STEMI Networks
and
Stents in STEMI-patients

Austrian view

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STEMI Guidelines 2012

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215

ESC GUIDELINES

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

What is new?

- Prehospital Management & Logistic
  prehospital Diagnosis, Triage, **Networks**
- Reperfusionsstrategy
  Maximal tolerable Delays
- Adjuvant Pharmacotherapy by PPCI
  P2Y12 Inhibitors, GpIIb/IIIa Inhibitors, Bivalirudin
- Cardiac arrest
  therapeutic Hypothermia, early invasive angio

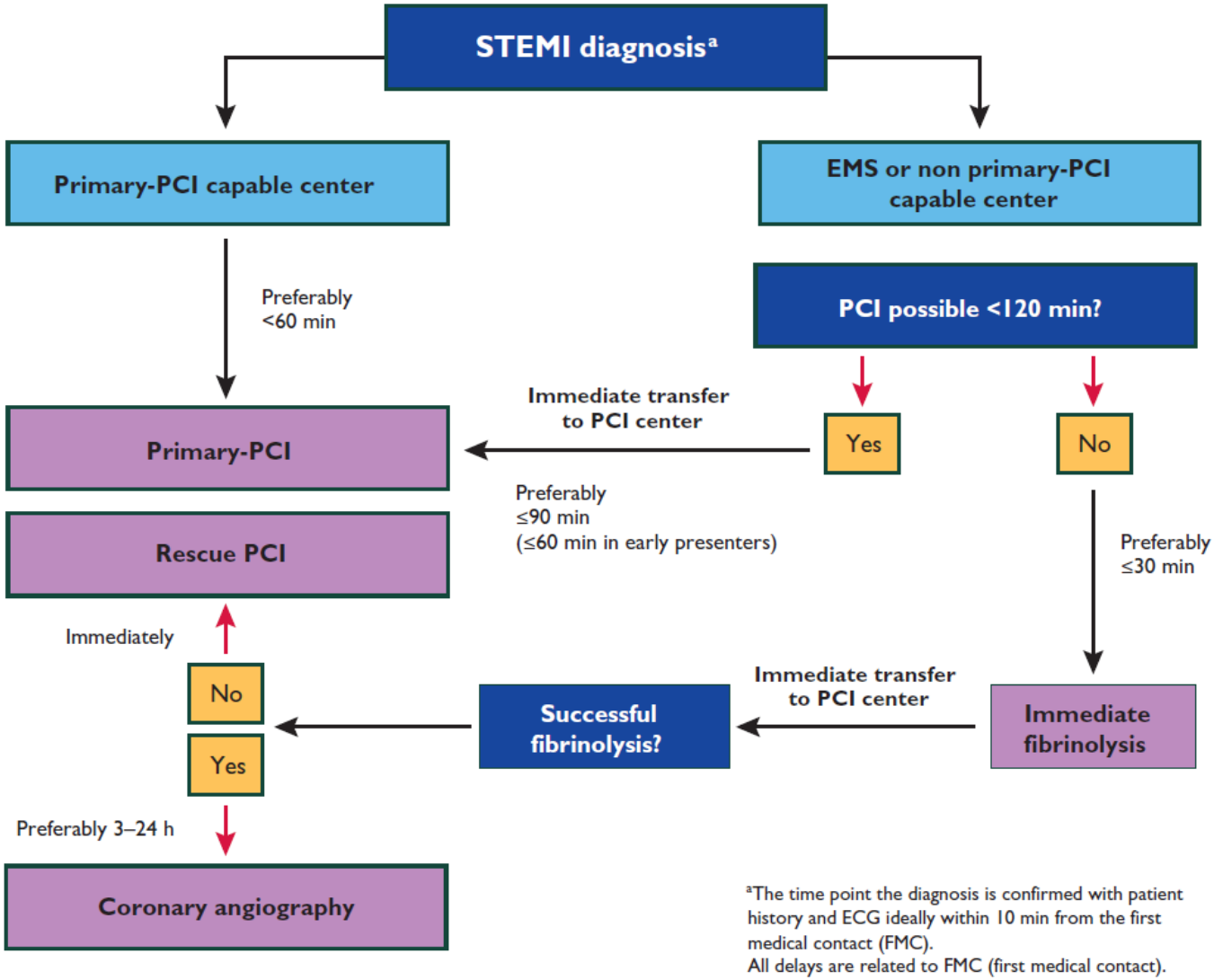
Prehospital Logistic by STEMI

Ambulance teams must be trained and equipped to identify STEMI (with use of ECG recorders and telemetry as necessary) and administer initial therapy, including thrombolysis where applicable.	I	B
The prehospital management of STEMI patients must be 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
Primary PCI-capable centres must deliver a 24/7 service and be able to start primary PCI as soon as possible but always within 60 min from the initial call.	I	B
All hospitals and EMSs participating in the care of patients with STEMI must record and monitor delay times and work to achieve and maintain the following quality targets: • first medical contact to first ECG ≤10 min; • first medical contact to reperfusion therapy; • for fibrinolysis ≤30 min; • for primary PCI ≤90 min (≤60 min if the patient presents within 120 min of symptom onset or directly to a PCI-capable hospital).	I	B
All EMSs, emergency departments, and coronary care units must have a written updated STEMI management protocol, preferably shared within geographic networks.	I	C
Patients presenting to a non-PCI-capable hospital and awaiting transportation for primary or rescue PCI must be attended in an appropriately monitored area.	I	C
Patients transferred to a PCI-capable centre for primary PCI should bypass the emergency department and be transferred directly to the catheterization laboratory.	IIa	B

G Steg et al. EHJ 2012 33, 269-2619

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215

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

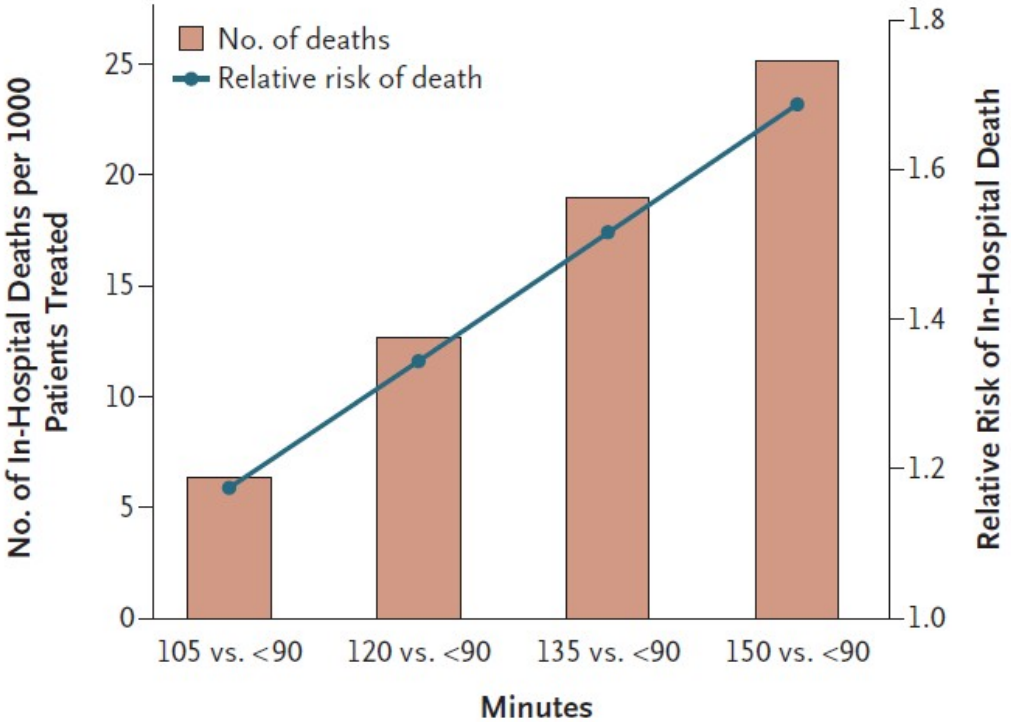


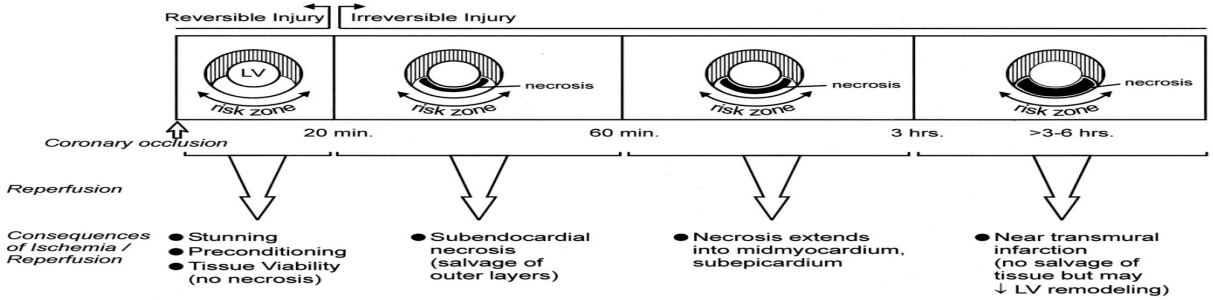
[a]The time point the diagnosis is confirmed with patient history and ECG ideally within 10 min from the first medical contact (FMC).
All delays are related to FMC (first medical contact).

Cath = catheterization laboratory; EMS = emergency medical system; FMC = first medical contact; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

Steg G. et al, EHJ 2012

Time to treatment in pPCI





Nallamothu B et al, NEJM 2007

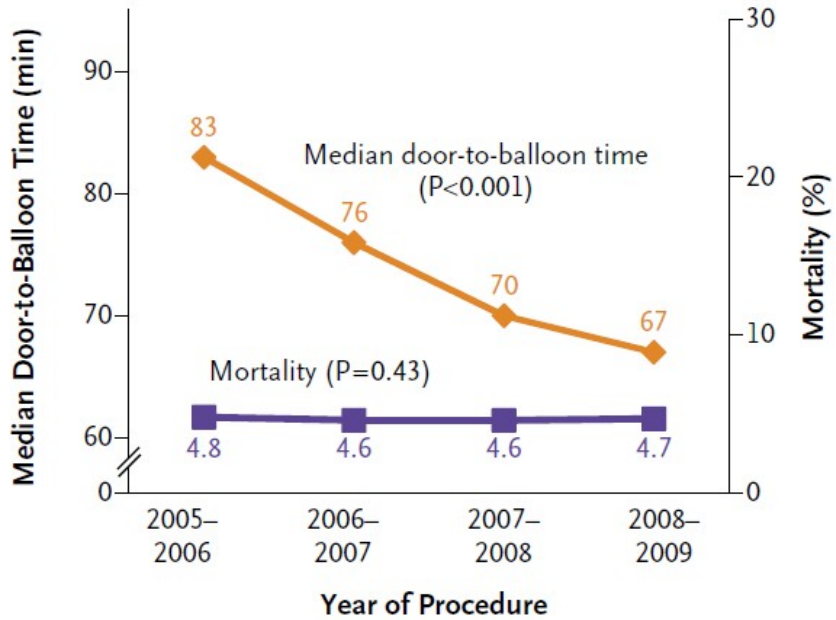
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 SEPTEMBER 5, 2013 VOL. 369 NO. 10

Door-to-Balloon Time and Mortality among Patients Undergoing Primary PCI

Daniel S. Menees, M.D., Eric D. Peterson, M.D., Yongfei Wang, M.S., Jeptha P. Curtis, M.D., John C. Messenger, M.D., John S. Rumsfeld, M.D., Ph.D., and Hitinder S. Gurm, M.B., B.S.

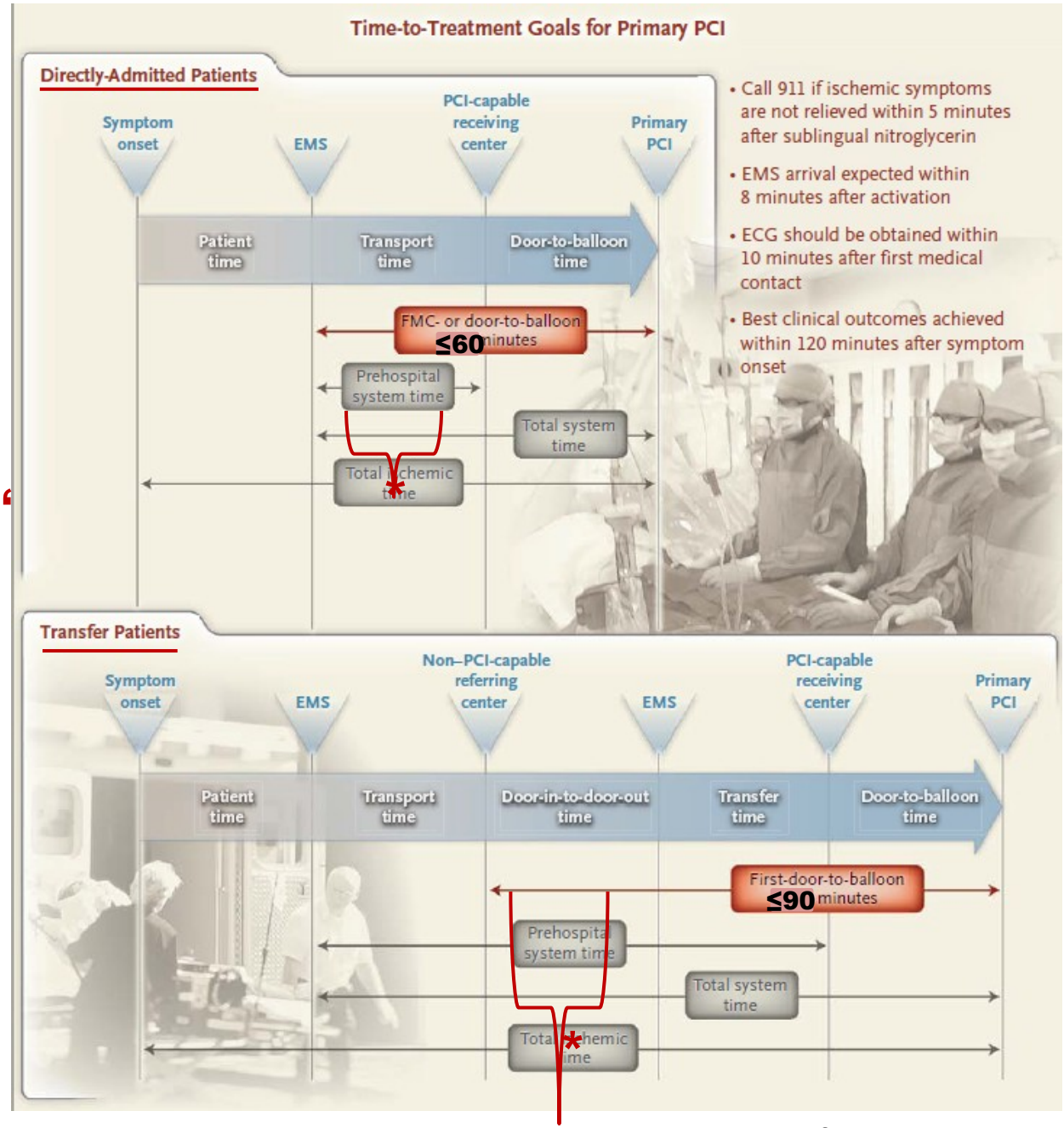
A Overall (N=96,739)



No. of Patients				
All patients	19,964	24,101	25,728	27,245
Deaths	938	1,108	1,190	1,268

Menees D. et al, NEJM 2013

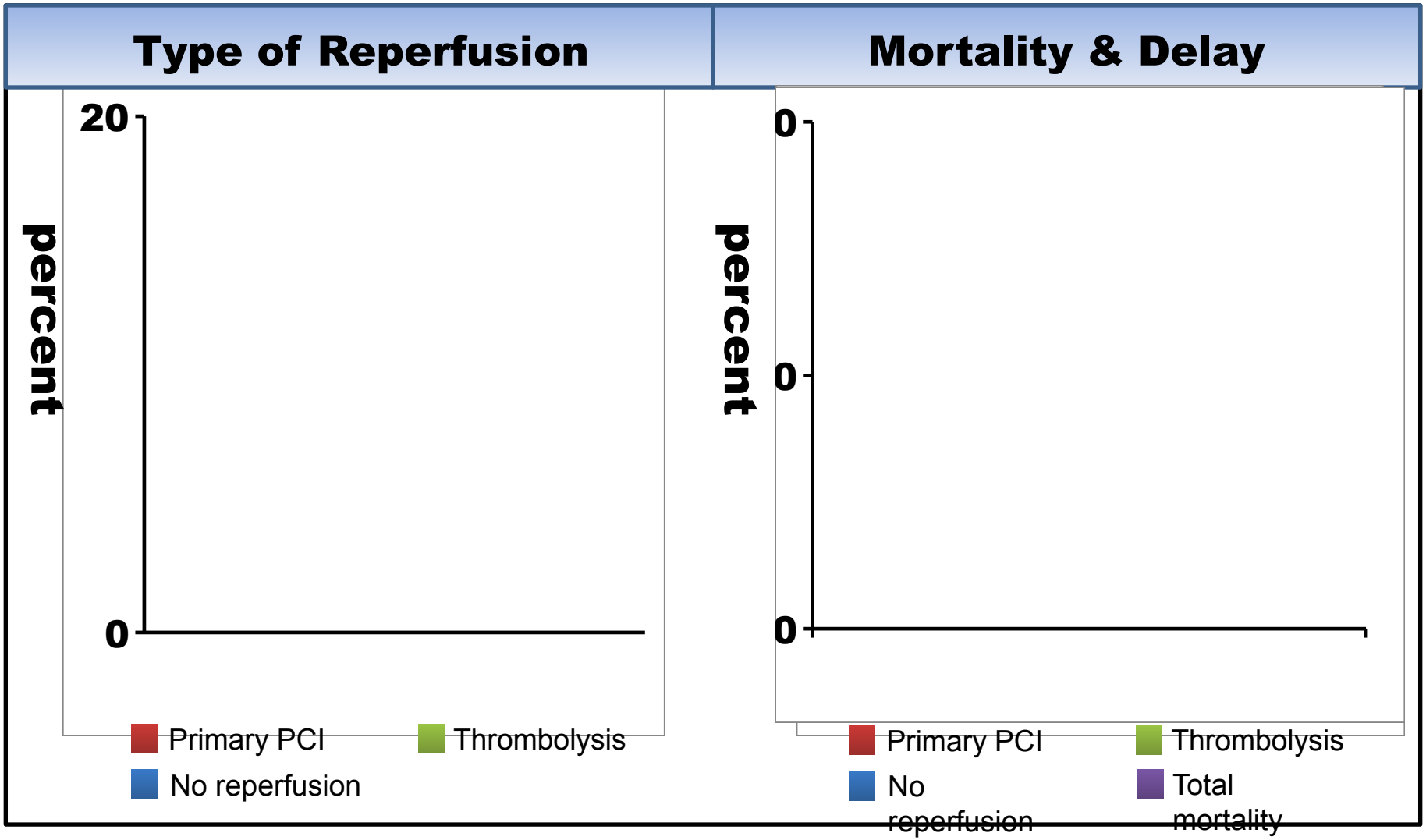
* „Network-Time“



adapted from: Bates E. et al, NEJM 2013

Viennese STEMI Network

Implementation of guidelines reduces Mortality



Kalla et al. Circulation 2006

Prehospitale Diagnosis and direct transfer for pPCI

Sorensen JT et al. EHJ 2011

Urban and rural implementation of prehospital diagnosis and direct referral for pPCI

