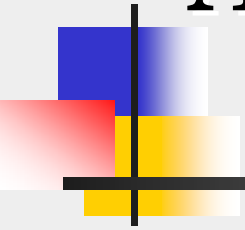


Update in the Management of Acute Myocardial Infarction

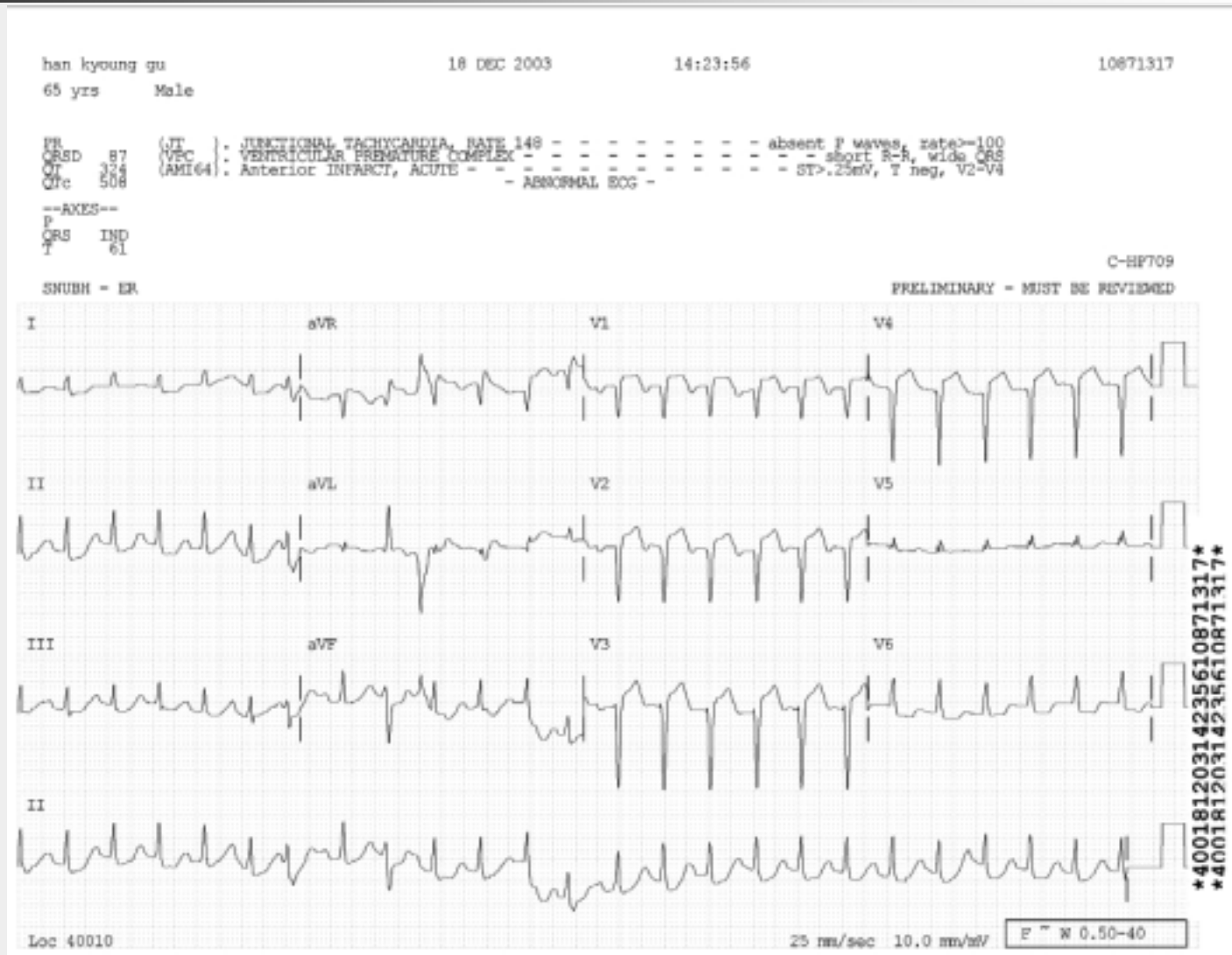




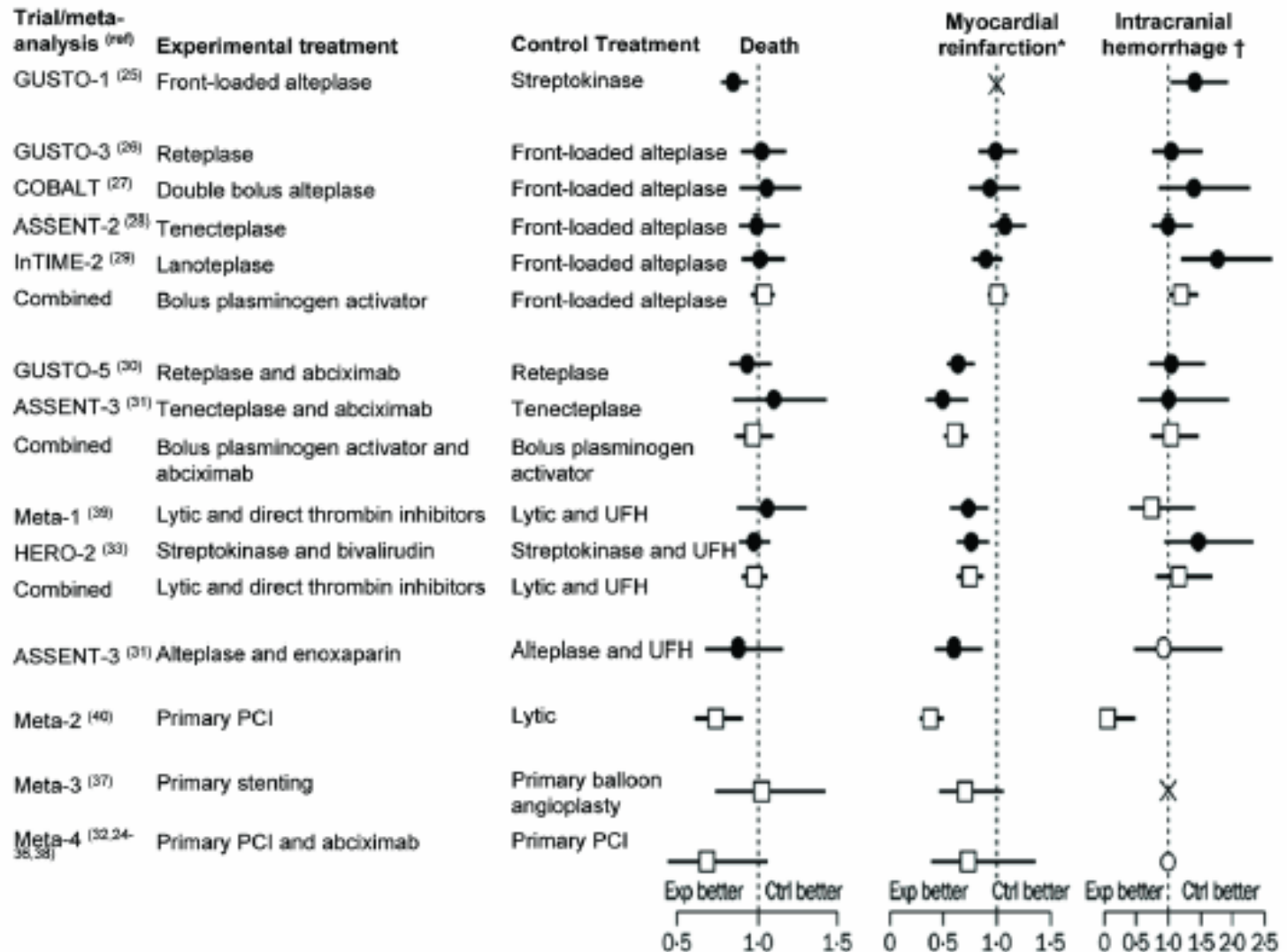
Case - History

- 65/M
- CC: severe dyspnea for 12 hours
- circulatory collapse during management for pneumonia at local hospital
- HT with irregular medication
- Heavy smoker
- BP : 90/45 mmHg HR : 136/m

