No	71/139 (51.1)	68/129 (52.7)	0.97 (0.77-1.22)	0.28
Yes	96/200 (48.0)	119/205 (58.1)	0.83 (0.69-1.00)	
Type of infarction				
NSTEMI	52/98 (53.1)	58/97 (59.8)	0.89 (0.69-1.14)	0.99
STEMI	114/237 (48.1)	128/233 (54.9)	0.88 (0.73-1.04)	
STEMI type				
Anterior infarction	59/108 (54.6)	61/113 (54.0)	1.01 (0.79-1.29)	0.24
Non-anterior infarction	37/97 (38.1)	45/92 (48.9)	0.78 (0.56-1.08)	
Previous infarction				
No	136/279 (48.8)	155/281 (55.2)	0.88 (0.75-1.04)	0.82
Yes	31/60 (51.7)	32/53 (60.4)	0.86 (0.62-1.19)	
Coronary artery disease				
2-vessel disease	53/122 (43.4)	64/124 (51.6)	0.84 (0.65-1.10)	0.78
3-vessel disease	118/218 (54.1)	129/215 (60.0)	0.90 (0.77-1.06)	
Chronic total occlusion				
No	123/265 (46.4)	143/263 (54.4)	0.85 (0.72-1.01)	0.64
Yes	49/79 (62.0)	51/78 (65.4)	0.95 (0.75-1.20)	



1-Year All-Cause Mortality or Reinfarction



Number at risk:

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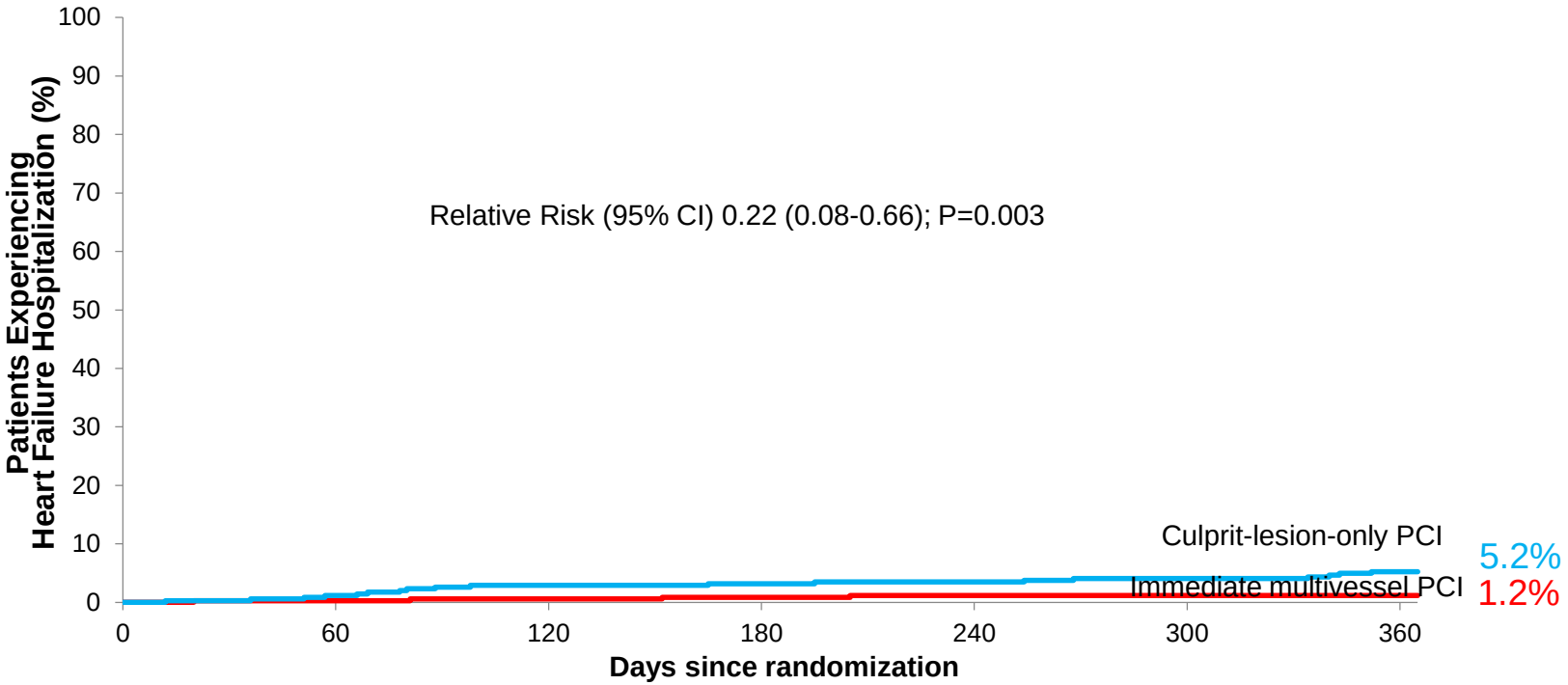
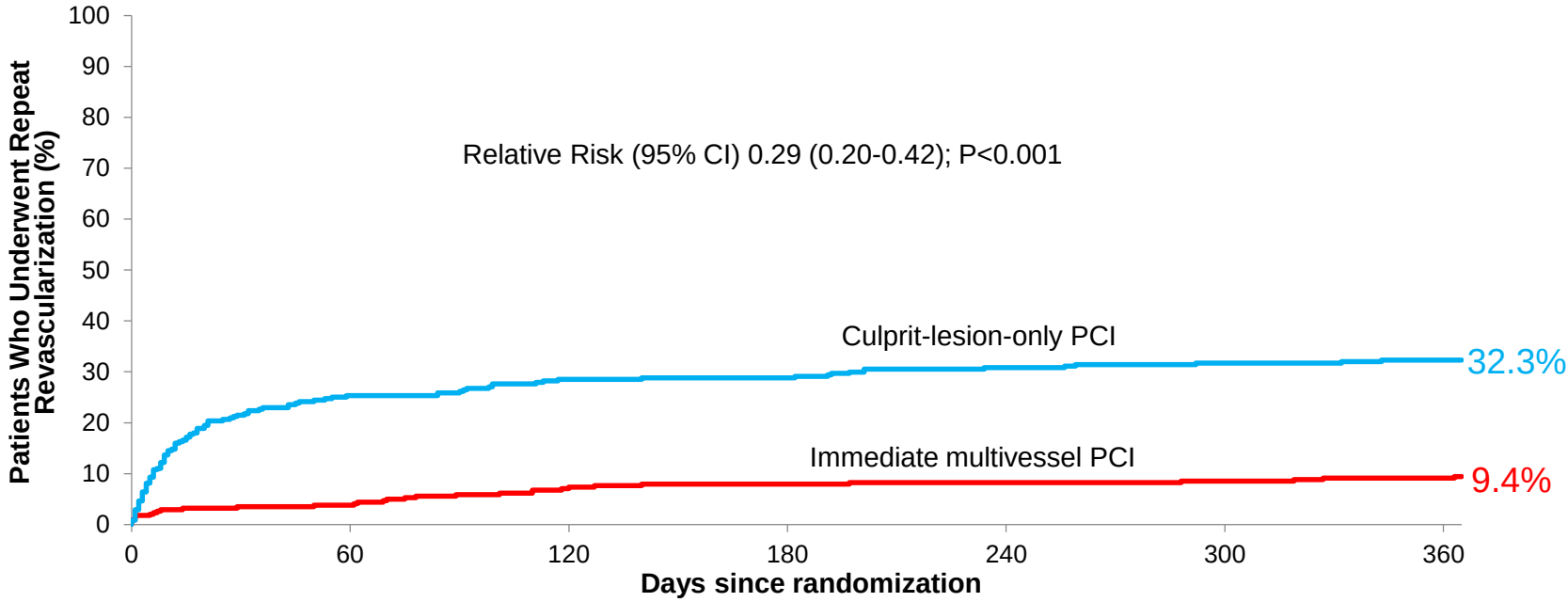
1-Year Rehospitalization Congestive Heart Failure



Number at risk:

Culprit-lesion-only PCI	344	339	333	332	331	329	301
Multivessel PCI	341	340	339	338	337	337	321

1-Year Repeat Revascularization



Number at risk:

Culprit-lesion only PCI	344	256	245	244	237	234	223
Multivessel PCI	341	327	316	313	312	311	293