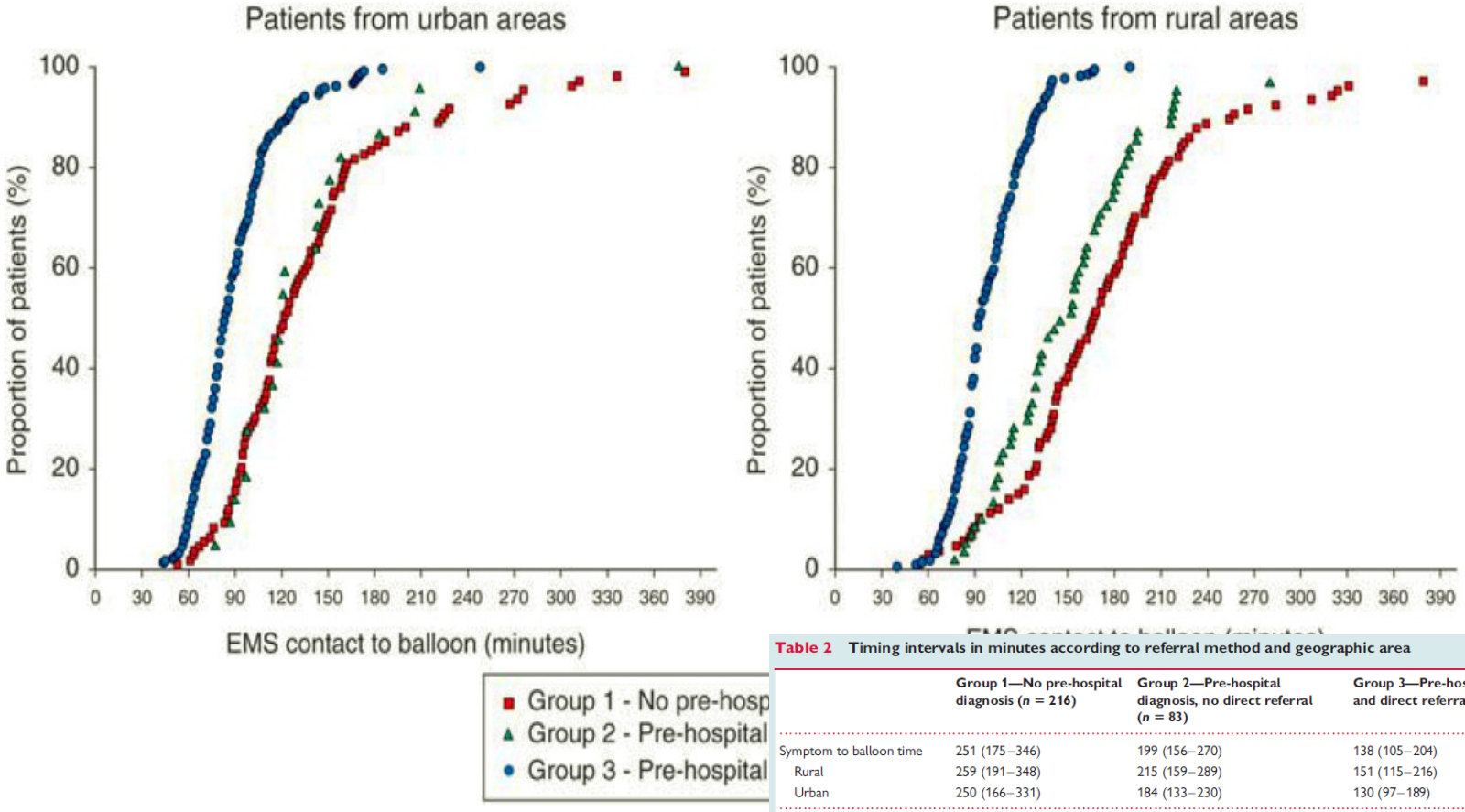
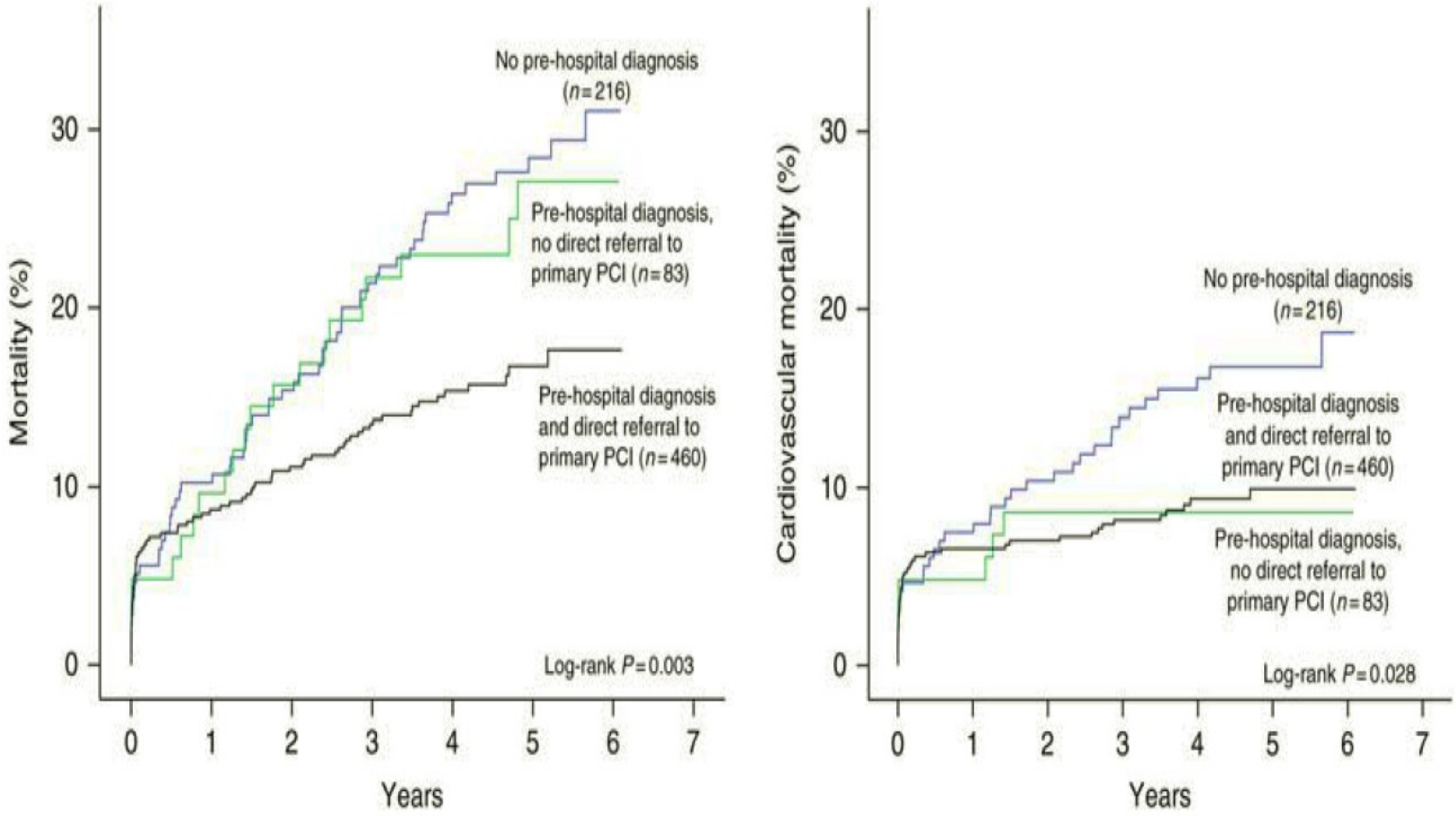


Table 2 Timing intervals in minutes according to referral method and geographic area

	Group 1—No pre-hospital diagnosis (n = 216)	Group 2—Pre-hospital diagnosis, no direct referral (n = 83)	Group 3—Pre-hospital diagnosis and direct referral (n = 460)	P-value
Symptom to balloon time	251 (175–346)	199 (156–270)	138 (105–204)	<0.001
Rural	259 (191–348)	215 (159–289)	151 (115–216)	
Urban	250 (166–331)	184 (133–230)	130 (97–189)	
EMS contact to balloon time	144 (112–186)	141 (109–179)	90 (77–107)	<0.001
Rural	167 (132–203)	152 (114–181)	93 (84–115)	
Urban	122 (97–156)	121 (98–153)	84 (72–102)	
Door-to-balloon time	30 (24–44)	31 (25–47)	34 (25–47)	0.02
Rural	29 (24–39)	29 (24–40)	32 (25–44)	
Urban	30 (24–47)	48 (29–89)	35 (26–51)	
EMS contact to balloon time ≤120 min, n (%)[a]	68 (32)	27 (33)	395 (86)	<0.001
Rural, n (%)	16 (15)	17 (28)	183 (83)	
Urban, n (%)	52 (48)	10 (46)	212 (89)	

Sorensen JT et al. EHJ 2011

Urban and rural implementation of prehospital diagnosis and direct referral for pPCI

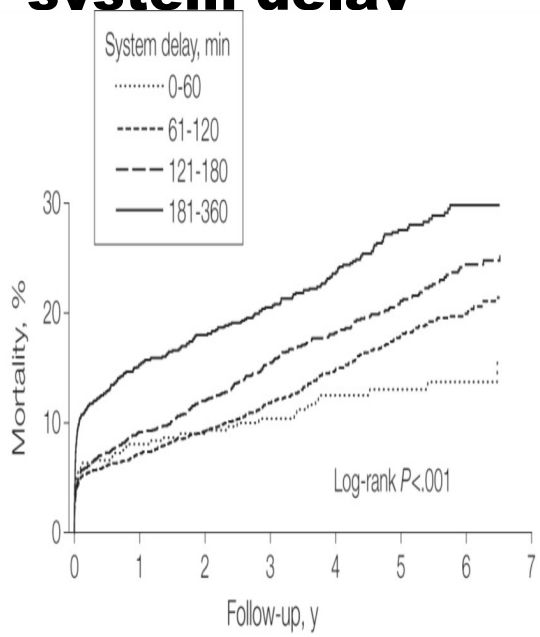


Sorensen JT et al. EHJ 2011

System delay and mortality

n= 6209 STEMIs treated with PPCI

Mortality estimates and system delay



No. at risk

System delay, min							
0-60	347	311	278	230	192	138	87
61-120	2643	2339	1906	1420	1006	667	375
121-180	2092	1836	1503	1183	842	533	278
181-360	1127	923	765	647	491	332	172

Co-variates of long-term mortality

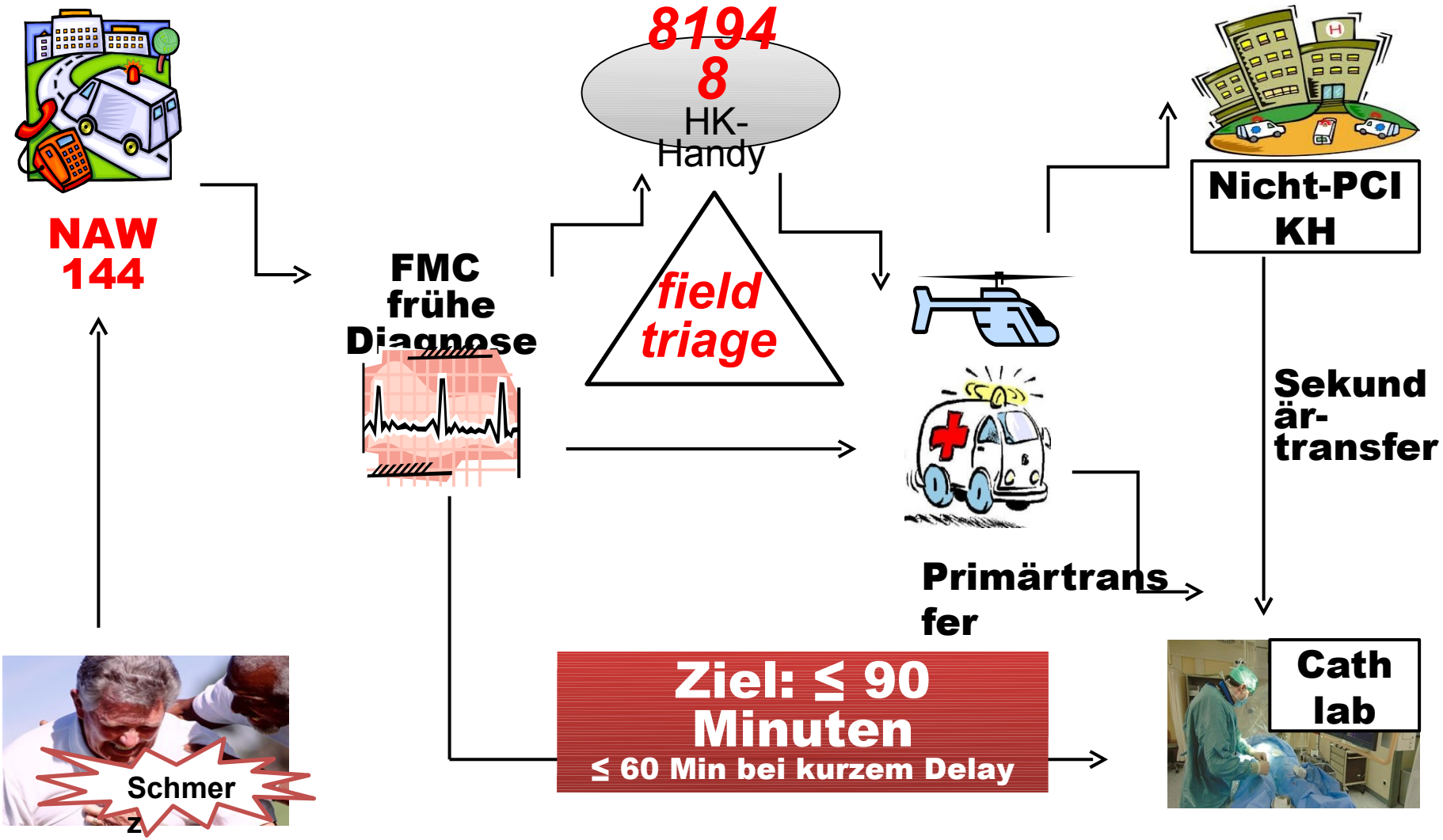
Table 2. Crude Hazard Ratios of Covariates Associated With Long-term Mortality in Univariable Cox Regression Analysis (N = 6209).

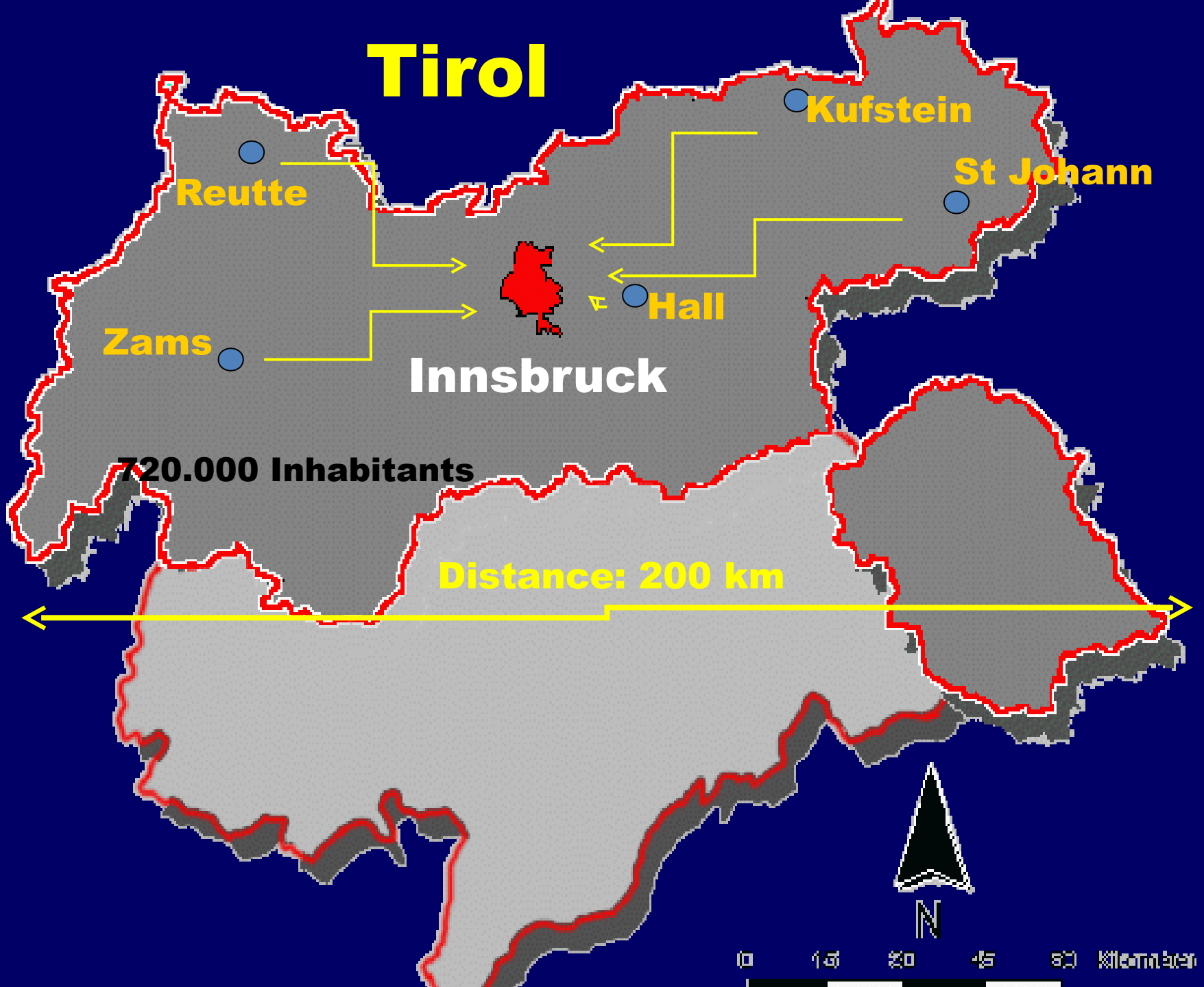
Characteristics	Valid Cases	Deaths[a]	HR (95% CI)	Wald Test	*P* Value[b]
Demographics					
Age, per 1-year increase	6209		1.074 (1.069-1.080)	666	<.001
Women	6209	364	1.46 (1.29-1.66)	35	<.001
Comorbid conditions					
Treated hypertension	4574	280	1.45 (1.25-1.69)	25	<.001
Diabetes	4725	146	2.29 (1.91-2.73)	82	<.001
Previous myocardial infarction	4510	122	1.55 (1.28-1.89)	20	<.001
Previous PCI	4506	53	1.19 (0.90-1.58)	1.5	.22
Previous congestive heart failure	5793	102	4.22 (3.43-5.17)	189	<.001
Active or previous smoker	4378	505	0.78 (0.66-0.93)	7.6	.006
Delays and transportation					
Delay, per 1-h increase[c]					
Treatment	6209		1.054 (1.029-1.080)	19	<.001
Patient	5493		1.042 (1.014-1.071)	8.8	.003
System	6209		1.22 (1.15-1.29)	51	<.001
Prehospital system	4652		1.19 (1.11-1.27)	26	<.001
Door-to-balloon	4626		1.13 (1.048-1.22)	10	.002
Transportation distance, per 1-km increase	6209		1.00 (0.999-1.002)	0.45	.50
75-84	1092	157	0.53 (0.43-0.65)	35	<.001
≥85	798	79	0.37 (0.29-0.48)	55	<.001
Killip class	6204	1073			
I	5629	811	1 [Reference]	545	<.001
II	297	97	2.63 (2.13-3.24)	81	<.001
III	140	76	5.09 (4.02-6.44)	184	<.001
IV	138	89	8.65 (6.94-10.8)	370	<.001
Anterior infarct location	5633	467	1.35 (1.19-1.54)	21	<.001
Culprit vessel LM/LAD	6009	520	1.28 (1.14-1.45)	16	<.001
Multivessel disease	5715	640	2.19 (1.92-2.49)	138	<.001

Terkelsen et al, JAMA 2010

Reperfusionsstrategie

Tiroler STEMI Netzwerk

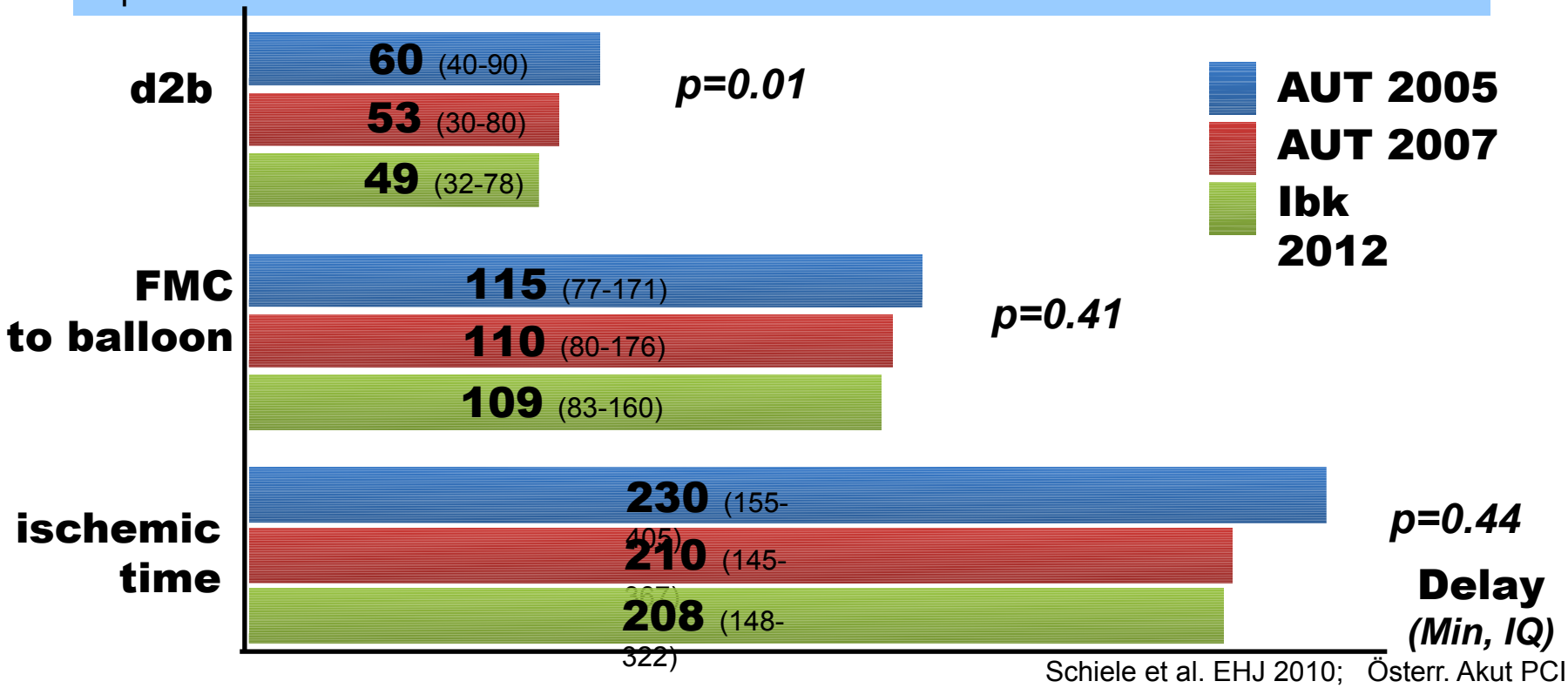



Tirol
Kufstein
St Johann
Reutte
Hall
Zams
Innsbruck
720.000 Inhabitants
Distance: 200 km
N
0
15
30
45
60
Kilometer