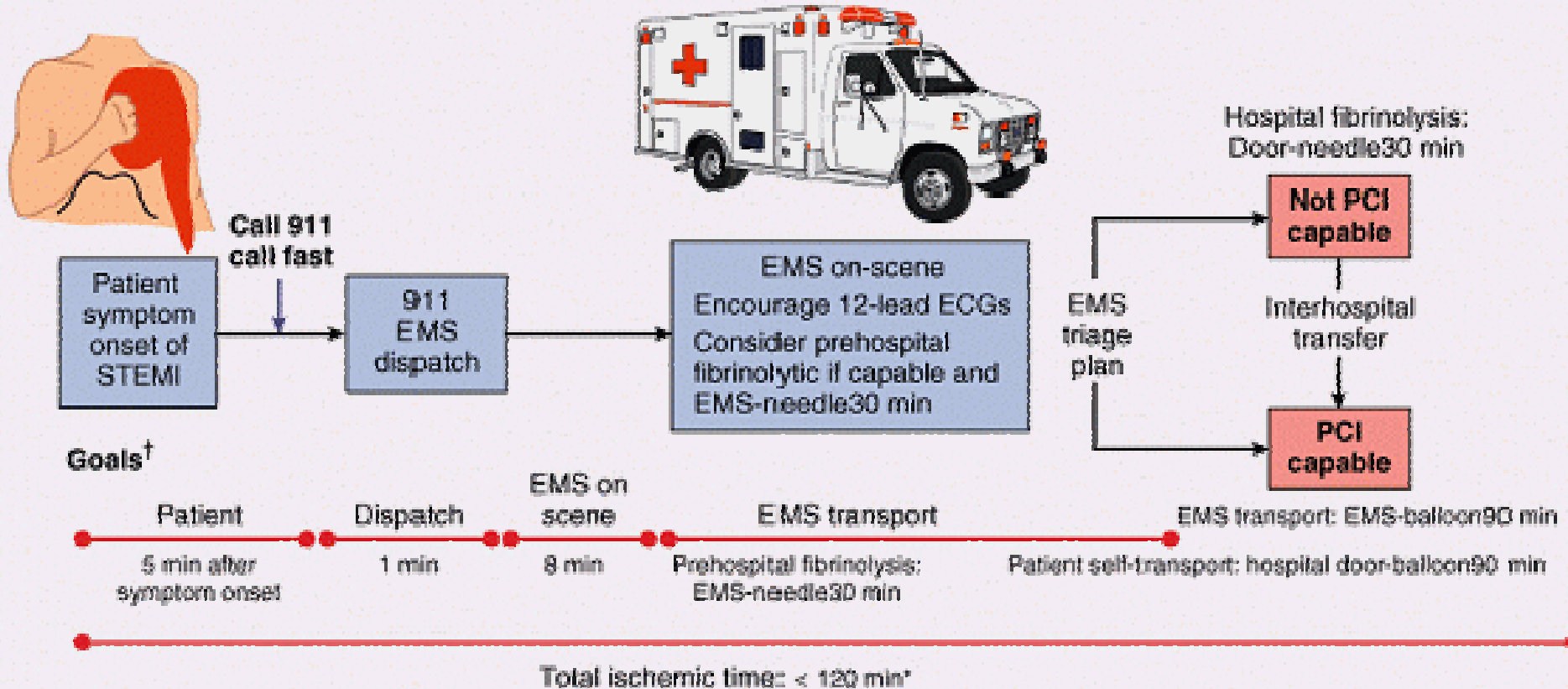
Case - Initial ECG



Relative treatment effect in several reperfusion modalities



Options for transportation & initial reperfusion treatment



*Golden hour = first 60 minutes

Efficacy of prehospital lysis

First Author and Reference	Year	Location	N	Design	Agent	End Points	Prehospital	Inhospital	p
Grampian Region Early Arteriotipase Trial (GREAT) Group (170)	1992-94	Grampian Region of Scotland	311	R, DB, PC	Arteriotipase	Time to treatment (mean)	101 min	240 min	NR
						Confirmed MI	99%	NR	NR
						Mortality (3 mo)	8%	15.5%	0.04
						Stroke	0.6%	0.6%	0.7
						Q-wave MI	53.3%	67.9%	0.02
						Q-wave MI (Rx less than 2 h)	50.0%	70.1%	0.01
						Q-wave MI (Rx greater than 2 h)	59.1%	64.4%	0.6
Werner (159)	1993-95	Seattle	360	R, DB, PC	Abolase	Time to treatment (mean)	77 min	110 min	less than 0.001
						Confirmed MI	98%	NR	NR
						Mortality (in-hospital)	5.7%	8.1%	0.49
						HF (MUGA)	5.3%	54%	0.34
						SPECT infarct size	6.3%	6.3%	0.72
						Serious bleeding	6%	6%	NS
						Stroke	2.28%	1.08%	NS
European Myocardial Infarction Project (EMIP) Group (171)	1993-97	Europe, Canada	5469	R, DB	Arteriotipase	Time to treatment (mean)	130 min	190 min	NR
						Confirmed MI	87%	NR	NR
						Mortality (30 d)	9.7%	11.1%	0.08
						Serious bleeding	1.2%	1.4%	NS
						Stroke	1.6%	1.5%	NS
Moraw (172)	1999-2001	United States	315	HC	Retolase	Time to treatment (median)	EMS-let rPA before = 31 min	EMS-in-hospital lytic = 63 min	less than 0.0001
Bournefoy* (173)	2000	France	840	R	Abolase	Strategy	Prehospital lysis	Primary PCI	
						Time to treatment (median)	130 min	150 min	NS
						Death, MI, or stroke	8.2%	6.2%	0.29
						Death	3.8%	4.8%	0.61
						Reinfarction	3.7%	1.7%	0.13
Disabling stroke	1%	0%	0.12						