1-Year Clinical Endpoints and Safety

	Culprit-lesion-only PCI (n=344)	Multivessel PCI (n=341)	Relative Risk	95% CI	P-Value
All-cause mortality; n/total (%)	172/344 (50.0)	194/341 (56.9)	0.88	0.76–1.01	0.07
Renal replacement therapy; n/total (%)	40/344 (11.6)	56/341 (16.4)	0.71	0.49–1.03	0.07
Reinfarction; n/total (%)	6/344 (1.7)	7/341 (2.1)	0.85	0.29–2.50	0.77
Death/reinfarction; n/total (%)	175/344 (50.9)	199/341 (58.4)	0.87	0.76–1.00	0.048
Rehospitalization for congestive heart failure; n/total (%)	18/344 (5.2)	4/341 (1.2)	4.46	1.53–13.04	0.003
Death/reinfarction/rehospitalization for congestive heart failure; n/total (%)	190/344 (55.2)	203/341 (59.5)	0.87	0.93–1.06	0.87
Repeat revascularization; n/total (%)	111/344 (32.3)	32/341 (9.4)	3.44	2.39-4.95	<0.001
Repeat PCI; n/total (%)	107/344 (31.1)	29/341 (8.5)	3.66	2.50–5.36	
Repeat CABG; n/total (%)	4/344 (1.2)	3/341 (0.9)	1.32	0.30–5.86	
All-cause mortality or renal replacement therapy; n/total (%)	179/344 (52.0)	203/341 (59.5)	0.87	0.76–0.99	0.048
Stroke; n/total (%)	15/344 (4.4)	14/341 (4.1)	1.06	0.52–2.17	0.87
Bleeding (BARC 2, 3 or 5); n/total (%)	65/344 (18.9)	79/341 (23.2)	0.82	0.61–1.09	0.82
Any bleeding event; n/total (%)	75/344 (21.8)	86/341 (25.2)	0.86	0.66–1.13	0.86

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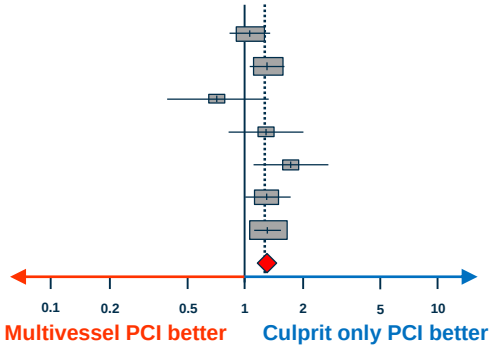

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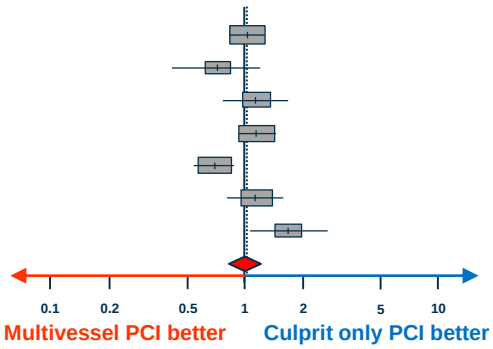

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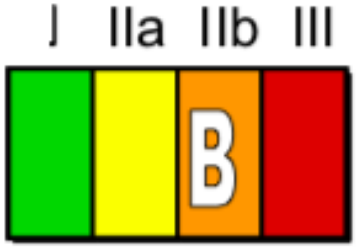
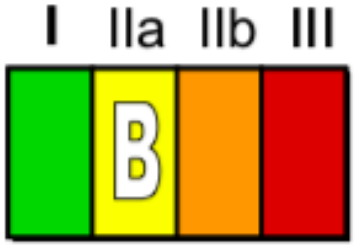