Huber K et al. Journal für Kardiologie 2007; 14 (5-6): 125-130 ©

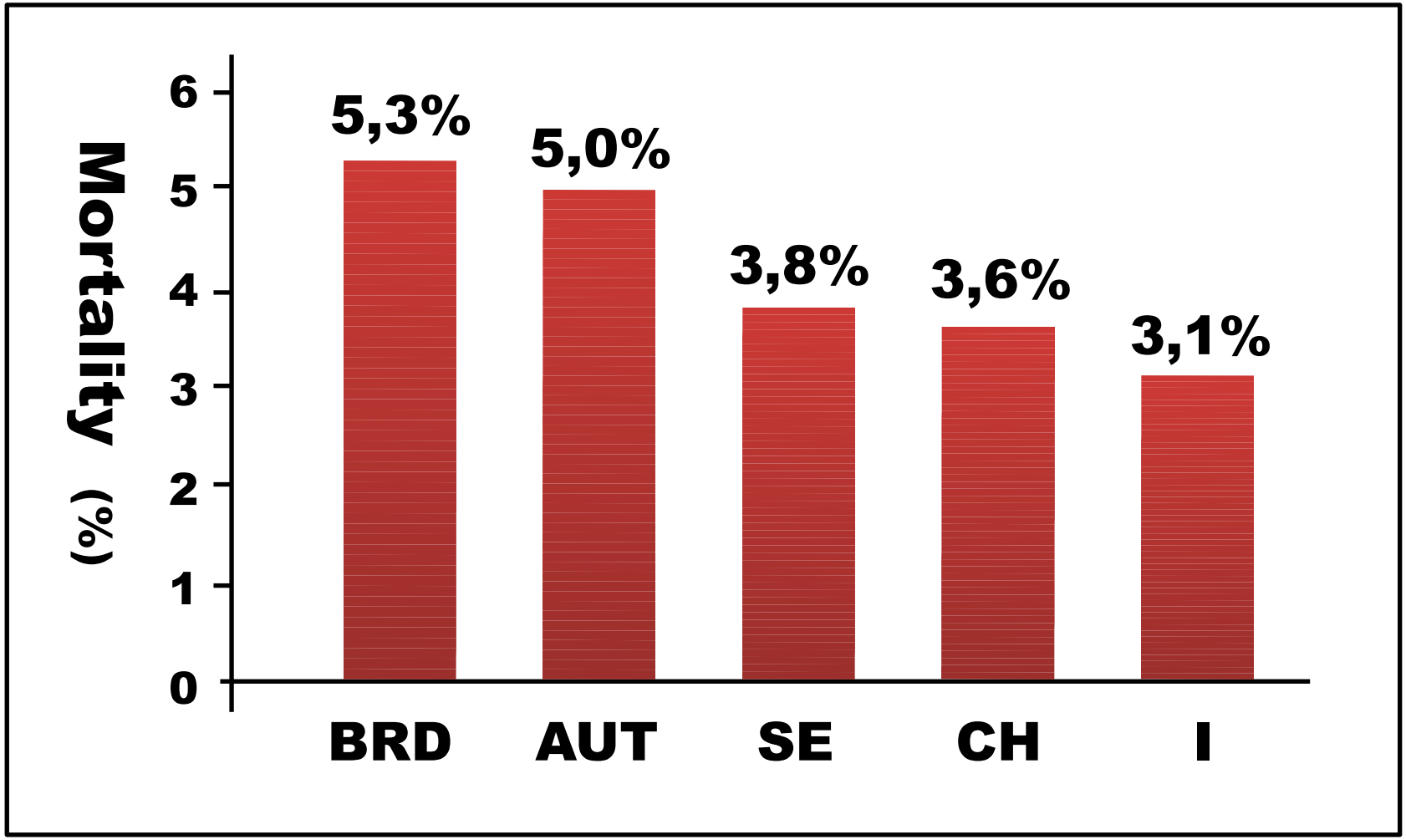
Delays in Primary PCI / FL
EHS-ACS III vs. Austria

Variable	Period 1	Period 2	Period 3	Period 4	Trend
Door to artery	60 (27-119)	53 (25-110)	50 (27-95)	45 (26-84)	<0.001
FL <30min	61.7%	65.0%	67.4%	71.1%	0.01
pPCI <90min	72.3%	72.3%	76.2%	80.4%	<0.001
Timely reperfused	68.8%	70.4%	74.1%	78.1%	<0.001



Schiele et al. EHJ 2010; Österr. Akut PCI Register

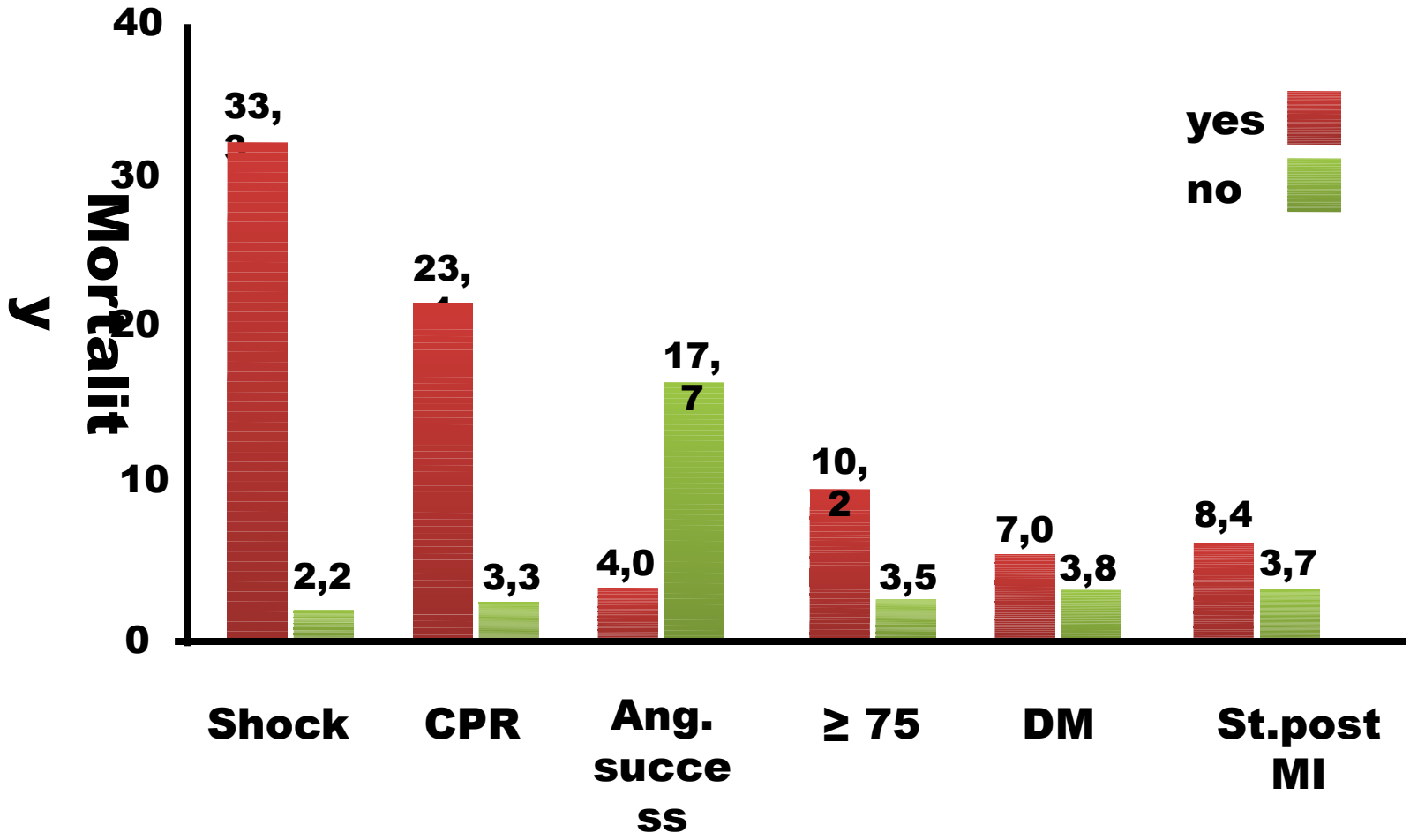
STEMI-Mortality by pPCI



Widimsky P et al. Eur Heart J. 2010 Apr;31(8):943-57

Benchmark 2011

STEMI-*Mortality by pPCI - Subgroups*



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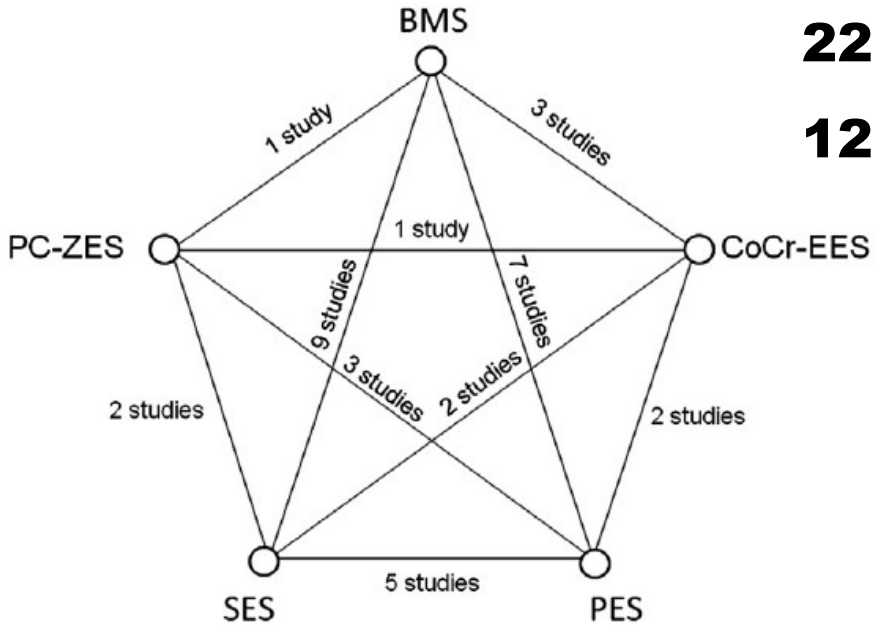
CLINICAL RESEARCH **Interventional Cardiology**

Clinical Outcomes With Drug-Eluting and Bare-Metal Stents in Patients With ST-Segment Elevation Myocardial Infarction

Evidence From a Comprehensive Network Meta-Analysis

Tullio Palmerini, MD,* Giuseppe Biondi-Zoccai, MD,† Diego Della Riva, MD,* Andrea Mariani, MD,*



22 trials

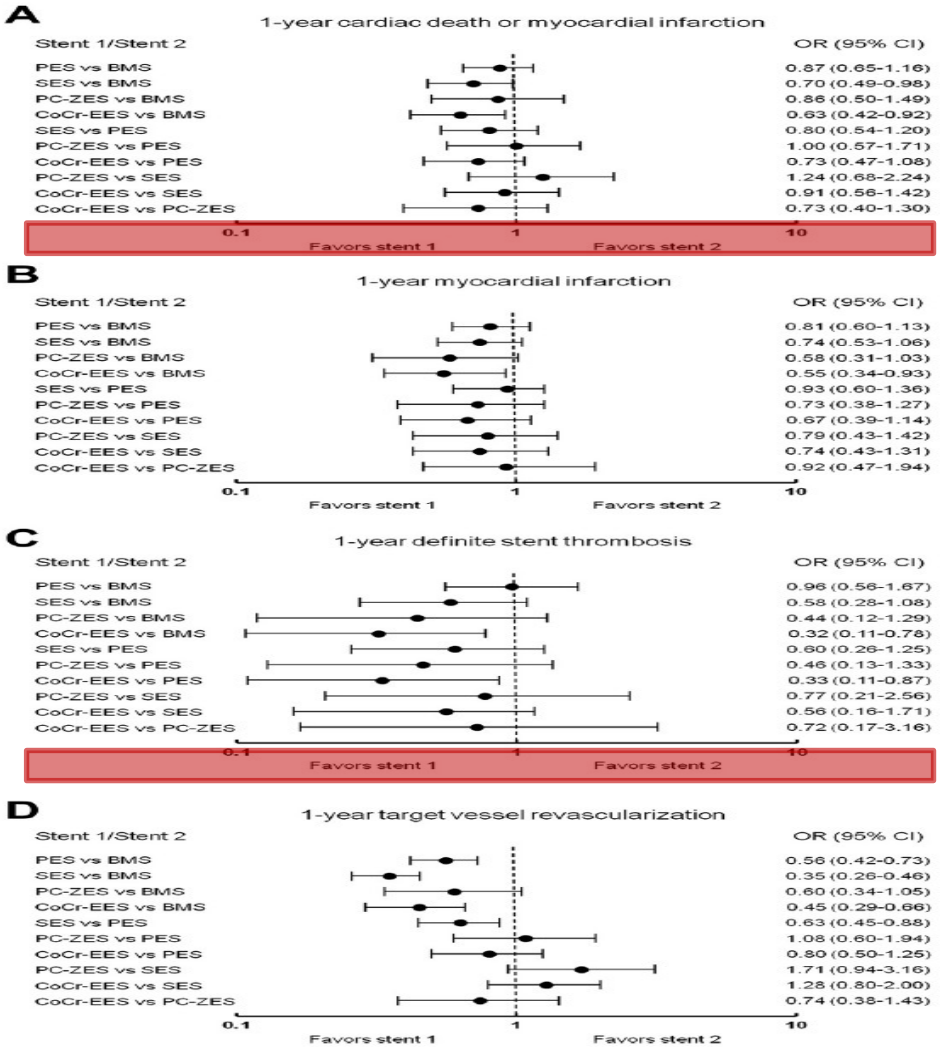
12,453 randomized patients

Palmerini T. et al. JACC

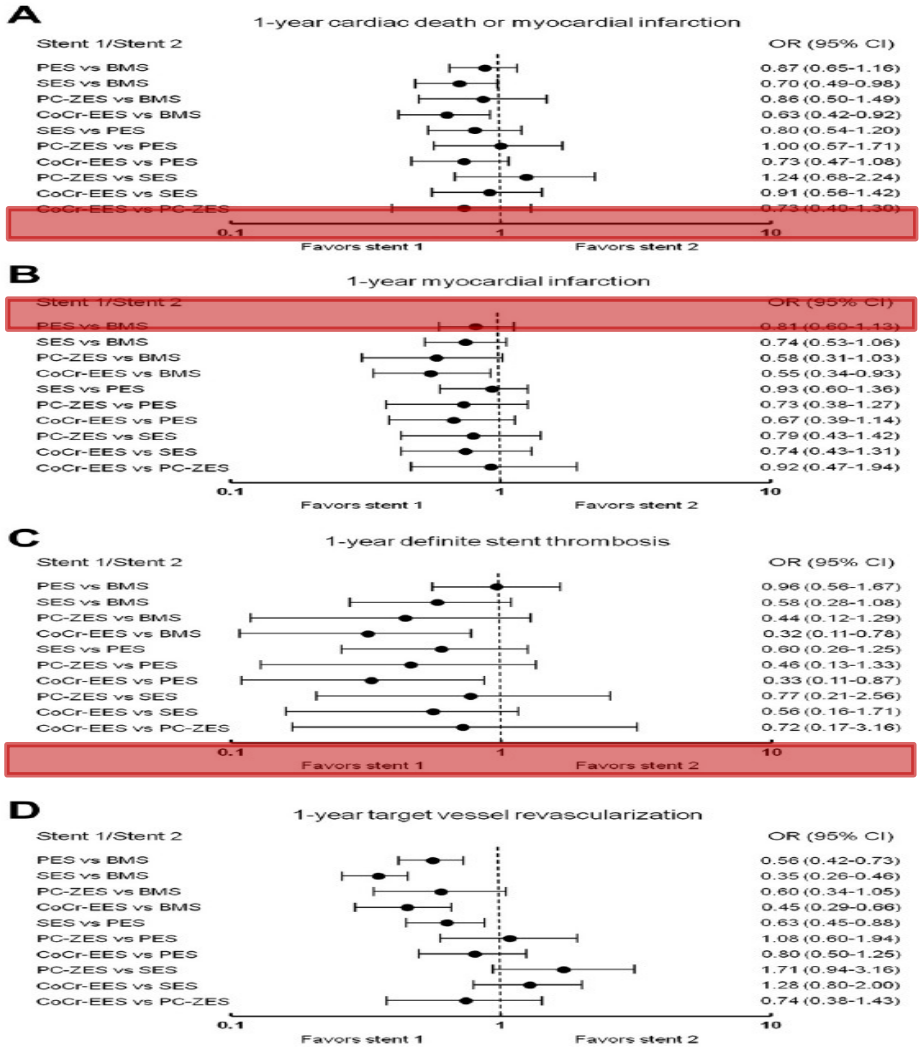
Table 2 Differences in Clinical Outcomes Among Different Stent Types at 1-Year and Long-Term Follow-Up

Stent Type	1-yr Death/MI OR (95% CI)	Long-Term Death/MI HR (95% CI)	1-yr Cardiac Death/MI OR (95% CI)	Long-Term Cardiac Death/MI HR (95% CI)
PES vs. BMS	0.77 (0.60–1.00)	0.93 (0.77–1.16)	0.87 (0.65–1.16)	0.98 (0.79–1.20)
SES vs. BMS	0.88 (0.69–1.10)	0.86 (0.71–1.05)	**0.70 (0.49–0.98)**	0.78 (0.61–1.05)
PC-ZES vs. BMS	0.91 (0.58–1.42)	0.96 (0.62–1.40)	0.86 (0.50–1.49)	0.93 (0.59–1.45)
CoCr-EES vs. BMS	**0.65 (0.46–0.90)**	**0.69 (0.53–0.91)**	**0.63 (0.42–0.92)**	**0.70 (0.50–0.96)**
SES vs. PES	1.14 (0.84–1.54)	0.91 (0.73–1.17)	0.80 (0.54–1.20)	0.80 (0.60–1.08)
PC-ZES vs. PES	1.20 (0.73–1.89)	1.03 (0.66–1.53)	1.00 (0.57–1.71)	0.95 (0.60–1.50)
CoCR-EES vs. PES	0.85 (0.57–1.22)	**0.73 (0.54–0.98)**	0.73 (0.47–1.08)	0.72 (0.51–1.00)
PC-ZES vs. SES	1.04 (0.66–1.63)	1.11 (0.71–1.75)	1.24 (0.68–2.24)	1.19 (0.71–1.99)
CoCr-EES vs. SES	0.74 (0.51–1.05)	0.80 (0.59–1.12)	0.91 (0.56–1.42)	0.90 (0.60–1.31)
CoCr-EES vs. PC-ZES	0.71 (0.42–1.16)	0.72 (0.47–1.14)	0.73 (0.40–1.30)	0.75 (0.46–1.25)
	1-yr MI OR (95% CI)	**Long-Term MI HR (95% CI)**	**1-yr TVR OR (95% CI)**	**Long-Term TVR HR (95% CI)**
PES vs. BMS	0.81 (0.60–1.13)	1.03 (0.78–1.40)	**0.56 (0.42–0.73)**	**0.65 (0.48–0.81)**
SES vs. BMS	0.74 (0.53–1.06)	0.91 (0.65–1.23)	**0.35 (0.26–0.46)**	**0.47 (0.35–0.60)**
PC-ZES vs. BMS	0.58 (0.31–1.03)	0.68 (0.36–1.24)	0.60 (0.34–1.05)	0.67 (0.40–1.16)
CoCr-EES vs. BMS	**0.55 (0.34–0.93)**	0.66 (0.44–1.05)	**0.45 (0.29–0.66)**	**0.43 (0.28–0.62)**
SES vs. PES	0.93 (0.60–1.36)	0.87 (0.60–1.25)	**0.63 (0.45–0.88)**	0.74 (0.54–1.01)
PC-ZES vs. PES	0.73 (0.38–1.27)	0.67 (0.35–1.19)	1.08 (0.60–1.94)	1.05 (0.61–1.86)
CoCR-EES vs. PES	0.67 (0.39–1.14)	0.64 (0.41–1.01)	0.80 (0.50–1.25)	0.67 (0.44–1.02)
PC-ZES vs. SES	0.79 (0.43–1.42)	0.75 (0.40–1.41)	1.71 (0.94–3.16)	1.43 (0.78–2.57)
CoCr-EES vs. SES	0.74 (0.43–1.31)	0.72 (0.47–1.24)	1.28 (0.80–2.00)	0.91 (0.59–1.39)
CoCr-EES vs. PC-ZES	0.92 (0.47–1.94)	0.99 (0.48–1.96)	0.74 (0.38–1.43)	0.64 (0.33–1.18)