Prehospital Issues

- Emergency care system
- Automated external defibrillator (AED)
- Prehospital fibrinolysis
 - IIa in 2004 ACC/AHA guideline
 - Establishment of a prehospital fibrinolysis protocol is reasonable in 1) settings in which physicians are present in the ambulance or 2) well-organized EMS systems with full-time paramedics who have 12-lead ECGs in the field with transmission capability, paramedic initial and ongoing training in ECG interpretation and STEMI treatment, on-line medical command, a medical director with training/experience in STEMI management, and an ongoing continuous quality-improvement program. (*Level of Evidence: B*)



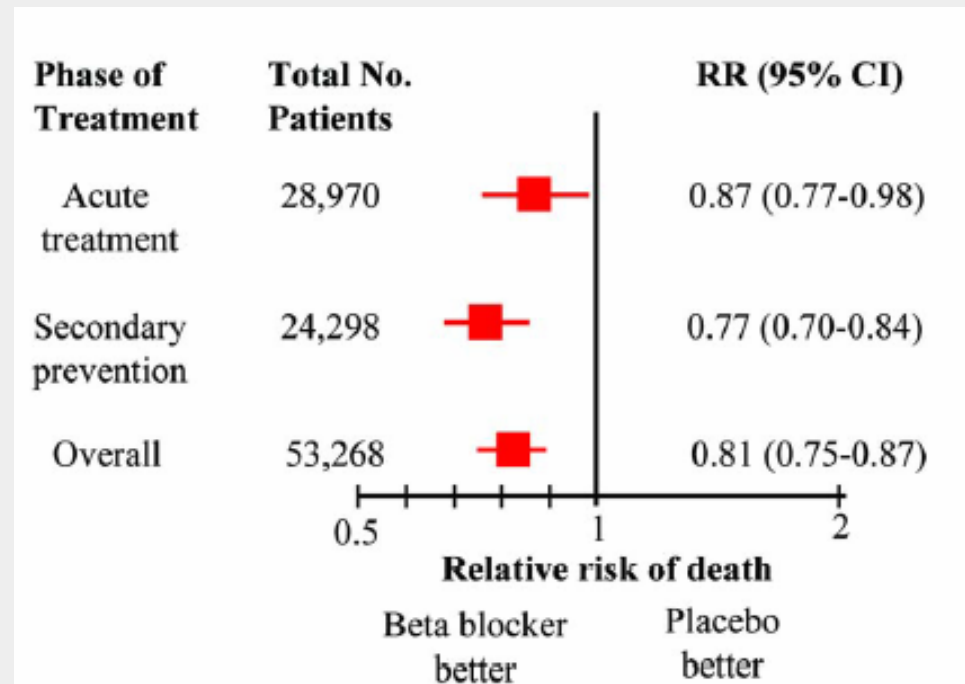
Prehospital destination protocol

Class I

1. Patients with STEMI who have cardiogenic shock and are less than 75 years of age should be brought immediately or secondarily transferred to facilities capable of cardiac catheterization and rapid revascularization (PCI or CABG) if it can be performed within 18 hours of onset of shock. (*Level of Evidence: A*)
2. Patients with STEMI who have contraindications to fibrinolytic therapy should be brought immediately or secondarily transferred promptly (i.e., primary receiving hospital door-to-departure time less than 30 minutes) to facilities capable of cardiac catheterization and rapid revascularization (PCI or CABG). (*Level of Evidence: B*)
3. Every community should have a written protocol that guides EMS system personnel in determining where to take patients with suspected or confirmed STEMI. (*Level of Evidence: C*)

Initial management

- Oxygen ($SaO_2 < 90\%$)
- Nitroglycerin, SL or IV
- Analgesia: Morphine
- Aspirin
- Beta blocker !!