STEMI, Shock

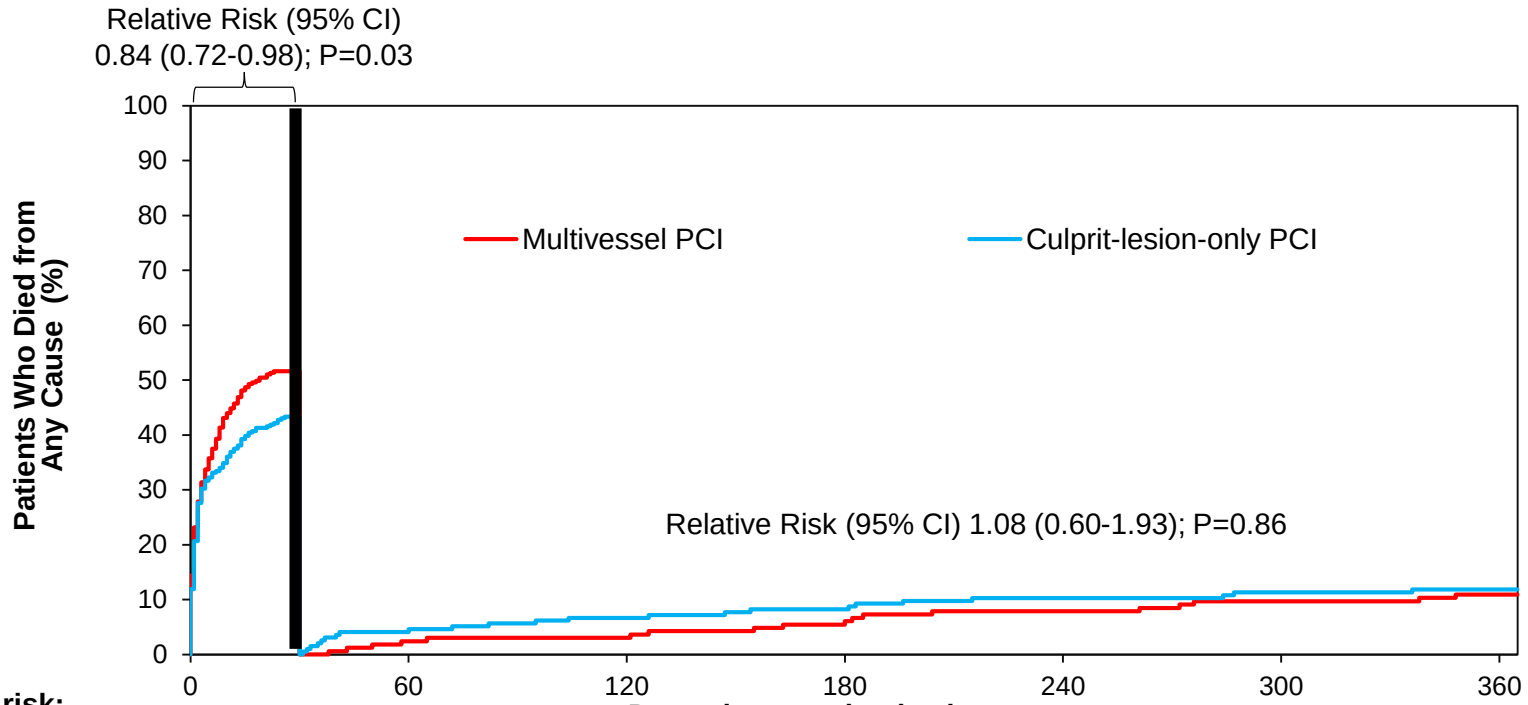


Multivessel PCI in STEMI?
ESC STEMI Guidelines 2017

STEMI, no shock

STEMI, shock

1-Year All-Cause Mortality – Landmark Analysis



Number at risk:

Multivessel PCI	165	161	160	156	152	149	131
Culprit-lesion-only PCI	195	186	181	178	174	172	147

Multivessel PCI in ACS? Guidelines

STEMI, Shock

1-Year Clinical Endpoints and Safety

	Culprit-lesion-only PCI (n=344)	Multivessel PCI (n=341)	Relative Risk	95% CI	P-Value
All-cause mortality; n/total (%)	172/344 (50.0)	194/341 (56.9)	0.88	0.76–1.01	0.07
Renal replacement therapy; n/total (%)	40/344 (11.6)	56/341 (16.4)	0.71	0.49–1.03	0.07
Reinfarction; n/total (%)	6/344 (1.7)	7/341 (2.1)	0.85	0.29–2.50	0.77
Death/reinfarction; n/total (%)	175/344 (50.9)	199/341 (58.4)	0.87	0.76–1.00	0.048
Rehospitalization for congestive heart failure; n/total (%)	18/344 (5.2)	4/341 (1.2)	4.46	1.53–13.04	0.003
Death/reinfarction/rehospitalization for congestive heart failure; n/total (%)	190/344 (55.2)	203/341 (59.5)	0.87	0.93–1.06	0.87
Repeat revascularization; n/total (%)	111/344 (32.3)	32/341 (9.4)	3.44	2.39-4.95	<0.001
Repeat PCI; n/total (%)	107/344 (31.1)	29/341 (8.5)	3.66	2.50–5.36	
Repeat CABG; n/total (%)	4/344 (1.2)	3/341 (0.9)	1.32	0.30–5.86	
All-cause mortality or renal replacement therapy; n/total (%)	179/344 (52.0)	203/341 (59.5)	0.87	0.76–0.99	0.048
Stroke; n/total (%)	15/344 (4.4)	14/341 (4.1)	1.06	0.52–2.17	0.87
Bleeding (BARC 2, 3 or 5); n/total (%)	65/344 (18.9)	79/341 (23.2)	0.82	0.61–1.09	0.82
Any bleeding event; n/total (%)	75/344 (21.8)	86/341 (25.2)	0.86	0.66–1.13	0.86