Palmerini T. et al. JACC



Palmerini T. et al. JACC



Palmerini T. et al. JACC

Everolimus-eluting stent *versus* BMS in STEMI

EXAMINATION Trial

	EES group (n=751)	BMS group (n=747)	Difference (95%CI)*	p value†
Up to 360 days				
Primary endpoint (patient oriented)††	89 (11·9%)	106 (14·2%)	−2·34 (−5·75 to 1·07)	0·19
Device-oriented secondary endpoint‡‡	44 (5·9%)	63 (8·4%)	−2·57 (−5·18 to 0·03)	0·05
Death*	26 (3·5%)	26 (3·5%)	−0·02 (−1·87 to 1·84)	1·00
Cardiac	24 (3·2%)	21 (2·83%)	0·38 (−1·34 to 2·11)	0·76
Vascular	1 (0·1%)	3 (0·4%)	−0·27 (−0·79 to 0·25)‖	0·37
Non-cardiovascular	1 (0·1%)	2 (0·3%)	−0·13 (−0·59 to 0·32)‖	0·62
Myocardial infarction§	10 (1·3%)	15 (2·0%)	−0·68 (−1·97 to 0·62)	0·32
Target-vessel related	8 (1·1%)	15 (2·0%)	−0·94 (−2·19 to 0·30)	0·14
Non-target-vessel related	2 (0·3%)	0	0·27 (−0·10 to 0·63)‖	0·49
Revascularisation	60 (8·0%)	79 (10·6%)	−2·59 (−5·52 to 0·35)	0·09
Target lesion	16 (2·1%)	37 (5·0%)	−2·82 (−4·69 to −0·96)	0·0032
Target vessel	28 (3·7%)	51 (6·8%)	−3·10 (−5·36 to −0·84)	0·0077
Non-target vessel	40 (5·3%)	41 (5·5%)	−0·16 (−2·45 to 2·13)	0·90
Definite stent thrombosis¶	4 (0·5%)	14 (1·9%)	−1·34 (−2·44 to −0·24)	0·0183
Probable stent thrombosis¶	3 (0·4%)	5 (0·7%)	−0·27 (−1·01 to 0·47)‖	0·50
Definite or probable stent thrombosis¶	7 (0·9%)	19 (2·5%)	−1·61 (−2·93 to −0·29)	0·0197
Bleeding	29 (4%)	39 (5%)	−1·4 (−3·47 to 0·75)	0.19
Major	9 (1%)	12 (2%)	−0·4 (−1·60 to 0·78)	0·65
Minor	21 (3%)	30 (4%)	−1·2 (−3·06 to 0·62)	0·21

Sabate M et al, Lancet 2012

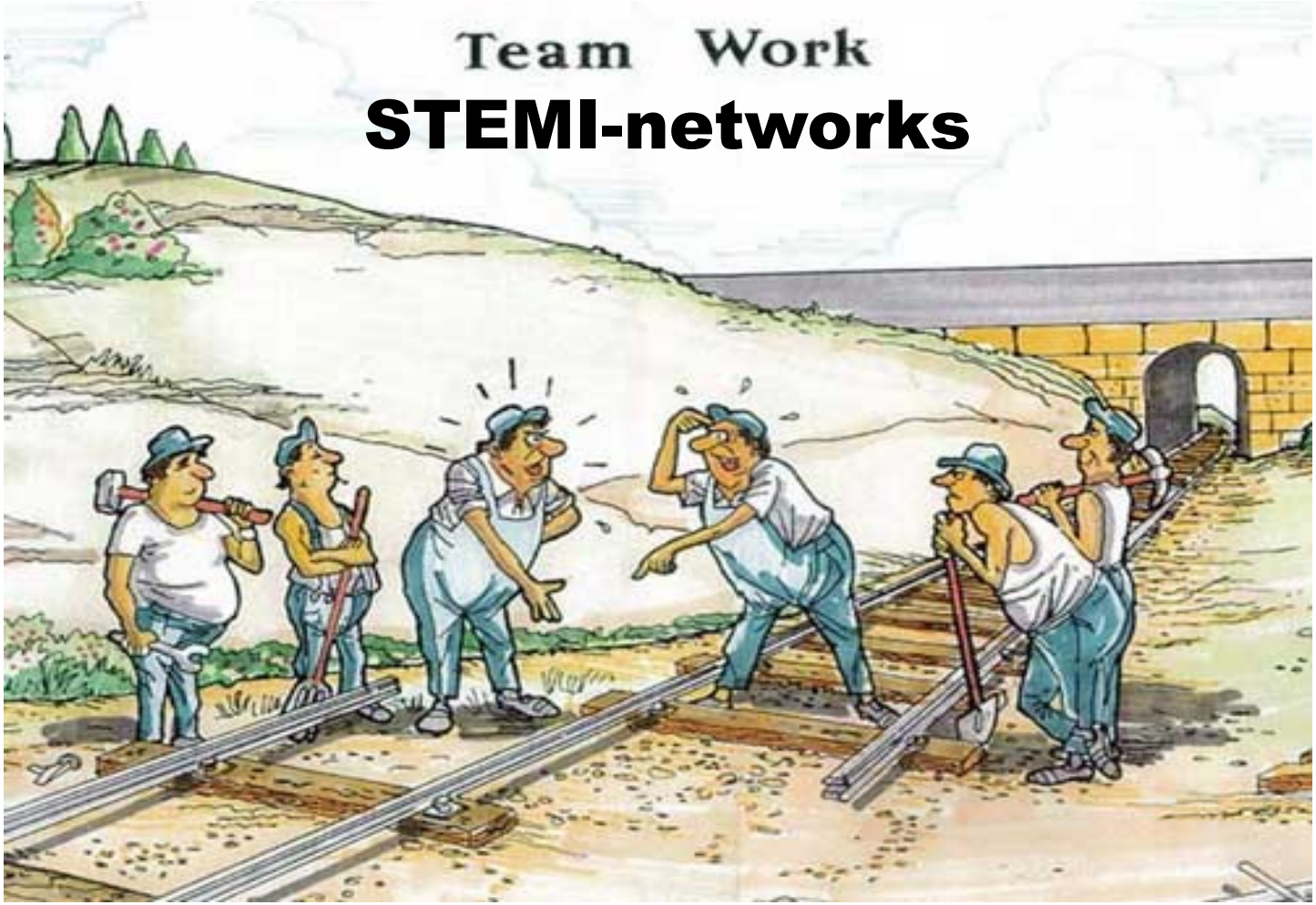
Conclusion

MI-networks are very important and save lives

class I recommendation)

hospital delays have to be minimized!!

place for BMS in STEMI-patients in the year 2013



STEMI-networks

Thank you

Table 3 Time-Related Differences Among Different Stent Types for the Risk of Definite and Definite/Probable Stent Thrombosis

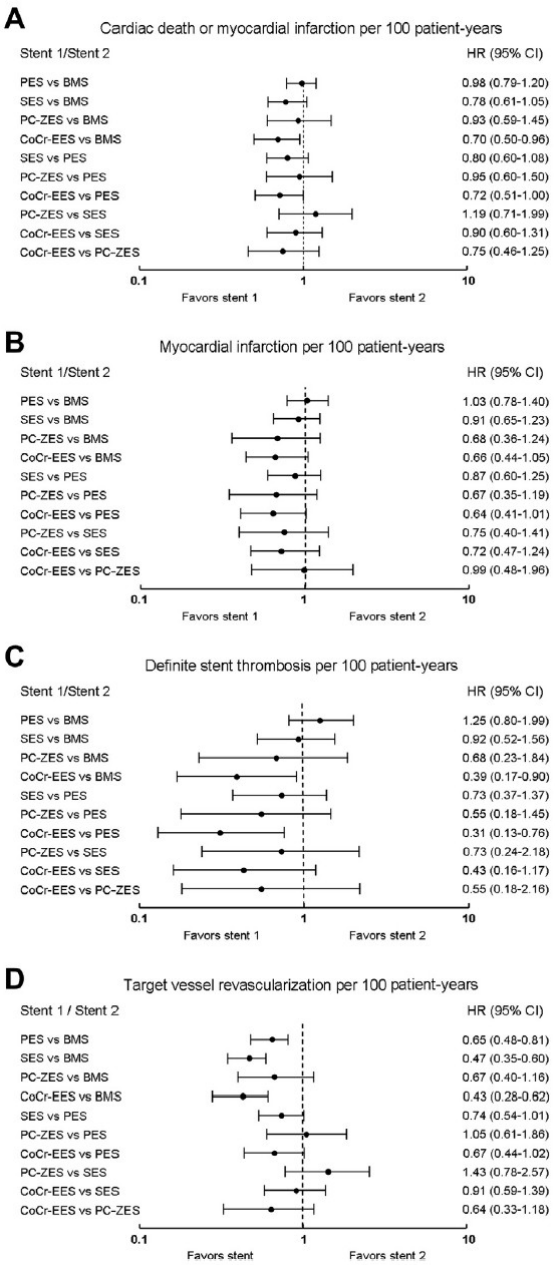
Stent Type	Early Definite ST OR (95% CI)	Late Definite ST OR (95% CI)	1-yr Definite ST OR (95% CI)	Long-Term Definite ST HR (95% CI)
PES vs. BMS	0.82 (0.39–1.62)	1.84 (0.24–357.81)	0.96 (0.56–1.67)	1.25 (0.80–1.99)
SES vs. BMS	0.47 (0.16–1.04)	0.68 (0.00–22.15)	0.58 (0.28–1.08)	0.92 (0.52–1.56)
PC-ZES vs. BMS	0.39 (0.08–1.43)	0.42 (0.00–35.87)	0.44 (0.12–1.29)	0.68 (0.23–1.84)
CoCr-EES vs. BMS	**0.26 (0.07–0.80)**	0.57 (0.01–38.90)	**0.32 (0.11–0.78)**	**0.39 (0.17–0.90)**
SES vs. PES	0.57 (0.19–1.39)	0.37 (0.00–7.94)	0.60 (0.26–1.25)	0.73 (0.37–1.37)
PC-ZES vs. PES	0.48 (0.10–1.70)	0.21 (0.00–6.14)	0.46 (0.13–1.33)	0.55 (0.18–1.45)
CoCr-EES vs. PES	0.32 (0.08–1.08)	0.29 (0.00–8.48)	**0.33 (0.11–0.87)**	**0.31 (0.13–0.76)**
PC-ZES vs. SES	0.84 (0.18–3.59)	NA	0.77 (0.21–2.56)	0.73 (0.24–2.18)
CoCr-EES vs. SES	0.56 (0.13–2.48)	NA	0.56 (0.16–1.71)	0.43 (0.16–1.17)
CoCr-EES vs. PC-ZES	0.67 (0.11–3.99)	NA	0.72 (0.17–3.16)	0.55 (0.18–2.16)
	Early Definite/Probable ST OR (95% CI)	**Late Definite/Probable ST OR (95% CI)**	**1-yr Definite/Probable ST OR (95% CI)**	**Long-Term Definite/Probable ST HR (95% CI)**
PES vs. BMS	0.75 (0.42–1.28)	1.23 (0.28–9.68)	0.82 (0.53–1.22)	1.25 (0.81–1.92)
SES vs. BMS	0.60 (0.28–1.20)	0.61 (0.04–4.00)	0.73 (0.41–1.22)	0.93 (0.56–1.49)
PC-ZES vs. BMS	0.45 (0.15–1.12)	0.26 (0.00–4.95)	0.47 (0.19–1.04)	0.68 (0.21–1.80)
CoCr-EES vs. BMS	**0.28 (0.12–0.61)**	0.73 (0.11–6.46)	**0.36 (0.18–0.66)**	**0.41 (0.16–0.88)**
SES vs. PES	0.80 (0.36–1.68)	0.49 (0.01–4.33)	0.90 (0.47–1.62)	0.73 (0.39–1.33)
PC-ZES vs. PES	0.59 (0.21–1.48)	0.21 (0.00–3.33)	0.57 (0.24–1.28)	0.53 (0.17–1.43)
CoCr-EES vs. PES	**0.38 (0.15–0.83)**	0.59 (0.08–3.51)	**0.44 (0.22–0.83)**	**0.32 (0.12–0.71)**
PC-ZES vs. SES	0.74 (0.25–2.06)	0.43 (0.01–21.37)	0.64 (0.25–1.52)	0.75 (0.22–2.11)
CoCr-EES vs. SES	0.47 (0.16–1.28)	1.21 (0.09–41.89)	0.49 (0.22–1.10)	0.44 (0.16–1.10)
CoCr-EES vs. PC-ZES	0.62 (0.20–2.17)	NA	0.77 (0.29–2.08)	0.59 (0.17–2.32)

Palmerini T. et al. JACC

Table 4 Event Rates per 100 Patient Years and Probability for Each Stent to Be Best at 1 Year and at the Latest Follow-Up Available

Event	Stent Type				
	BMS	PES	SES	PC-ZES	CoCr-EES
Death					
Rate per 100 patient-yrs (95% CI)	3.01 (1.75–5.22)	2.7 (1.49–4.90)	2.50 (1.37–4.57)	3.68 (1.76–8.04)	2.13 (1.11–4.07)
Best at 1 yr	0%	5%	28%	2%	65%
Best at latest follow-up	0%	6%	18%	2%	74%
Cardiac death					
Rate per 100 patient*-yrs (95% CI)	2.03 (1.19–3.47)	1.78 (0.96–3.29)	1.54 (0.83–2.90)	2.81 (1.22–6.32)	1.46 (0.73–2.90)
Best at 1 yr	0%	8%	38%	3%	51%
Best at latest follow-up	0%	7%	35%	2%	56%
MI					
Rate per 100 patient-yrs (95% CI)	3.48 (1.18–3.48)	2.07 (1.13–3.80)	1.70 (0.90–3.22)	1.34 (0.60–2.90)	1.26 (0.62–2.47)
Best at 1 yr	0%	1%	6%	37%	56%
Best at latest follow-up	0%	0%	5%	45%	50%
Cardiac death/MI					
Rate per 100 patient*-yrs (95% CI)	3.69 (2.12–6.45)	3.56 (1.96–6.42)	2.71 (1.47–5.00)	3.33 (1.65–6.79)	2.42 (1.27–4.6)
Best at 1 yr	0%	1%	30%	10%	59%
Best at latest follow-up	0%	0%	25%	10%	65%
Definite stent thrombosis					
Rate per 100 patient-yrs (95% CI)	0.91 (0.54–1.54)	1.26 (0.59–2.53)	0.81 (0.34–1.73)	0.64 (0.11–2.57)	0.35 (0.13–1.03)
Best at 1 yr	0%	0%	7%	30%	63%
Best at latest follow-up	0%	0%	3%	18%	79%
Definite/probable stent thrombosis					
Rate per 100 patient-yrs (95% CI)	1.23 (0.70–2.09)	1.34 (0.67–2.64)	1.11 (0.52–2.33)	0.64 (0.18–1.84)	0.52 (0.22–1.19)
Best at 1 yr	0%	0%	1%	29%	69%
Best at latest follow-up	0%	0%	2%	23%	75%
Target vessel revascularization					
Rate per 100 patient-yrs (95% CI)	4.50 (2.60–7.90)	2.90 (1.60–5.30)	2.10 (1.10–3.90)	2.50 (1.00–5.50)	1.90 (0.90–3.70)
Best at 1 yr	0%	1%	82%	3%	14%
Best at latest follow-up	0%	0%	29%	7%	64%

Palmerini T. et al. JACC



Palmerini T. et al. JACC

Adjuvante Plättchenhemmung bei PPCI

ESC STEMI Guidelines 2012

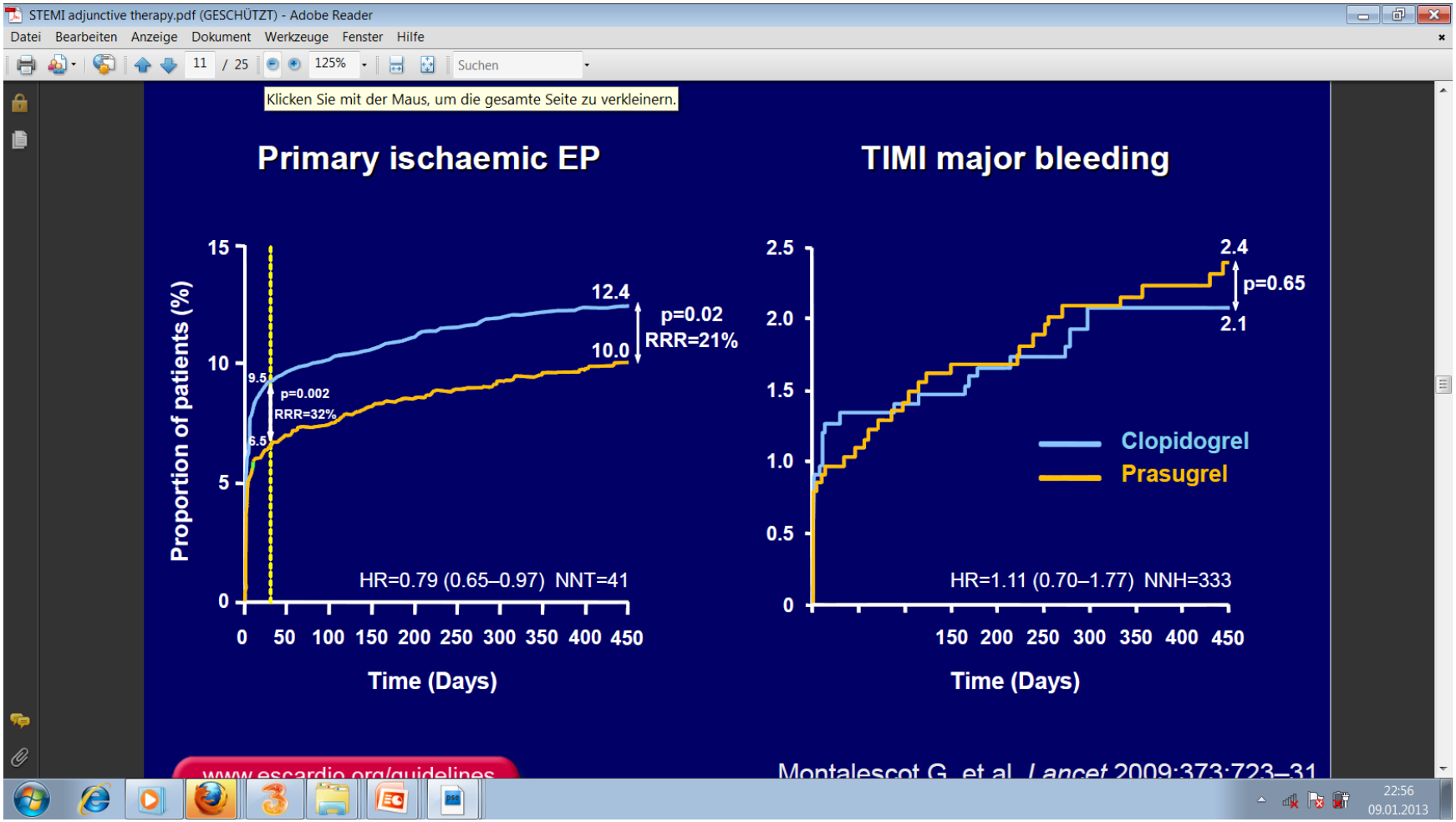
Aspirin oral or i.v. (if unable to swallow) is recommended	I	B
An ADP-receptor blocker is recommended in addition to aspirin. Options are:	I	A
• Prasugrel in clopidogrel-naive patients, if no history of prior stroke/TIA, age <75 years.	I	B
• Ticagrelor.	I	B
• Clopidogrel, preferably when prasugrel or ticagrelor are either not available or contraindicated.	I	C

AHA/ACC Guidelines 2013

Aspirin		
• 162- to 325-mg load before procedure	I	B
• 81- to 325-mg daily maintenance dose (indefinite)*	I	A
• 81 mg daily is the preferred maintenance dose*	IIa	B
$P2Y_{12}$ inhibitors		
Loading doses		
• Clopidogrel: 600 mg as early as possible or at time of PCI	I	B
• Prasugrel: 60 mg as early as possible or at time of PCI	I	B
• Ticagrelor: 180 mg as early as possible or at time of PCI	I	B