Case - Initial chest PA





Case - Lab finding

- ABGA: 7.04-45-27-12
→ 7.23-36-71-15
- CK 2155 IU/L (20-270)
- LD 753 IU/L (100-225)
- CK-MB 332 ng/ml (0-3.6)
- Troponin I 127.6 ng/mL (0-0.5)
- BUN/Cr 25/2.8 mg/dL



Risk at initial presentation of AMI

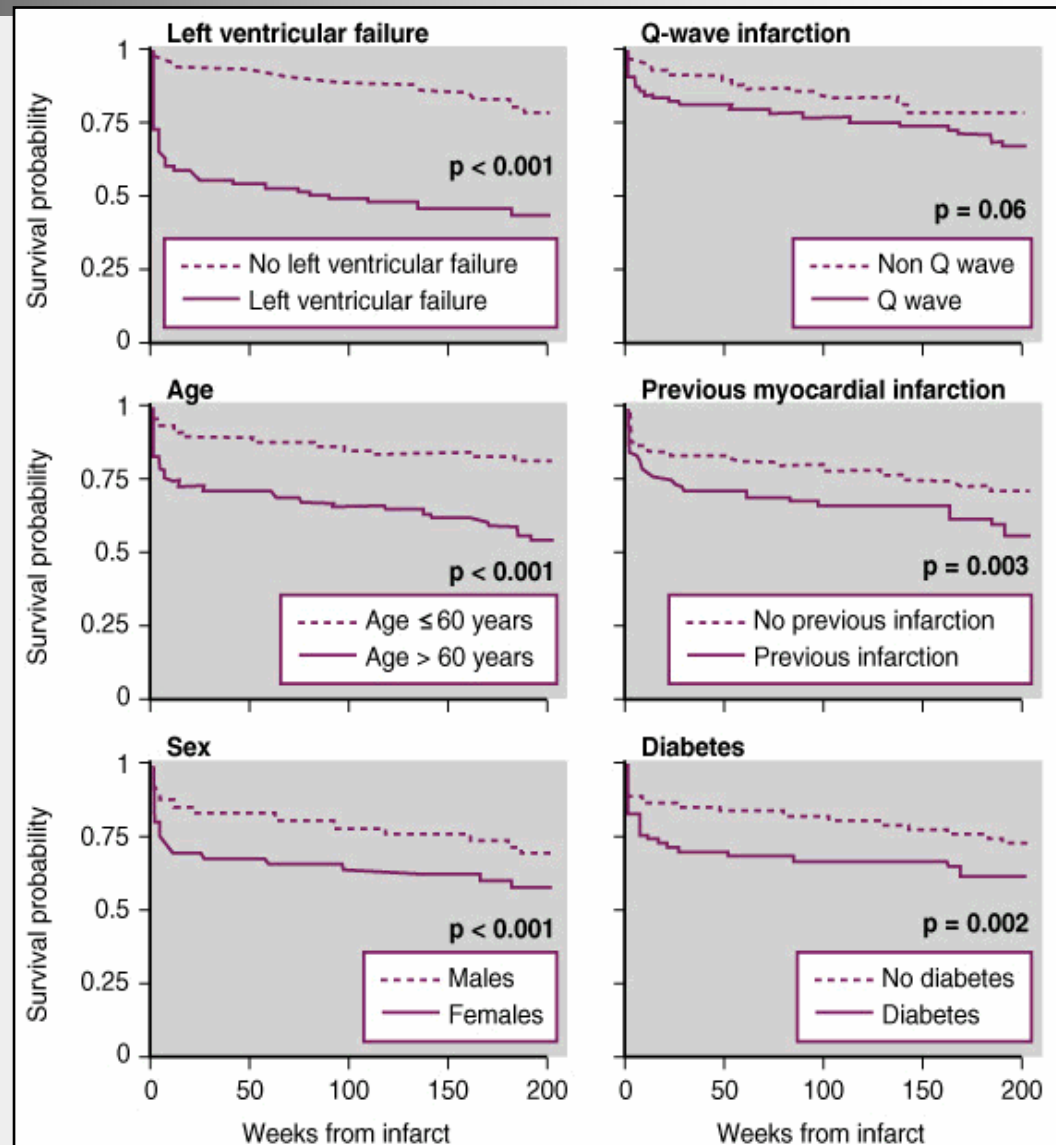
■ Clinical parameters

- Female
- Old age
- DM
- Prior angina pectoris or previous MI
- Cardiogenic shock or complication of MI