TRITON-TIMI 38

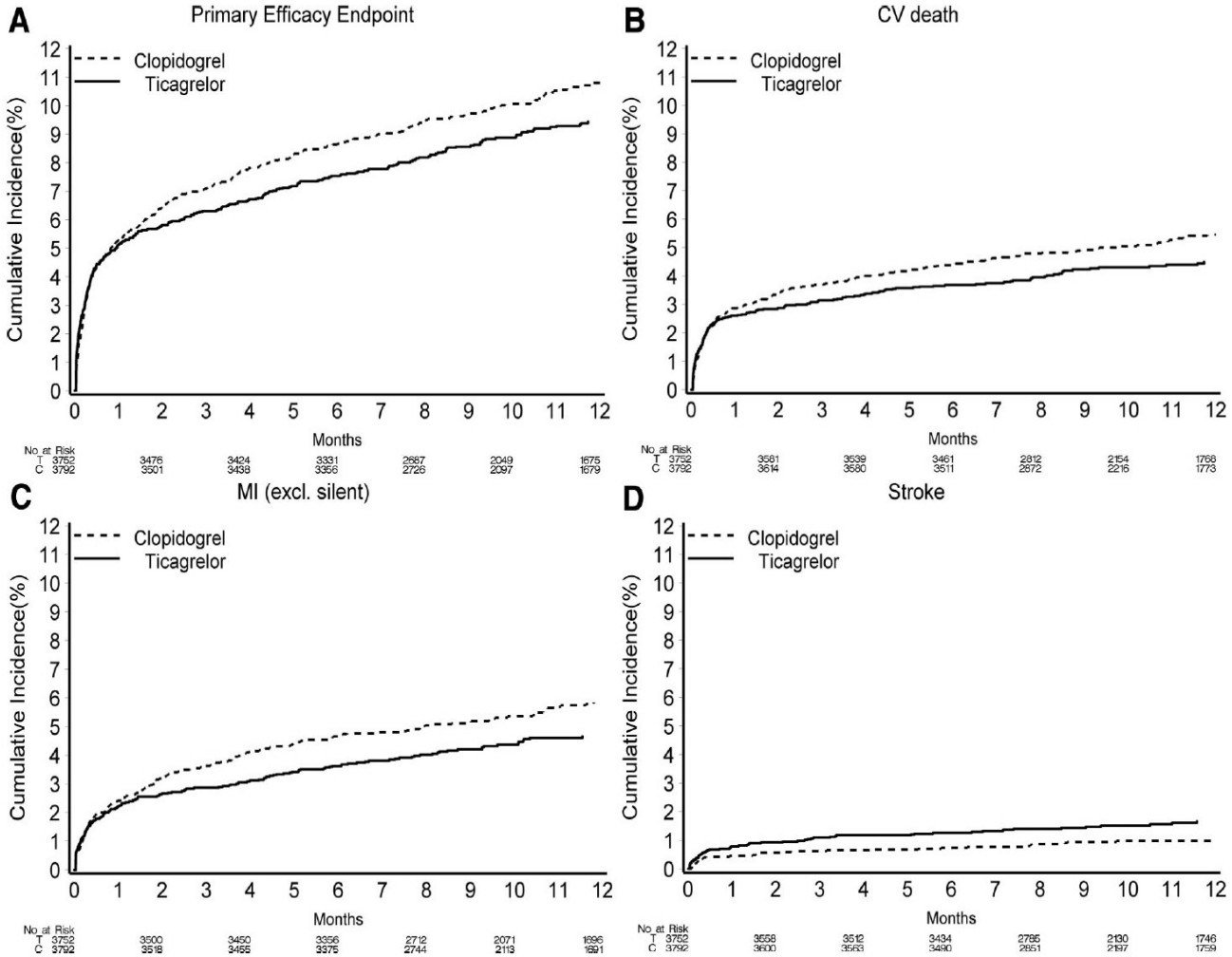
Prasugrel vs. Clopidogrel n=3534 STEMI's



Montalescot G, et al. Lancet 2009

PLATO - STEMI

Ticagrelor vs. Clopidogrel n=7544 STEMI's



Steg G et al. Circ. 2010

Anticoagulation for pPCI

ESC STEMI Guidelines 2012

An injectable anticoagulant must be used in primary PCI.	I	C
Bivalirudin (with use of GP IIb/IIIa blocker restricted to bailout) is recommended over unfractionated heparin and a GP IIb/IIIa blocker.	I	B
Enoxaparin (with or without routine GP IIb/IIIa blocker) may be preferred over unfractionated heparin.	IIb	B
Unfractionated heparin with or without routine GP IIb/IIIa blocker must be used in patients not receiving bivalirudin or enoxaparin.	I	C
Fondaparinux is not recommended for primary PCI.	III	B
The use of fibrinolysis before planned primary PCI is not recommended.	III	A

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Unfractionated heparin with or without routine GP IIb/IIIa blocker must be used in patients not receiving bivalirudin or enoxaparin.	I	C
Fondaparinux is not recommended for primary PCI.	III	B
The use of fibrinolysis before planned primary PCI is not recommended.	III	A

AHA/ACC Guidelines 2013

• UFH:	I	C
• With GP IIb/IIIa receptor antagonist planned: 50- to 70-U/kg IV bolus to achieve therapeutic ACT‡	I	C
• With no GP IIb/IIIa receptor antagonist planned: 70- to 100-U/kg bolus to achieve therapeutic ACT§	I	B
• Bivalirudin: 0.75-mg/kg IV bolus, then 1.75–mg/kg/h infusion with or without prior treatment with UFH. An additional bolus of 0.3 mg/kg may be given if needed.		
• Reduce infusion to 1 mg/kg/h with estimated CrCl <30 mL/min		
• Preferred over UFH with GP IIb/IIIa receptor antagonist in patients at high risk of bleeding	IIa	B
• Fondaparinux: not recommended as sole anticoagulant for primary PCI	III: Harm	B

Antikoagulation bei pPCI

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AHA/ACC Guidelines 2013

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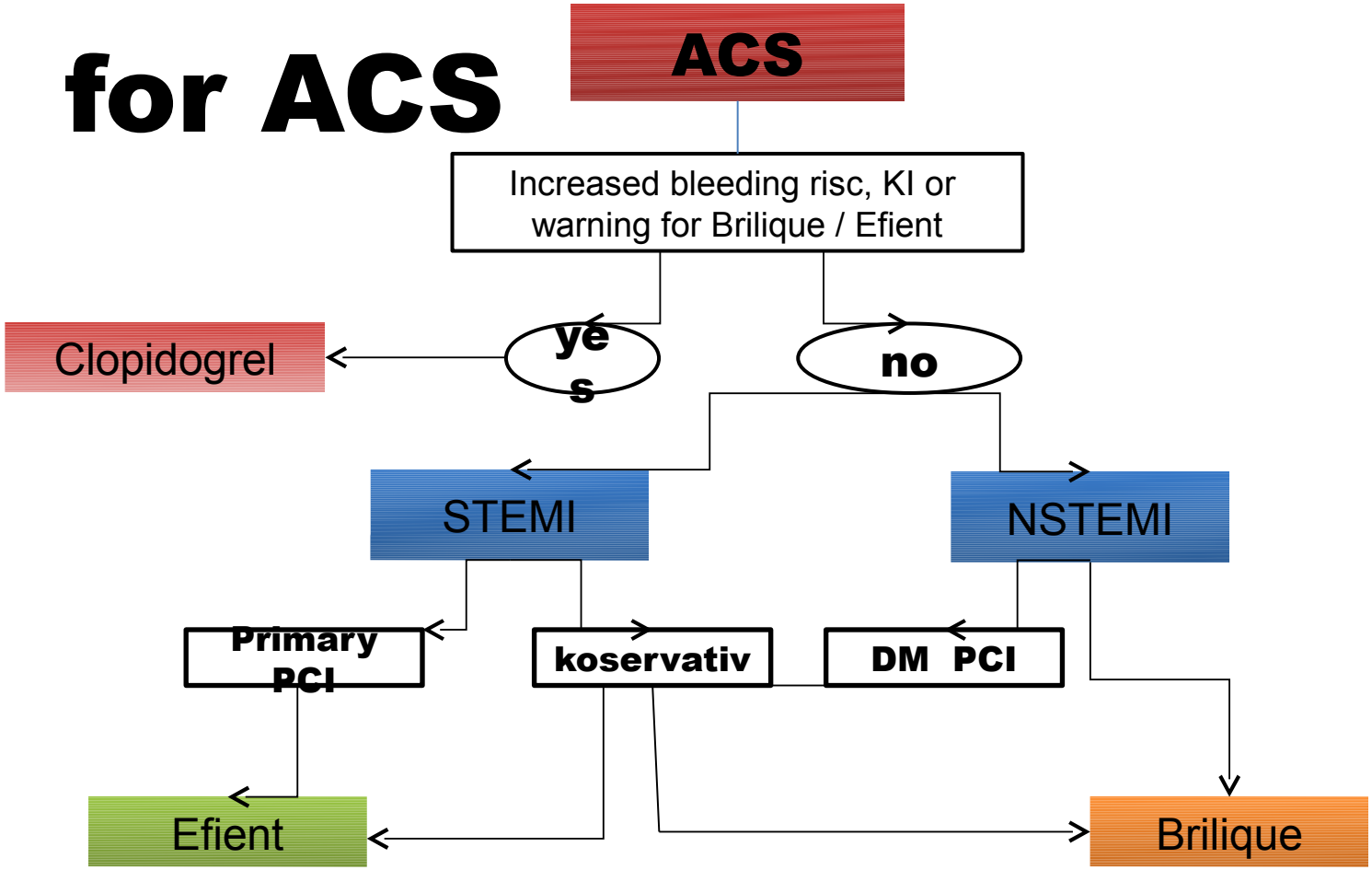
Antiplatelet-therapy for ACS



Increased bleeding risk:
oAK or recent Lysis, anamnesis for bleeding (z.B. Ulcus), St.p. cerebral Event, Age (biolog.) >75-80 Jahre, weight <60kg

Cardiac Arrest

Cardiac arrest

Recommendations	Class	Level
All medical and paramedical personnel caring for a patient with suspected myocardial infarction must have access to defibrillation equipment and be trained in cardiac life support.	I	C
It is recommended to initiate ECG monitoring at the point of FMC in all patients with suspected myocardial infarction.	I	C
Therapeutic hypothermia is indicated early after resuscitation of cardiac arrest patients who are comatose or in deep sedation.	I	B
Immediate angiography with a view to primary PCI is recommended in patients with resuscitated cardiac arrest whose ECG shows STEMI.	I	B
Immediate angiography with a view to primary PCI should be considered in survivors of cardiac arrest without diagnostic ECG ST-segment elevation but with a high suspicion of ongoing infarction.	IIa	B

ECG = electrocardiogram; FMC = first medical contacts; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215

www.escardio.org/guidelines

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Steg G et al. EHJ 2012

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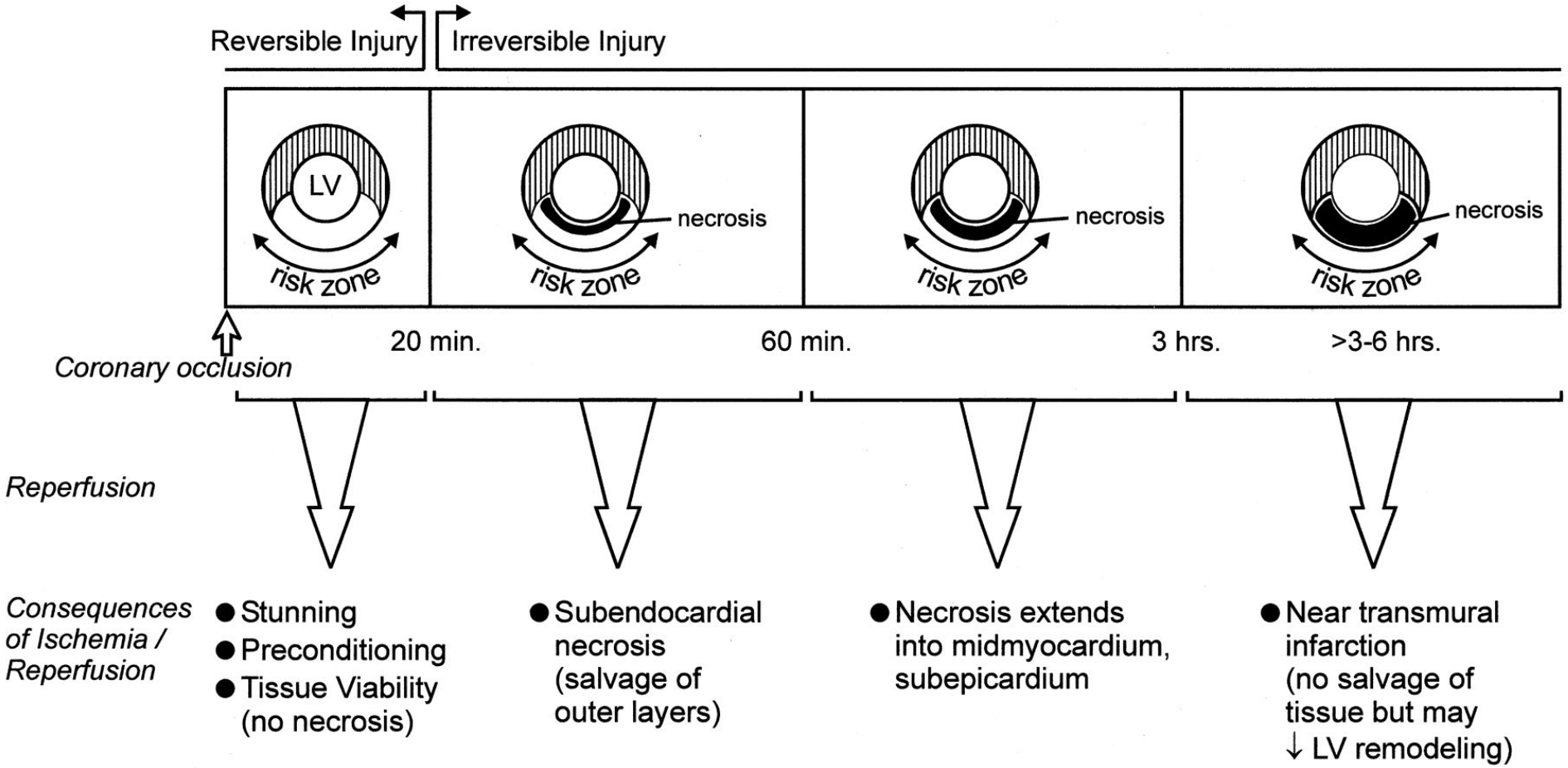
G Steg et al. EHJ 2012 33, 269-2619



Kloner et al, Circ 2001

Schwierig zu interpretierende EKGs

Atypische EKG-Veränderungen bei STEMI

Linksschenkelblock

Schrittmacher EKG

Patienten ohne diagnostische ST-Streckenhebung, aber mit Symptomen anhaltender Ischämie

ST-Streckenhebung in aVR

Odds Ratios and Scores for Independent Electrocardiographic Criteria

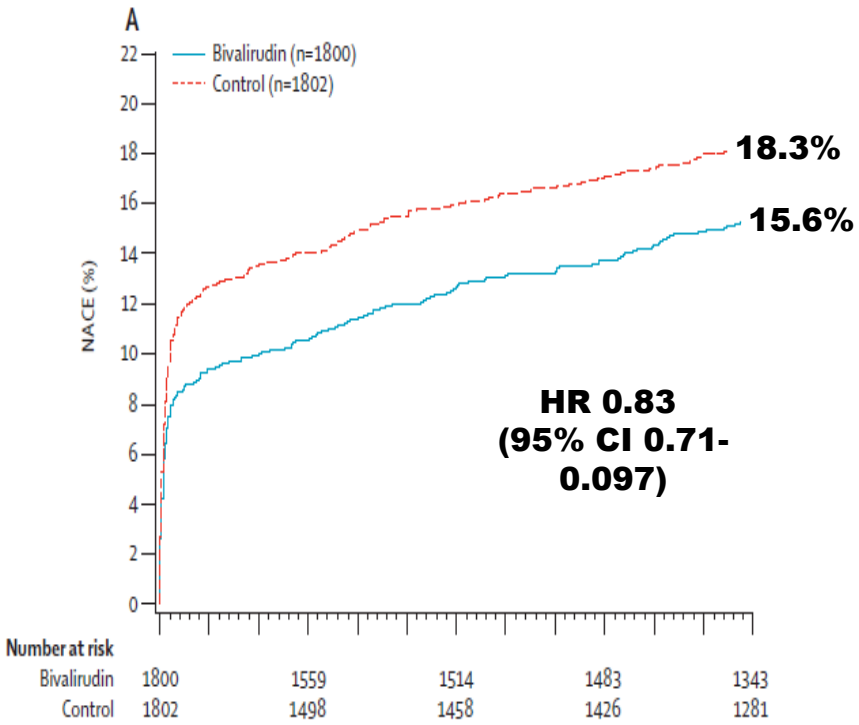
Criterion	Odds Ratio (95% CI)	Score
ST-elevation ≥1 mm and concordant with QRS complex	25.2 (11.6 - 54.7)	5
ST-segment depression ≥1 mm in lead V_1, V_2, or V_3	6.0 (1.9 - 19.3)	3
ST-elevation ≥5 mm and discordant with QRS complex	4.3 (1.8 - 10.6)	2

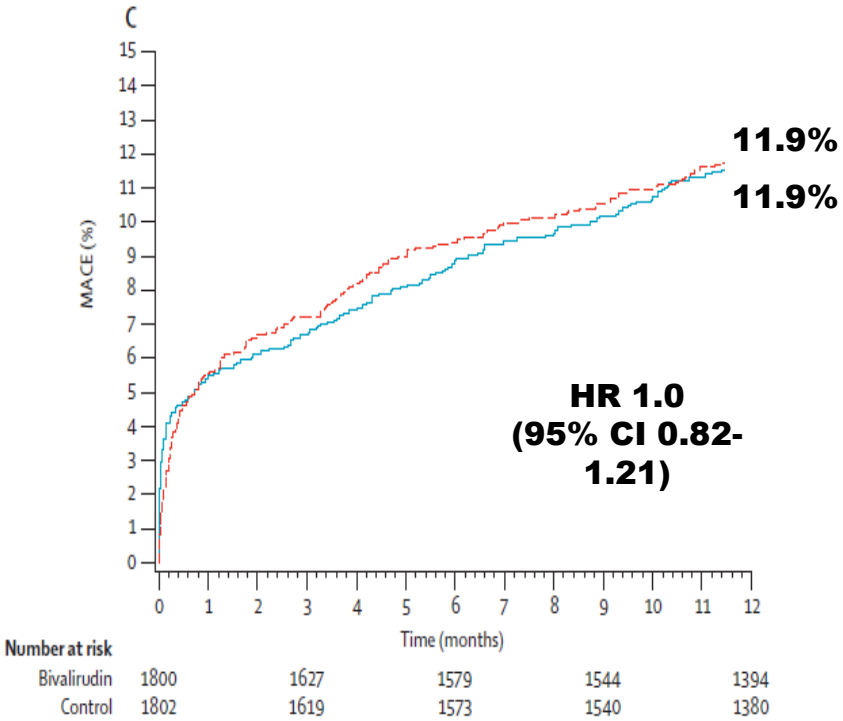
G Steg et al. EHJ 2012 33, 269-2619
Sgarabossa EB et al., N Engl J Med 1996 Apr 4;334(14):931

HORIZONS-AMI

Bivalirudin vs. UFH & GPIIb/IIIa in pPCI

Net Clinical Events	MACE



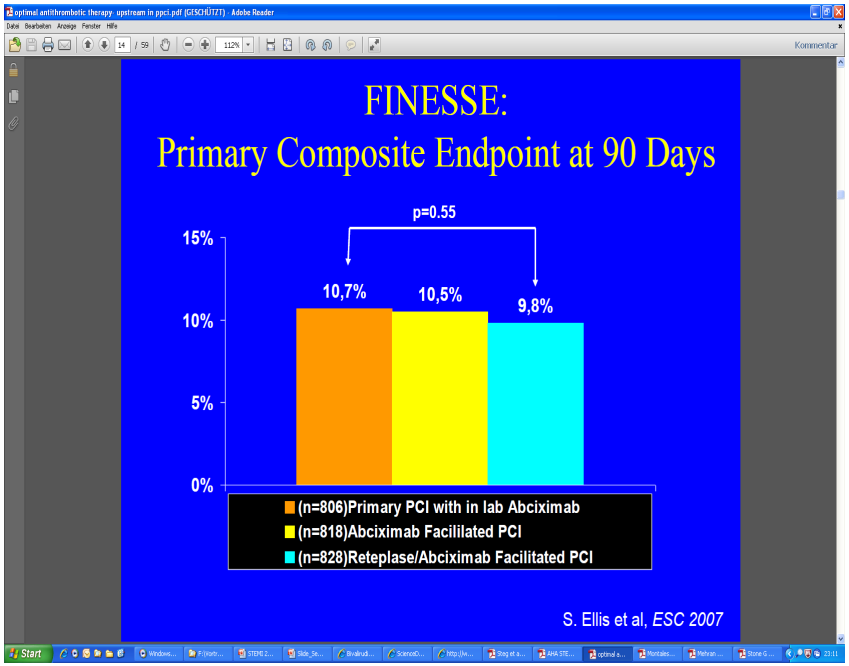


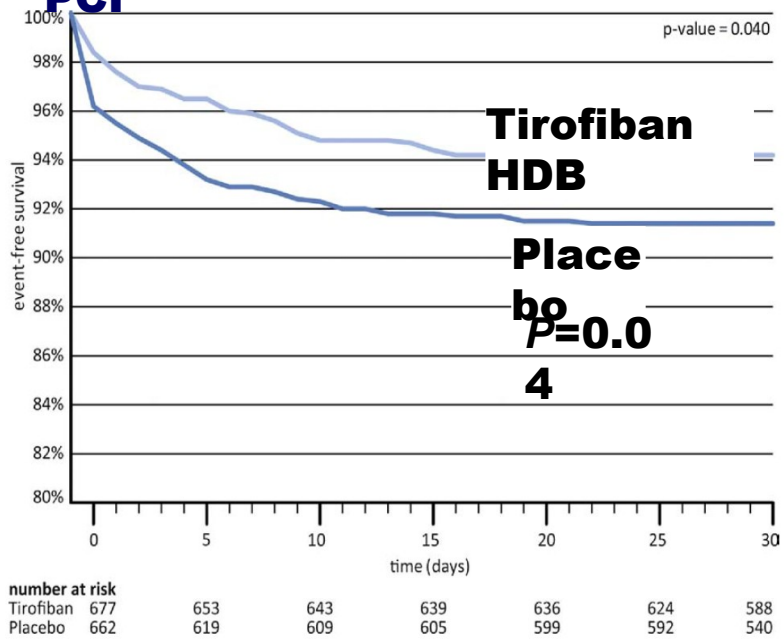
R Mehran et al. Lancet. 2009 Oct 3;374(9696)

FINESSE & On-TIME-2

Upstream GpIIb/IIIa Inhibitor in pPCI

STEMI Guidelines 2008		STEMI Guidelines 2012	
Adjunctive Therapy in pPCI: GPI, fibrinolytics or the combination	**III B**	**Upstream GPI may be considered in high risk pts. undergoing tranfer for PCI**	**IIb B**





S Ellis et al. ESC 2007

ten Berg JM et al. J Am Coll Cardiol. 2010 Jun 1;55(22):2446-55

Periinterventionelle antithrombotische Therapie

ESC STEMI Guidelines 2012

GP IIb/IIIa inhibitors should be considered for bailout therapy if there is angiographic evidence of massive thrombus, slow or no-reflow or a thrombotic complication.	IIa	C
Routine use of a GP IIb/IIIa inhibitor as an adjunct to primary PCI performed with unfractionated heparin may be considered in patients without contraindications.	IIb	B
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
Options for GP IIb/IIIa inhibitors are (with LoE for each agent):		
• Abciximab		A
• Eptifibatide (with double bolus)		B
• Tirofiban (with a high bolus dose)		B

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AHA/ACC Guidelines 2013

IV GP IIb/IIIa receptor antagonists in conjunction with UFH or bivalirudin in selected patients		
• Abciximab: 0.25-mg/kg IV bolus, then 0.125 mcg/kg/min (maximum 10 mcg/min)	IIa	A
• Tirofiban: (high-bolus dose): 25-mcg/kg IV bolus, then 0.15 mcg/kg/min • In patients with CrCl <30 mL/min, reduce infusion by 50%	IIa	B
• Eptifibatide: (double bolus): 180-mcg/kg IV bolus, then 2 mcg/kg/min; a second 180-mcg/kg bolus is administered 10 min after the first bolus • In patients with CrCl <50 mL/min, reduce infusion by 50%	IIa	B
• Intracoronary abciximab 0.25-mg/kg bolus	IIb	B

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• Pre–catheterization laboratory administration of intravenous GP IIb/IIIa receptor antagonist	IIb	B
• Intracoronary abciximab 0.25-mg/kg bolus	IIb	B

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Cardiac arrest

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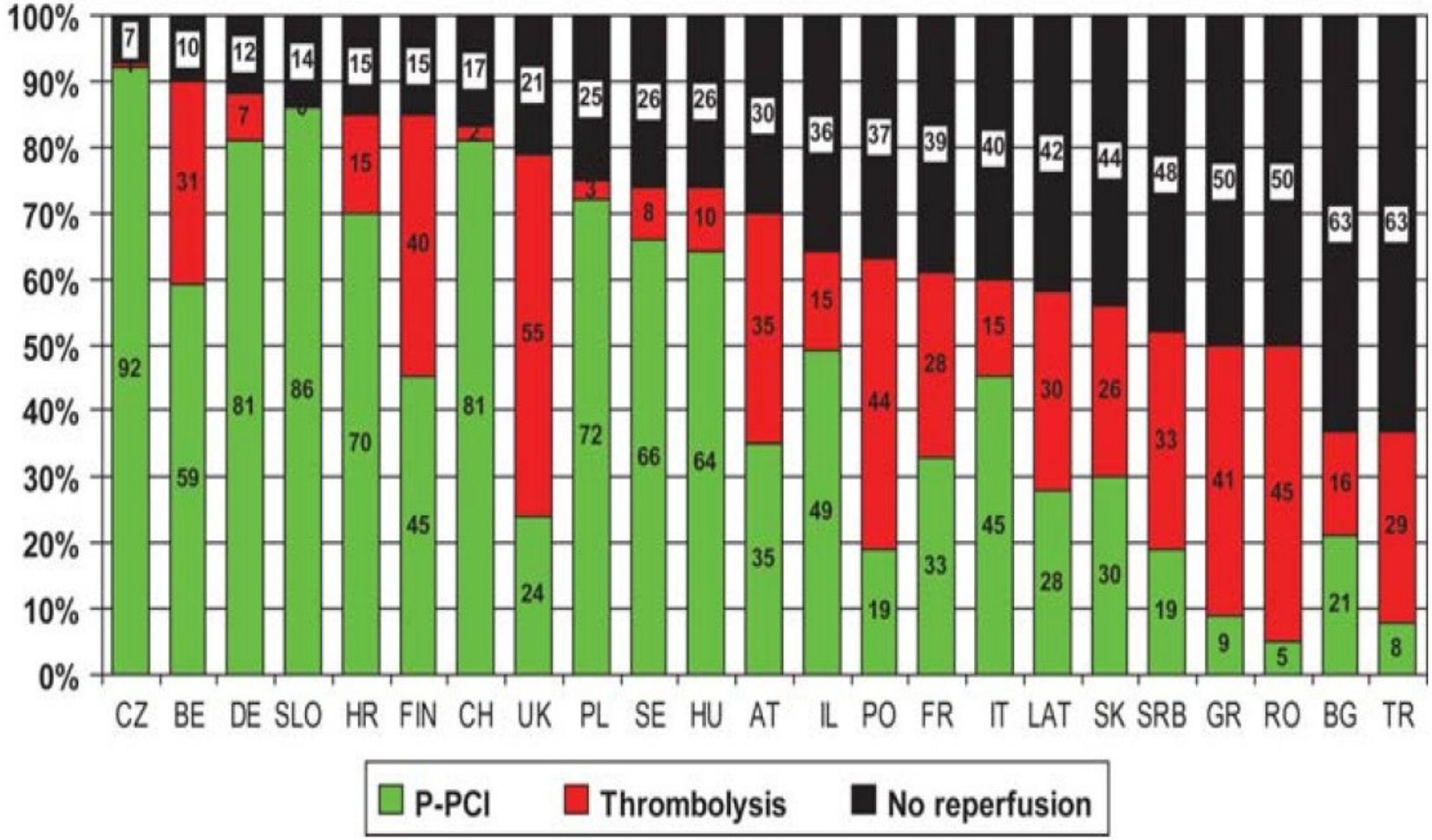
G Steg et al. EHJ 2012 33, 269-2619

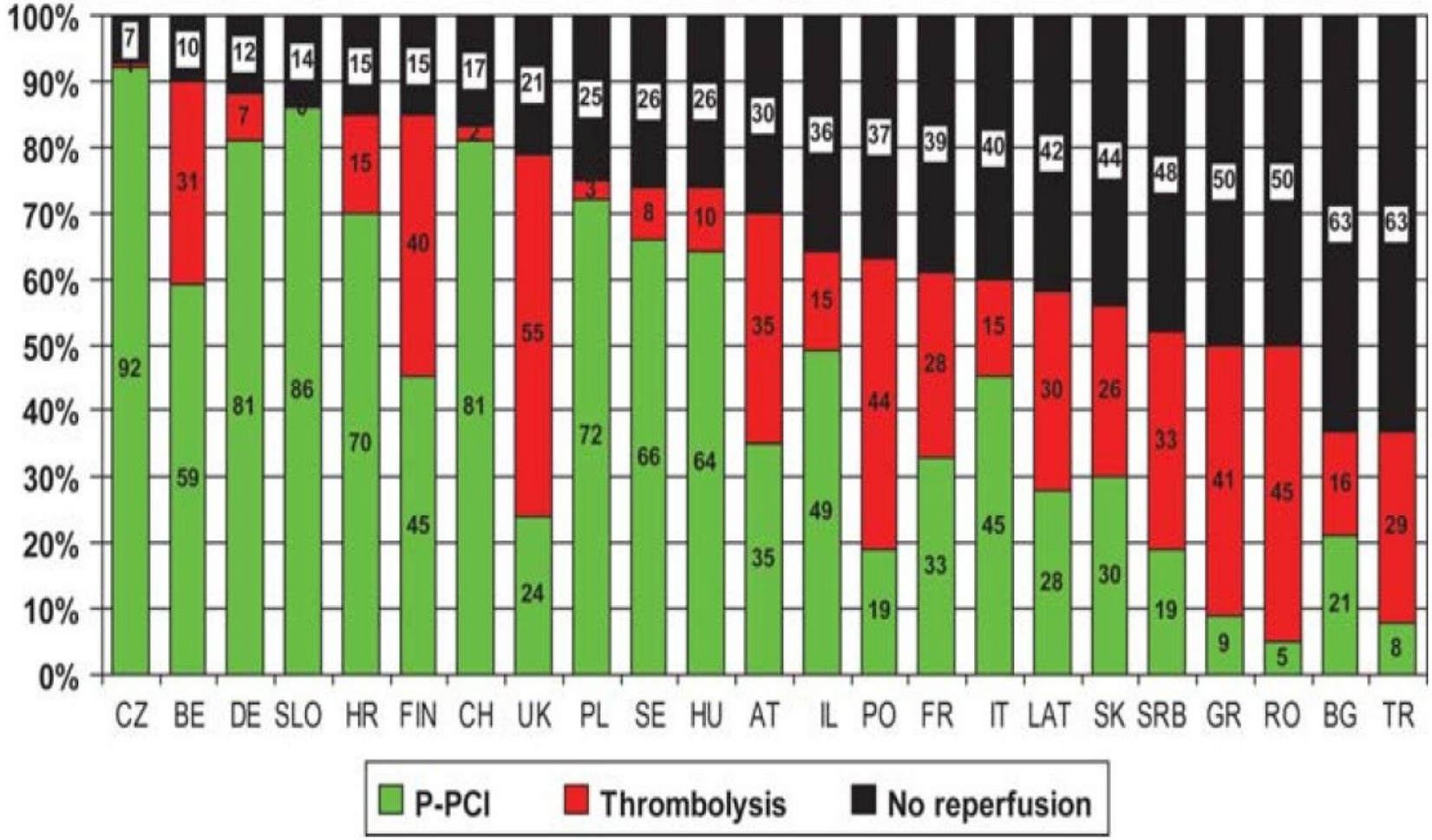
Wo stehen wir?

Reperfusion in STEMI current situation in Europe



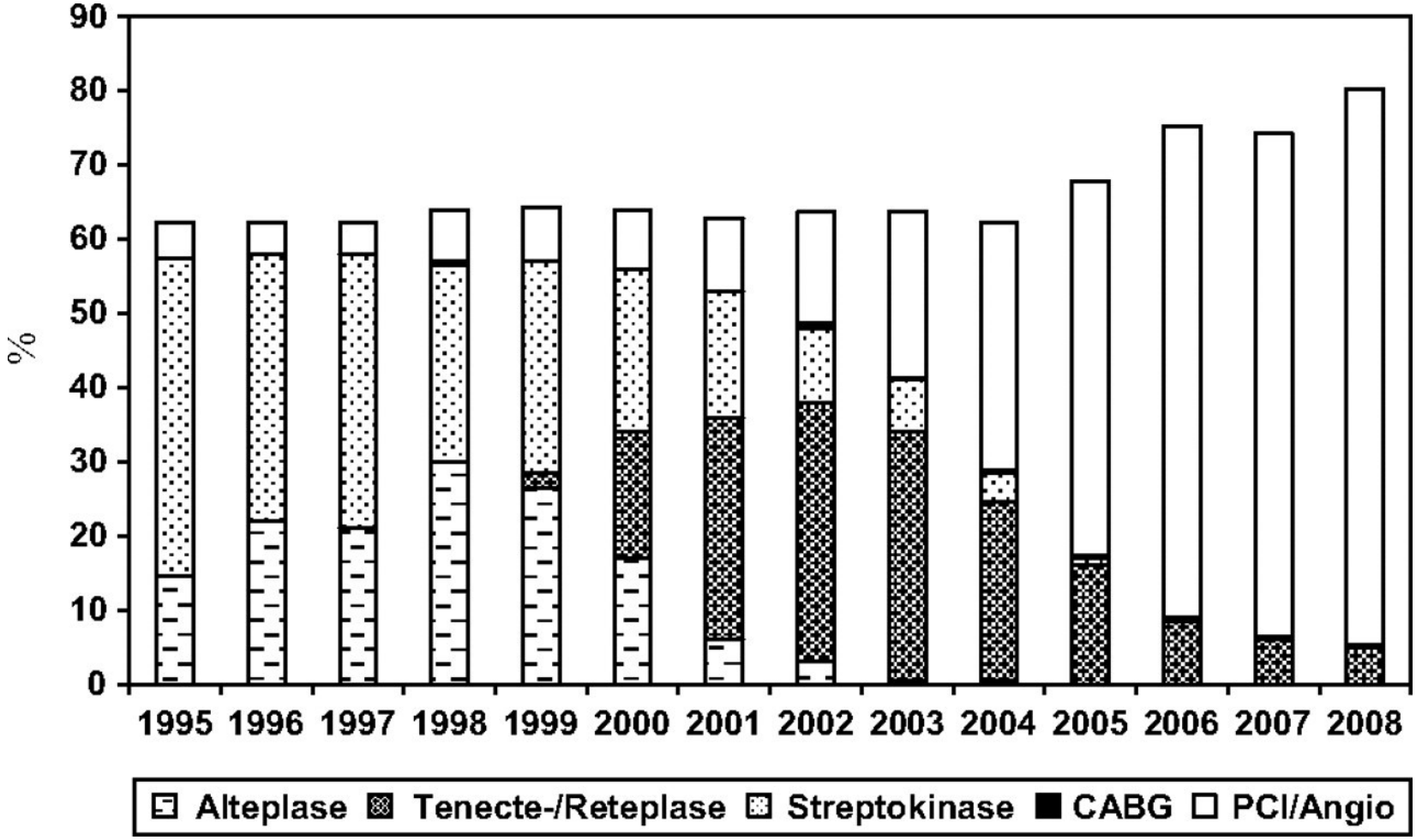
Widimsky P et al. Eur Heart J. 2010 Apr;31(8):943-57

Reperfusion in STEMI current situation in Europe



Widimsky P et al. Eur Heart J. 2010 Apr;31(8):943-57

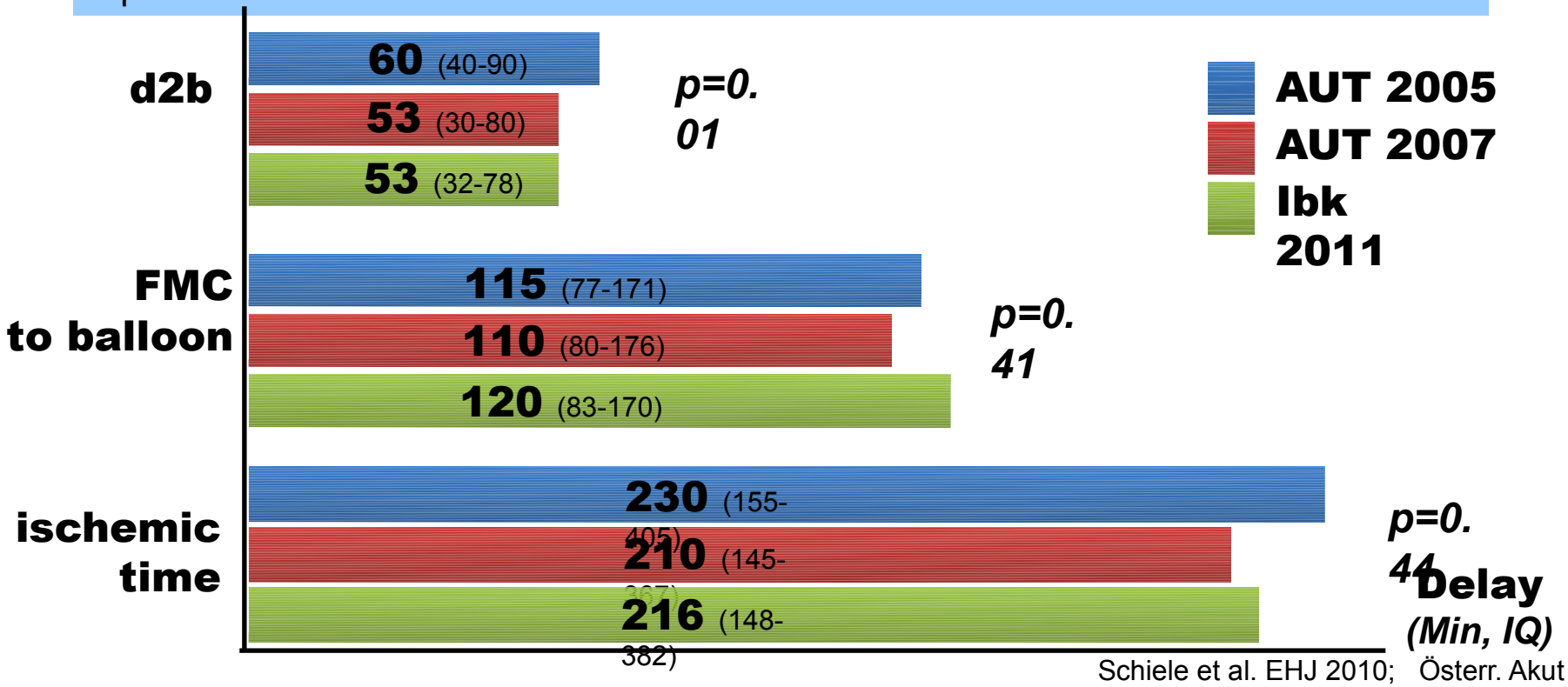
Reperfusion therapy in STEMI



Jernberg T et al. Heart 2010;96:1617-1621

Delays in Primary PCI / FL EHS-ACS III vs. Austria

Variable	Period 1	Period 2	Period 3	Period 4	Ptrend
Door to artery	60 (27-119)	53 (25-110)	50 (27-95)	45 (26-84)	<0.001
FL <30min	61.7%	65.0%	67.4%	71.1%	0.01
pPCI <90min	72.3%	72.3%	76.2%	80.4%	<0.001
Timely reperfused	68.8%	70.4%	74.1%	78.1%	<0.001



Schiele et al. EHJ 2010; Österr. Akut PC Register

Tele-EKG Triage

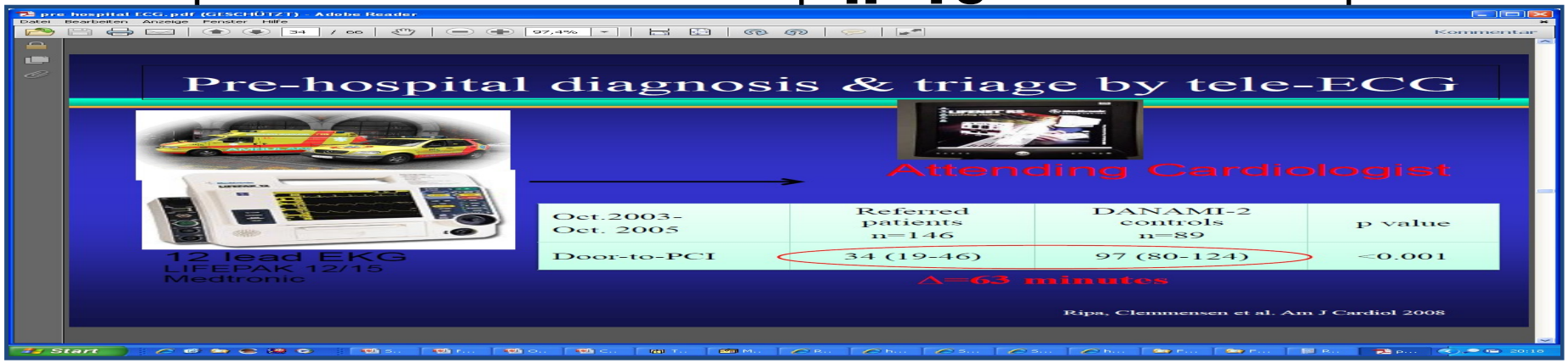
565 Pat.