■ EKG

- Anterior wall MI
- Inferior wall MI with RV infarction
- ST change: multiple leads or high sum
- High grade block: > type 2 Morbitz, I VCD

Risk factors at initial presentation



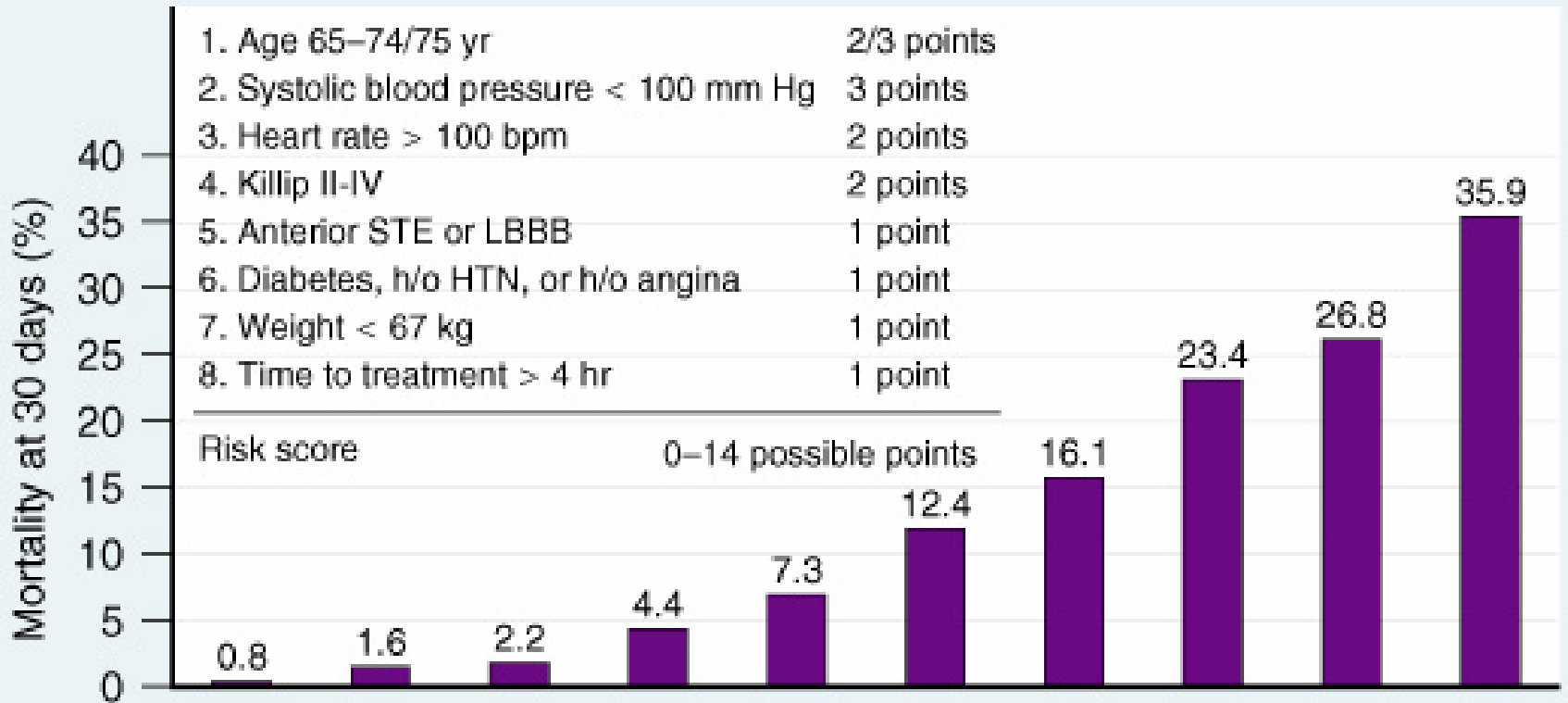


Outcomes by gender in CADILLAC

outcomes	Women (n=562)	Men (n=1520)	p
Hypotension, in - hospital (%)	8.9	4.7	<0.00 ¹
New CHF, in - hospital (%)	6.6	3.5	0.003 ¹
CPR, in - hospital (%)	1.1	0.1	0.002
Delay in presentation (hr)	2.05	1.68	<0.00
Door - to - balloon time (hr)	2.18	1.95	<0.00 ¹
MACE, 1 year (%)	23.9	15.4	<0.00 ¹
Death, 1 year (%)	7.6	3.0	<0.00 ¹
TVR, 1 year (%)	16.7	12.1	0.006 ¹
Moderate/severe bleeding, 1 year (%)	7.2	2.8	<0.00 ¹

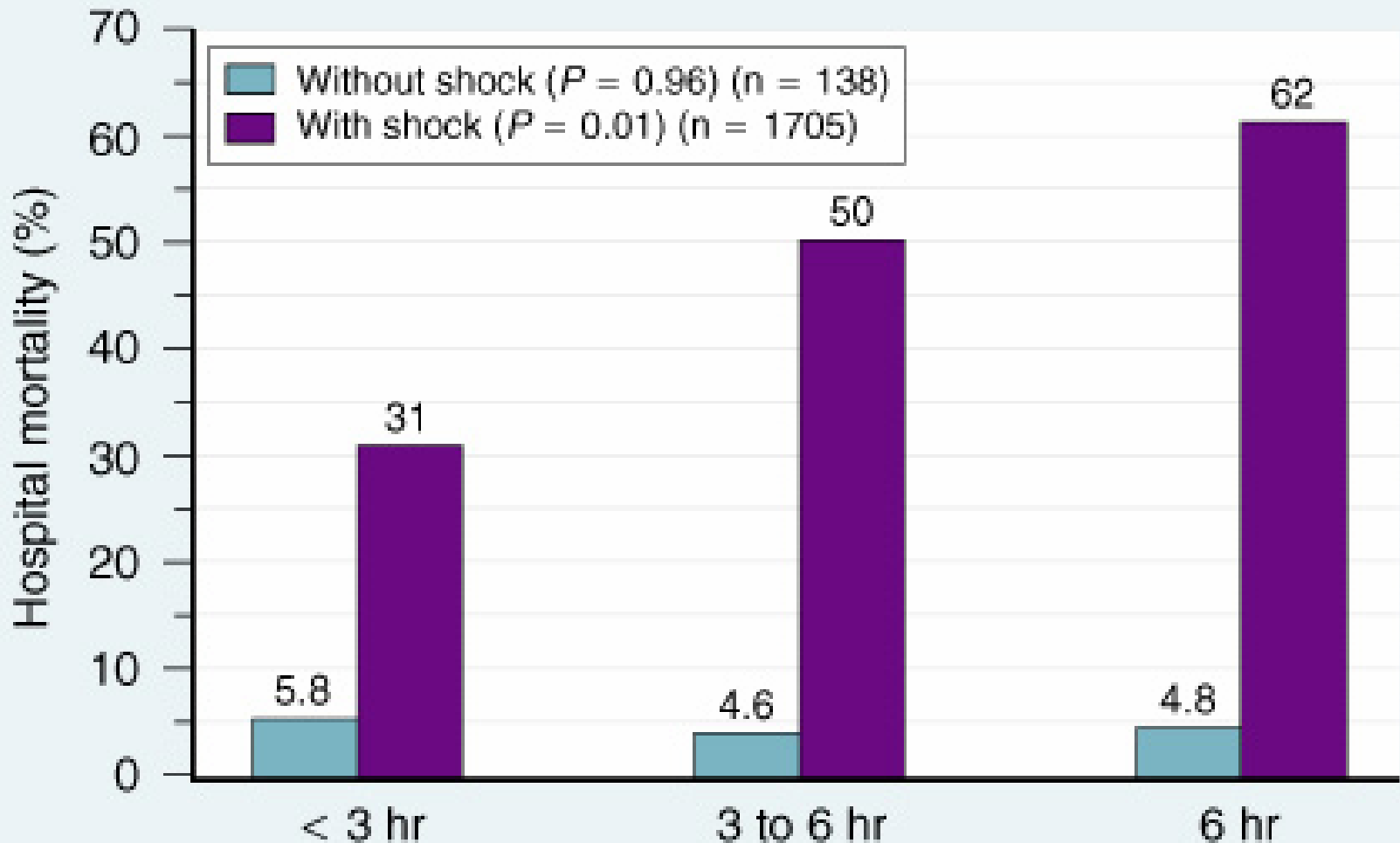
Lansky AJ. Circulation 2005

TIMI risk score for STEMI predicting 30-day mortality



Risk score	0	1	2	3	4	5	6	7	8	> 8
At risk (%)	12%	22%	16%	16%	14%	9%	6%	3%	2%	1%

In-hospital mortality by time to reperfusion regarding presence of shock





Case - Initial management

- CPR
- Inotropics (LV EF 25%)
- Ventilator
- IABP
- Swan-Ganz catheterization
- Reperfusion therapy
 - Thrombolysis vs. PCI or CABG