pPCI n=169

periph. KH n=397

sek. ad pPCI n=16

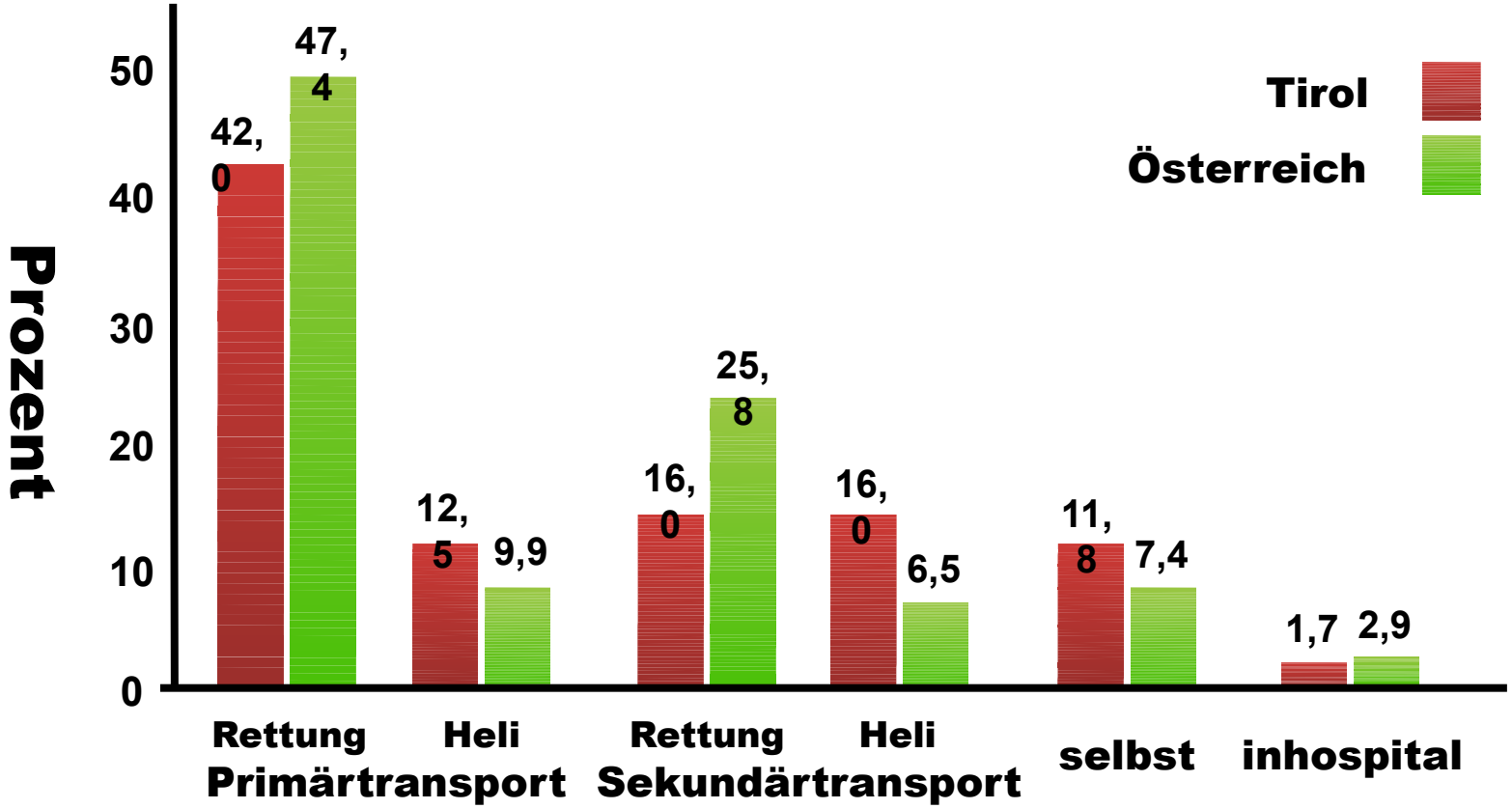
periph KH n=381



Sejersten et al Am J Cardiol 2008;101:941–9

Zuweisungsmodus

Österreich vs. Tirol



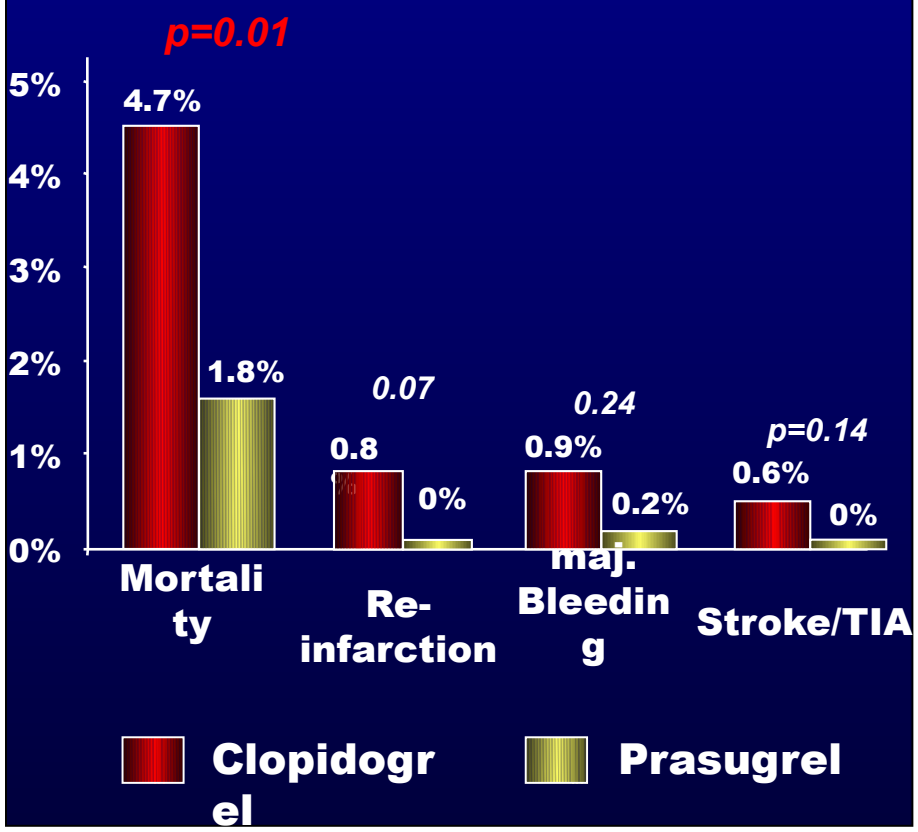
field triage:	68,1 %	67,6 %

Benchmark Acute PCI-Registry 2011

Prasugrel in Primary PCI

Austrian Acute PCI Registry (n=2454 pts.)

In-hospital outcome



Multivariate analysis

	OR	95% CI	p-value
Age (years)	**0.97**	**0.96 –**	**<0.0**
Sex (female)	**0.69**	**0.98**	**1**
Diabetes mellitus	**1.13**	**0.51 –**	**0.02**
Smoker	**1.16**	**0.94**	**0.47**
Card. Shock	**0.72**	**0.81 –**	**0.27**
Reanimation	**1.57**	**1.58**	**0.31**
Prev. PCI	**0.75**	**0.90 –**	**0.12**
Prev. MCI	**1.23**	**1.52**	**0.31**
Pain to PCI	**0.99**	**0.39 –**	**0.48**
Field Triage	**1.59**	**1.35**	**0.45**
		0.89	**<0.0**

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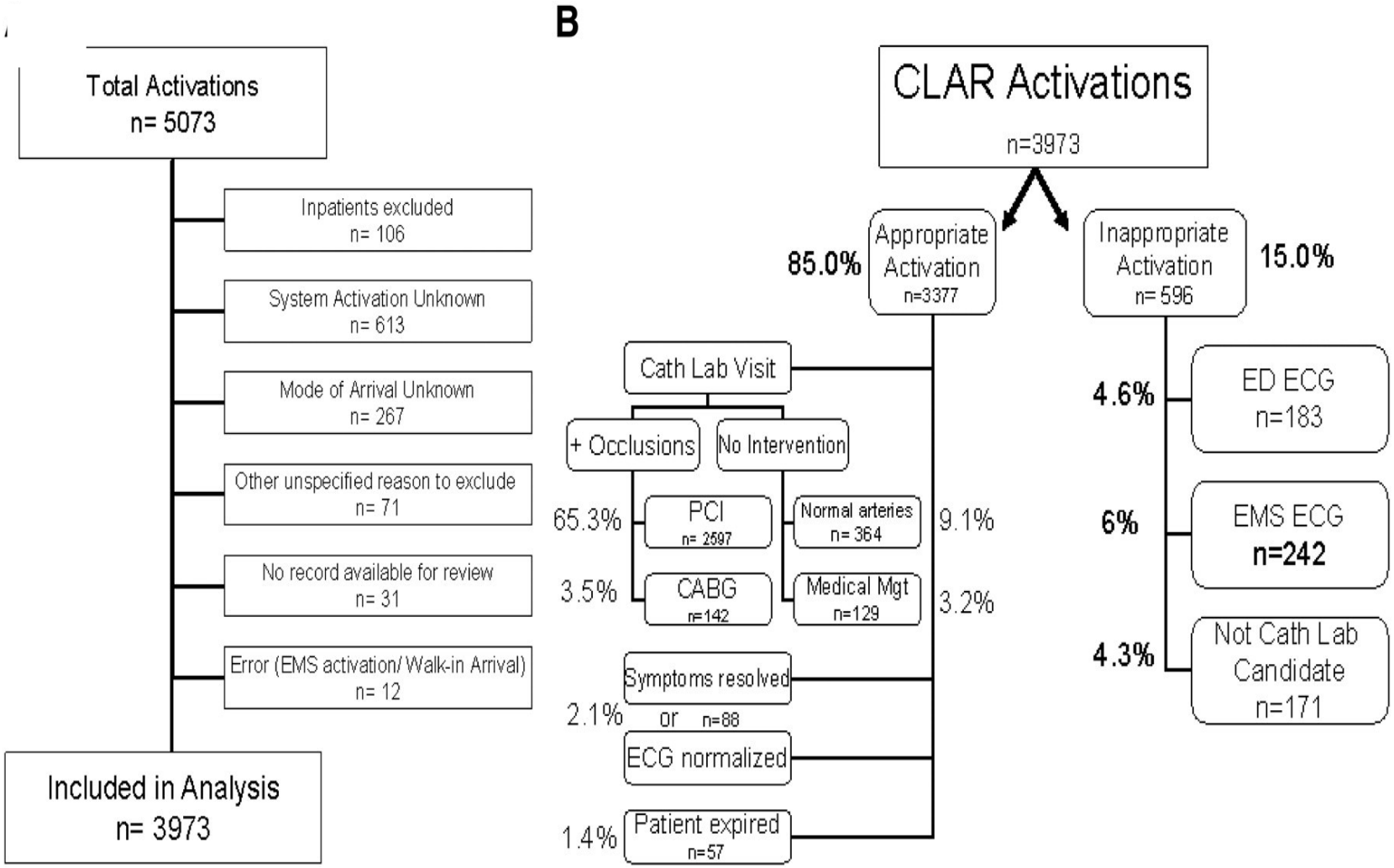
Falsch positive Aktivierung des Katheterlabors

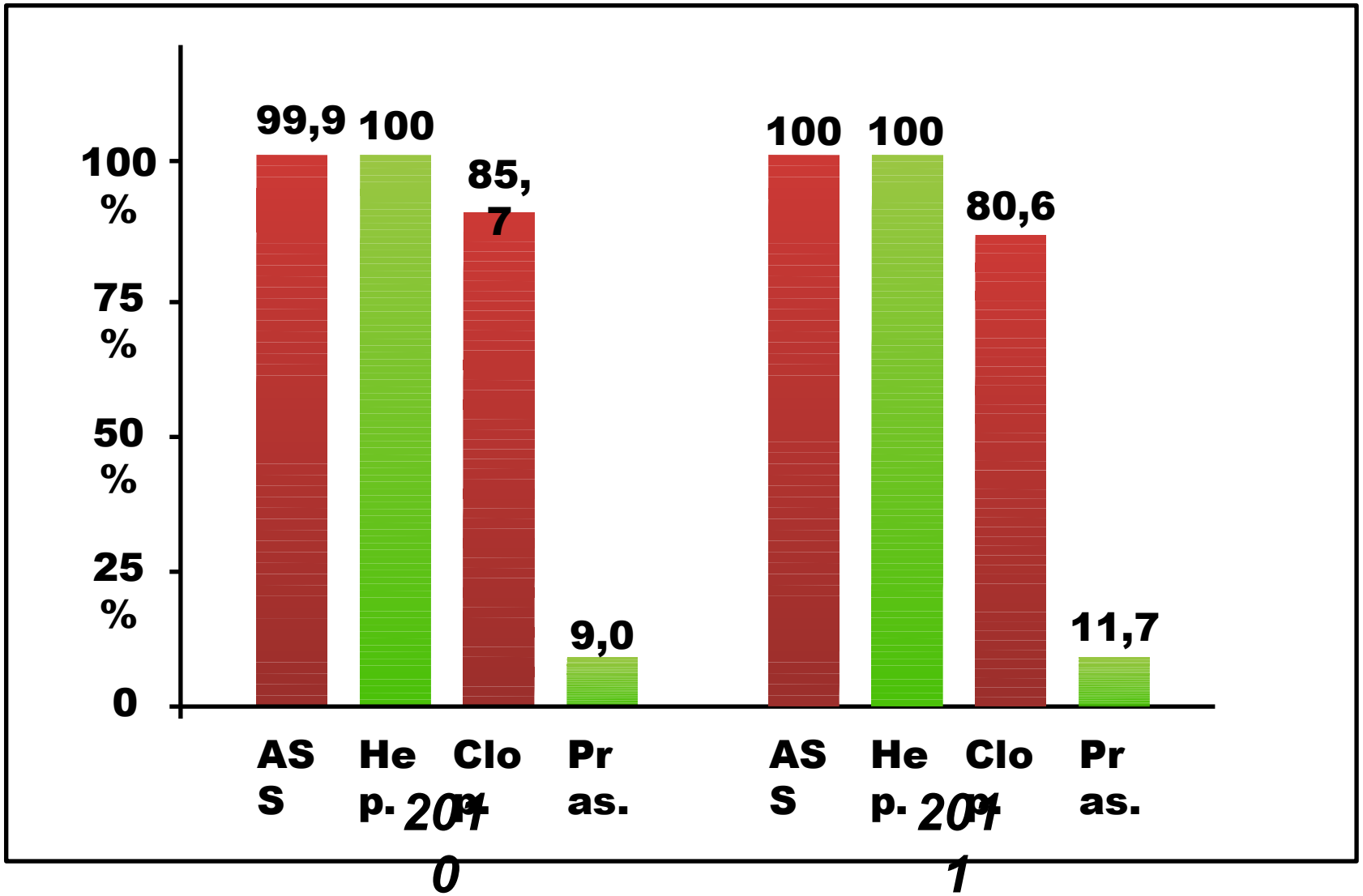
Larson et al. JAMA. 2007 Dec 19;298(23):2754-60

Rates of Cath.-Lab Cancelation



Garvey JL et al. Circulation. 2012;125:3
313

Antithrombotische Vortherapie bei PPCI in Tirol



Welche Reperfusionsstrategie?

(Notfallort, peripheres Krankenhaus)

- **Decision delay 120min.:**

  = max. PCI assoziiertes Delay

- **Ziel:**

  90 Min. bis zur Primär PCI

  60 Min. bis zur Primär PCI bei kurzem Schmerzdelay und großem MI

  30 Min. für Thrombolyse

Zusammenfassung

Durch Tiroler STEMI Netzwerk wurde erreicht

- Steigerung der PPCI (24/7)
- Verkürzung der D2B-time
- Erhöhung des Anteils der Reperfusion in Gesamt-STEMI-Population geführt
- Verbesserung der adjuvanten Therapie bei PPCI

Hauptprobleme bleiben:

- Zu späte Patientenpräsentation in ca. 20 %
- Zeitverlust durch Sekundärtransporte (30% der Pat.)
- Optimale Therapie im Einzelfall oft unklar wegen Unklarer Zeitangaben, Transportlogistik Fehldiagnosen (EKG, atyp. Symptome)

Danke

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StoDt Wien

Austrian Acute PCI Registry

Enrolled patients 2005-2012 (Status: Oct 2012)

„Acute PCI"
(n=15551)

STEMI
11759 (75,6%)

NSTEMI
3792 (24,4%)

Primary PCI
10909 (70,1%)

Rescue PCI / post Lysis
667 (4,2%)

Facil. PCI
201 (1,3%)

Stand Okt 2012

Austrian Acute PCI Registry

Enrolled patients 2010-2012 (Status: Oct 2012)

„Acute PCI"
(n=5957)

STEMI
4351 (73,0%)

NSTEMI
1606 (27,0%)

Primary PCI
4176 (96,0%)

Rescue PCI
98 (2,3%)

post Lysis
76 (1,7%)

Stand Okt 2012

Austrian Acute-PCI Investigators

Akut-PCI Register ÖKG 2011

Indikationen und Vergleich zum Vorjahr

Indikation	*2011 n (%)*	*2012 n (%)*
Primär-PCI:	**1786 (69,4)**	**778 (62,8)**
Rescue PCI:	41 (1,6)	13 (1,1)
PCI after	32 (1,2)	16 (1,3)
NSTEMI		
NSTEMI urgent	24 (0,9)	20 (1,6)
NSTEMI <72h	**692 (26,9)**	**431 (34,8)**
Kard. Schock	207 (8,0)	102 (8,2)
Z.n. Reanimation	206 (8,0)	104 (8,4)

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Benchmark 2011

in-hospital Outcome bei Akut PCI

	gesamt	PPCI	Rescue PCI	Post Lyse
	n=1814	*n=1742*	*n=40*	*n=32*
Mortalität	**5,5%**	**5,0%**	**30,0%**	**3,0%**
Reinfarkt	**0,8%**	**1,0%**	**3,0%**	**-**
Major Bleeding	**0,8 %**	**1,0%**	**8,0%**	**3,0%**
2. elekt.	**11,0%**	**11,0%**	**10,0%**	**9,0%**
Revaskularisierung	**0,5%**	**-**	**-**	**3,0%**
Schlaganfall/TIA				

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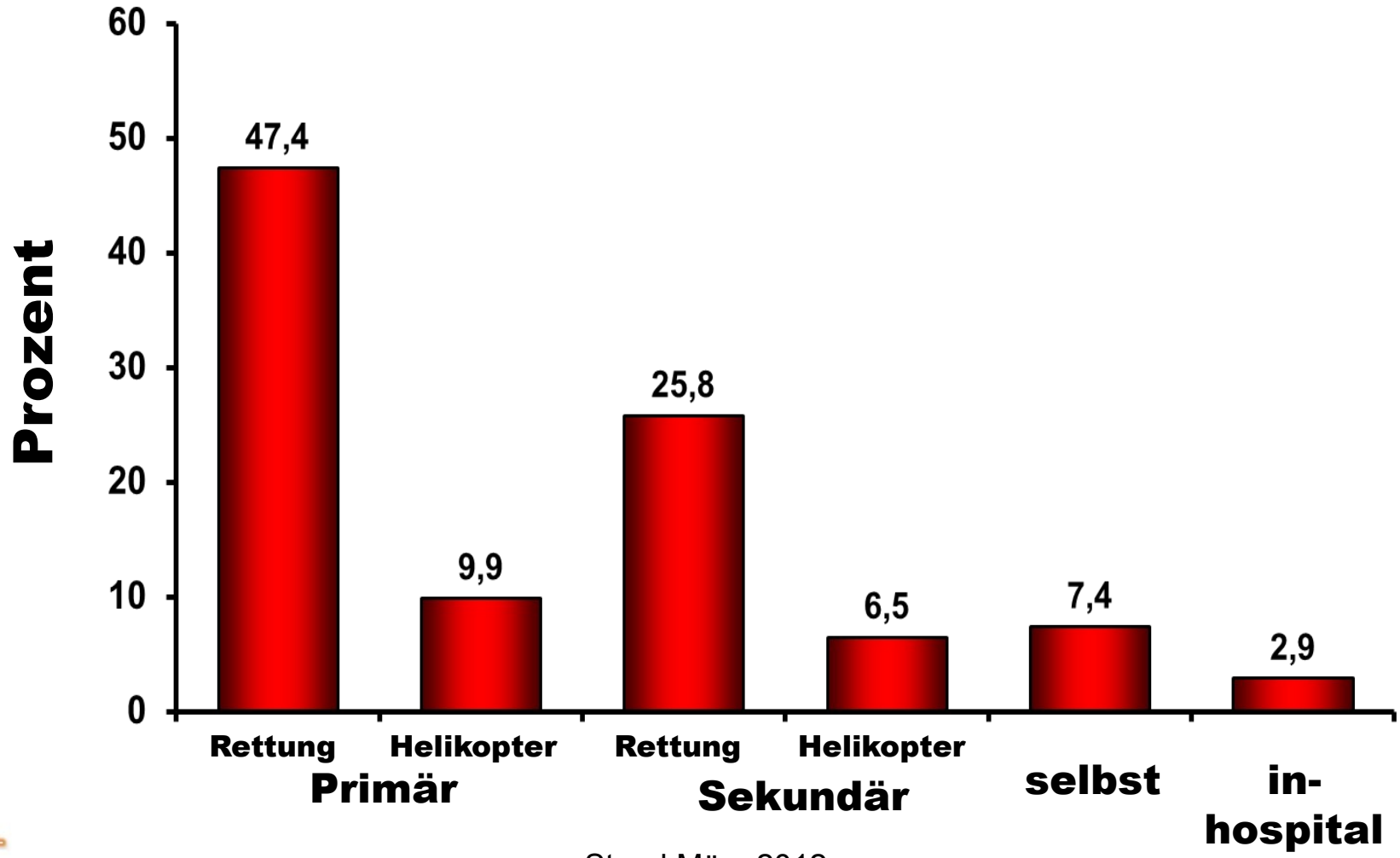
Benchmark 2011

Zuweisungsmodus



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Benchmark 2011

Primär PCI n=1742

Patientencharakteristika	
Alter (Jahre, Range)	**62 (17-95)**
Männer	**74,0%**
Kardiogener Schock	**9,9,0 %**
Reanimation	**8,0%**
Diabetiker	**16,0%**
Raucher	**48,0%**
Frühere MCI	**11,0%**
Frühere PCI / CABG	**13,0%**
Frühere TIA /	**3,0%**

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Benchmark 2011

Therapie bei Primär PCI n= 1742

Med. Vortherapie

ASS	98,0%
Heparin	
LMWH	19,0%
UFH	72,0%
Clopidogrel	
prä PCI Zentrum	44,0%
PCI Zentrum	23,0%
Prasugrel	
prä PCI Zentrum	9,0%
PCI Zentrum	13,0%
Ticagrelor	
prä PCI	1,0%
Zentrum	1,0%
PCI Zentrum	<0,1%
Fondaparinux	
GPIIb/IIIa	<0,1%
Prä PCI	5,0%
Zentrum	
PCI Zentrum	

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Benchmark 2011

Interventionsdaten

TIMI Fluss

TIMI vor Intervention

0-I 72,0%
II 16,0%
III 12,0%

TIMI nach Intervention

0-I 5,0%
II 6,0%
III 89,0%
No reflow 1,0%
II + III 95,0%

Intervention

BMS	30,0%
DES	55,0%
ohne Stent	6,0%
MV-PCI	14,0%
Keine PCI	9,0%

GpIIb/IIIa	43,0%
Bivalirudin	5,0%
Thrombectomie	30,0%
IABP	2,0%

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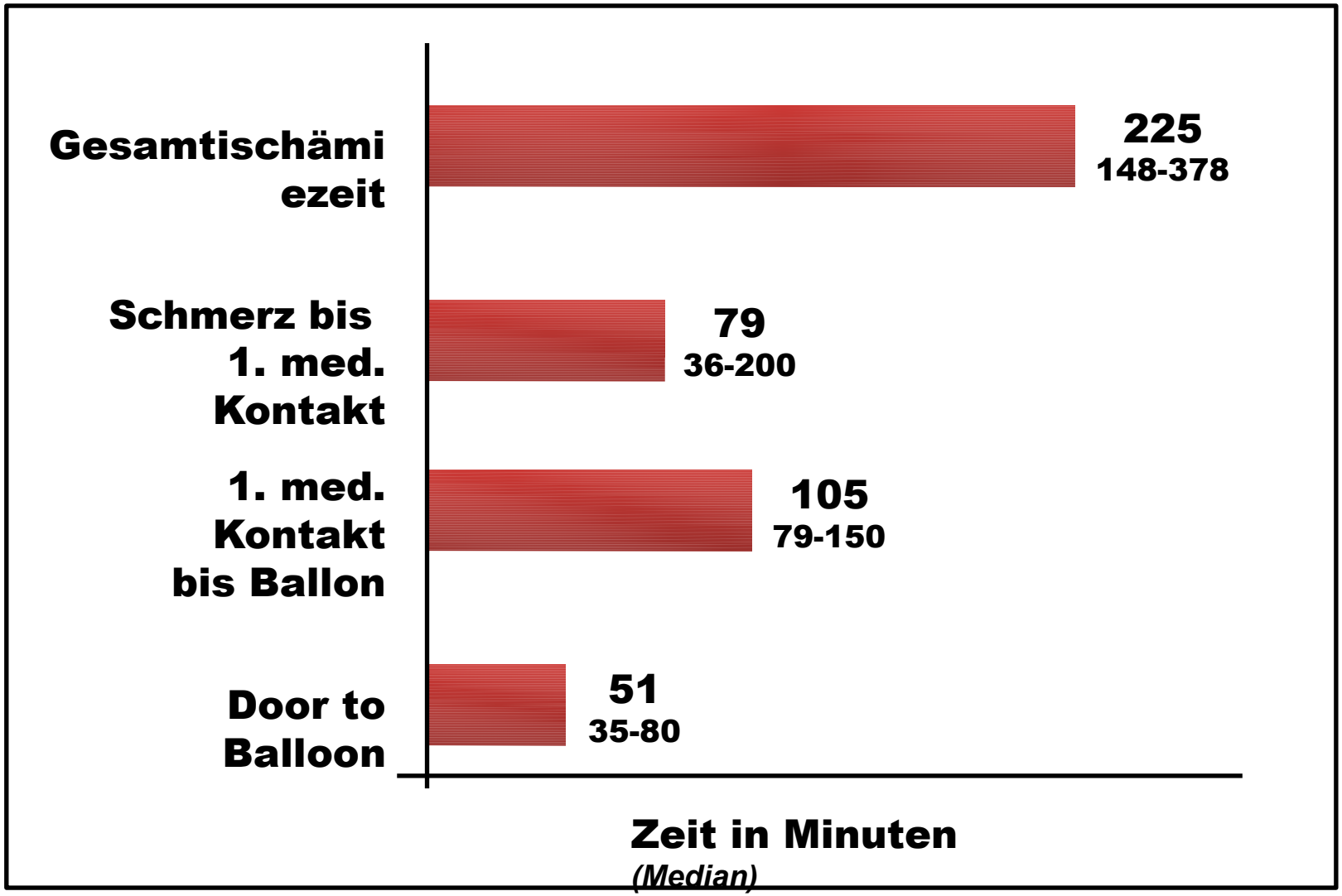
Benchmark 2011

Delays bei Primär PCI



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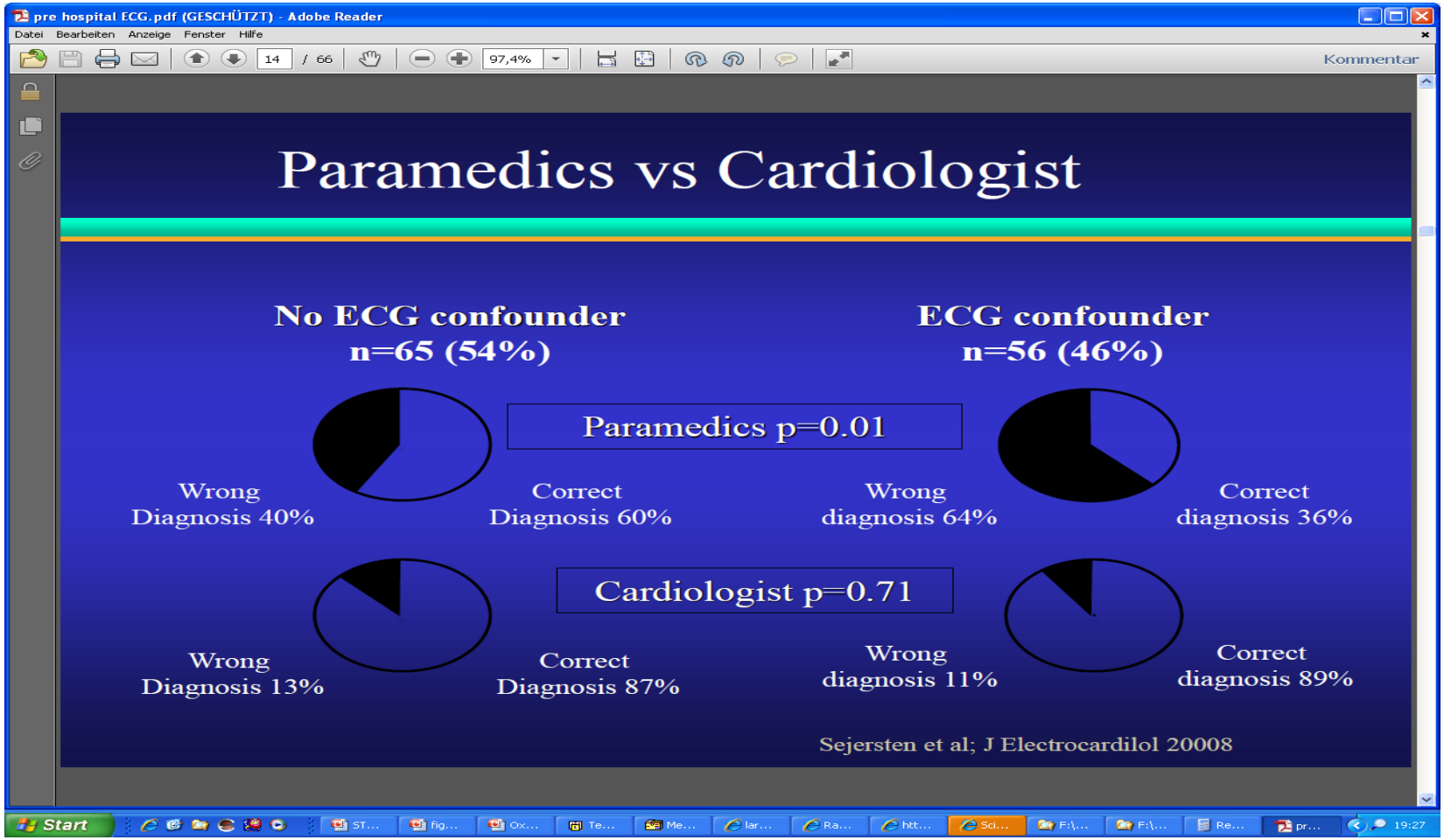
Paramedics vs. Cardiologists



Sejersten et al, J Electrocardiol 2008

Early Diagnosis

Recommendation for initial diagnosis

	Class	Level
A 12-lead ECG must be obtained as soon as possible at the point of FMC, with a target delay of ≤ 10 min.	I	B
ECG monitoring must be initiated as soon as possiblein all patients with suspected STEMI.	I	B
Blood sampling for serum markers is recommended routinely in the acute phase but one should not wait for the results before initiating reperfusion treatment.	I	C
The use of additional posterior chest wall leads (V7–V9 ≥ 0.05 mV) in patients with high suspicion of infero-basal myocardial infarction (circumflex occlusion) should be considered.	IIa	C
Echocardiography may assist in making the diagnosis in uncertain cases but should not delay transfer for angiography.	IIb	C

ECG = electrocardiogram; FMC = first medical contacts; STEMI = ST-segment elevation myocardial infarction.

European Heart Journal (2012) 33, 2569–2619
doi:10.1093/eurheartj/ehs215

www.escardio.org/guidelines

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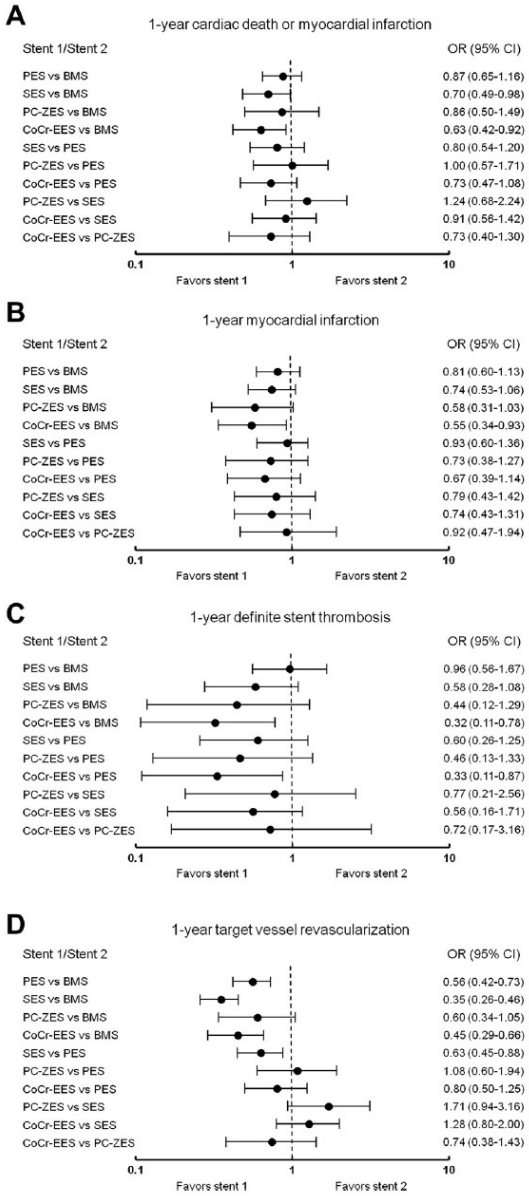
G Steg et al. EHJ 2012 33, 269-2619



Palmerini T. et al. JACC

Universal definition of myocardial infarction

Detection of rise and/or fall of cardiac biomarker values (preferably troponin) with at least one value above the 99th percentile of the upper reference limit and with at least one of the following:

Detection of rise and/or fall of cardiac biomarker values (preferably troponin) with at least one value above the 99th percentile of the upper reference limit and with at least one of the following:

- Symptoms of ischaemia;
- New or presumably new significant ST-T changes or new LBBB;
- Development of pathological Q waves in the ECG;
- Imaging evidence of new loss of viable myocardium, or new regional wall motion abnormality;
- Identification of an intracoronary thrombus by angiography or autopsy.

- Imaging evidence of new loss of viable myocardium, or new regional wall motion abnormality;
- Identification of an intracoronary thrombus by angiography or autopsy.

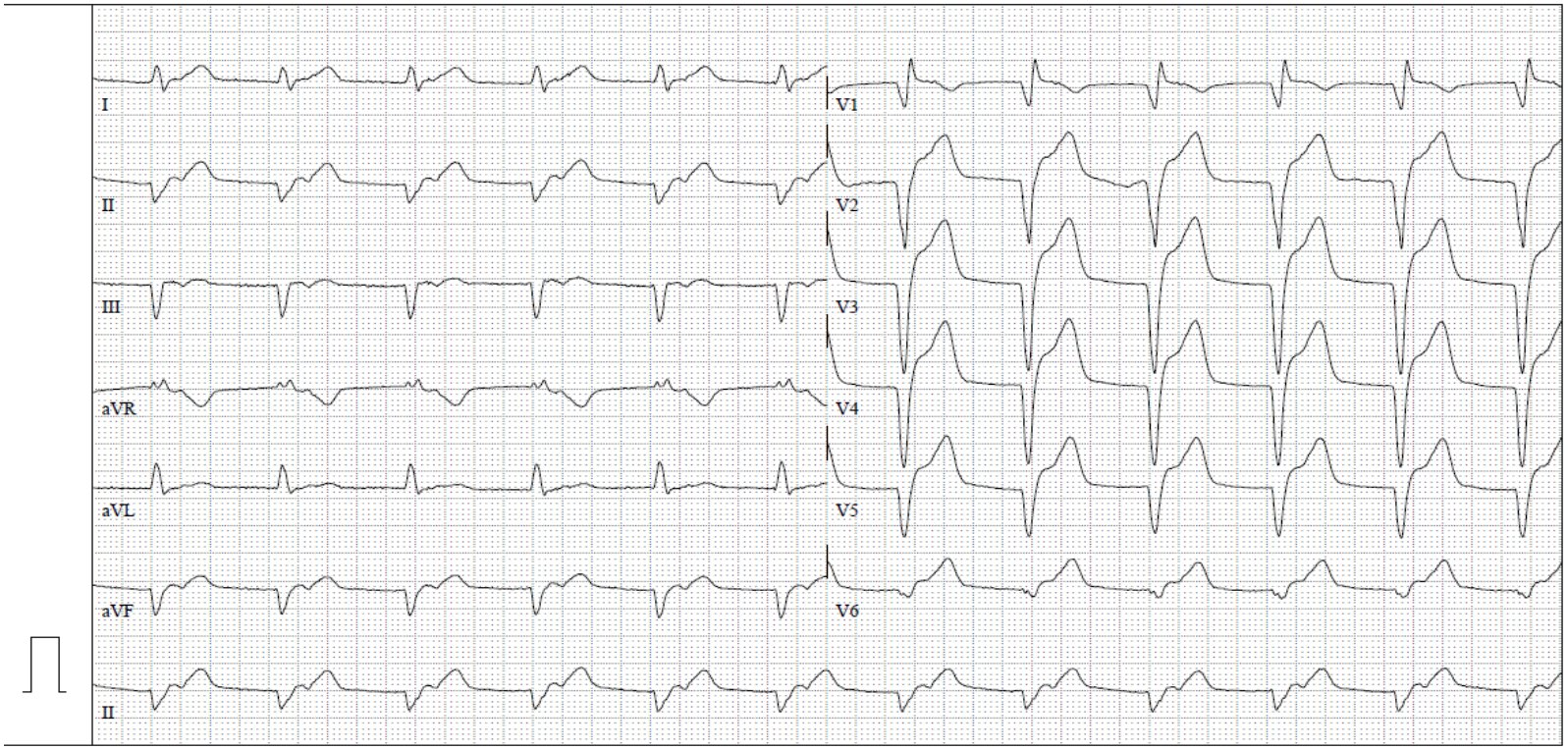
Steg G et al. EHJ 2012

Atypical ECG-Changes

STEMI by LBBB

Patienten-Nr.: 2001686987
08.10.2010 73J. männlich
10:15:52

Herzfrequenz	71/min
PQ Intervall	ms
QRS Dauer	152ms
QT/QTc	476/517ms
P-QRS-T Winkel	/-71/44°
P Dauer	ms
RR/PP Intervall	844/855ms



GE CardioSoft V6.01(1) nicht befundet
25mm/s 10mm/mV 40Hz 50Hz ADS 12SL 20.1 Behand. Arzt: Seite 1

Atypical ECG-Changes

Elevation in aVR

Patienten-Nr.: 2101079530
14.10.2010 männlich
14:06:09 60J.

Herzfrequenz	98/min
PQ Intervall	136ms
QRS Dauer	90ms
QT/QTc	360/459ms
P-QRS-T Winkel	72/12/83°
P Dauer	108ms
RR/PP Intervall	608/610ms

Blutdruck [mmHg]: 179/92

GE CardioSoft V6.51(2) nicht befundet
25mm/s 10mm/mV 0.01-20Hz 50Hz ADS 12SL 20.1 Behand. Arzt: Seite 1

Early Diagnosis - Initial Management

Recommendation for initial diagnosis

	Class	Level
A 12-lead ECG must be obtained as soon as possible at the point of FMC, with a target delay of ≤ 10 min.	I	B
ECG monitoring must be initiated as soon as possiblein all patients with suspected STEMI.	I	B
Blood sampling for serum markers is recommended routinely in the acute phase but one should not wait for the results before initiating reperfusion treatment.	I	C
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G Steg et al. EHJ 2012 33, 269-2619

European Heart Journal Advance Access published September 14, 2011

European Heart Journal
doi:10.1093/eurheartj/ehr360

CLINICAL RESEARCH

Clopidogrel pre-treatment is associated with reduced in-hospital mortality in primary percutaneous coronary intervention for acute ST-elevation myocardial infarction

Jakob Dörler[1], Michael Edlinger[2], Hannes F. Alber[1], Johann Altenberger[3], Werner Benzer[4], Georg Grimm[5], Kurt Huber[6], Otmar Pachinger[1], Herwig Schuchlenz[7], Peter Siostrzonek[8], Gerald Zenker[9], and Franz Weidinger[10]*, For the Austrian Acute PCI Investigators

	Clopidogrel			P_{trend}
	Pre-treatment, *n* = 1635	Intermediate, *n* = 3244	Late, *n* = 1076	
Mortality	3.4% (*n* = 55)	4.7% (*n* = 154)	10.2% (*n* = 110)	<0.01
Re-infarction	0.6% (*n* = 10)	1.2% (*n* = 39)	2.1% (*n* = 22)	<0.01
Major bleeding	1.0% (*n* = 16)	0.8% (*n* = 26)	1.5% (*n* = 15)	0.39
Second revascularization	4.4% (*n* = 72)	4.7% (*n* = 150)	4.2% (*n* = 41)	0.89
Stroke	0.7% (*n* = 12)	1.1% (*n* = 35)	2.4% (*n* = 25)	<0.01

Dörler J et al. EHJ 2011

Subgroupanalysis according the use of GP IIb/IIIa in the Cath-Lab

Variable	GP IIb/IIIa yes			GP IIb/IIIa no		
	OR	95% CI	p-value	OR	95% CI	p-value
Clopidogrel pre-treatment (yes vs. no)	**0.4**	**0.19-0.83**	**0.01**	**0.88**	**0.39-1.95**	**0.75**
Cardiogenic shock (yes vs. no)	27.6	15.3 - 49.6	<0.01	21.7	10.7 - 44.1	<0.01
Resuscitation (yes vs. no)	1.63	0.85 - 3.11	0.14	2.83	1.21 - 6.60	0.02
Previous myocardial infarction (yes vs. no)	1.43	0.69 - 2.96	0.34	1.80	0.79 - 4.13	0.16
Year (2008-2009 vs. 2005-2007)	1.52	0.87 - 2.64	0.14	1.26	0.64 - 2.44	0.50
Gender (male vs. female)	1.18	0.66 - 2.11	0.57	1.31	0.64 - 2.67	0.46
Age (per year)	1.04	1.02 - 1.06	<0.01	1.06	1.03 - 1.09	<0.01
ASA / heparin pre-treatment	0.70	0.36 -	0.31	0.92	0.37 -	0.85

Dörler J et al. EHJ 2011