Reperfusion option: assess time & risk

- Time since onset of symptoms
- Risk of STEMI
- Risk of fibrinolysis
- Time required for transport to a skilled PCI lab

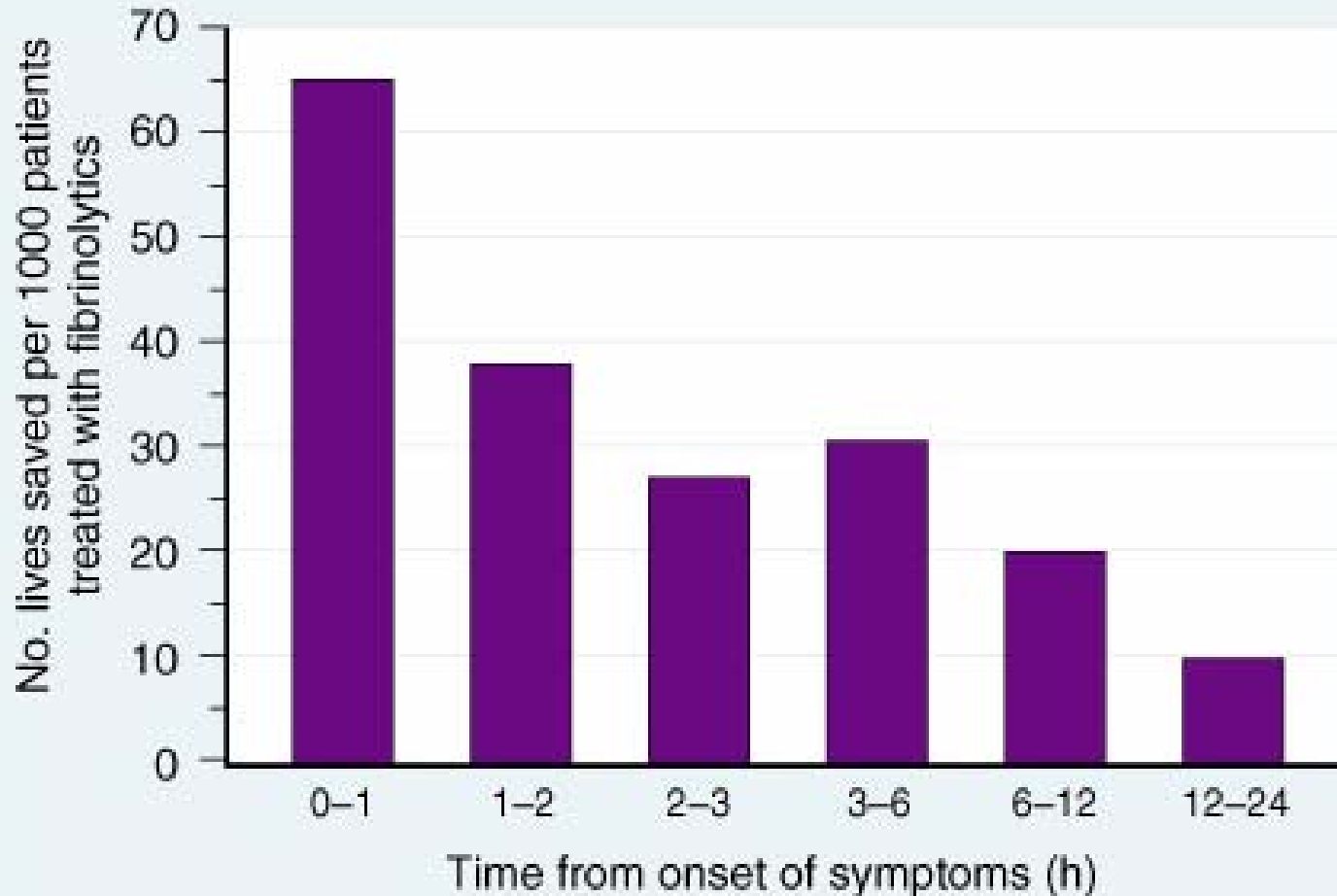


Indication for fibrinolysis

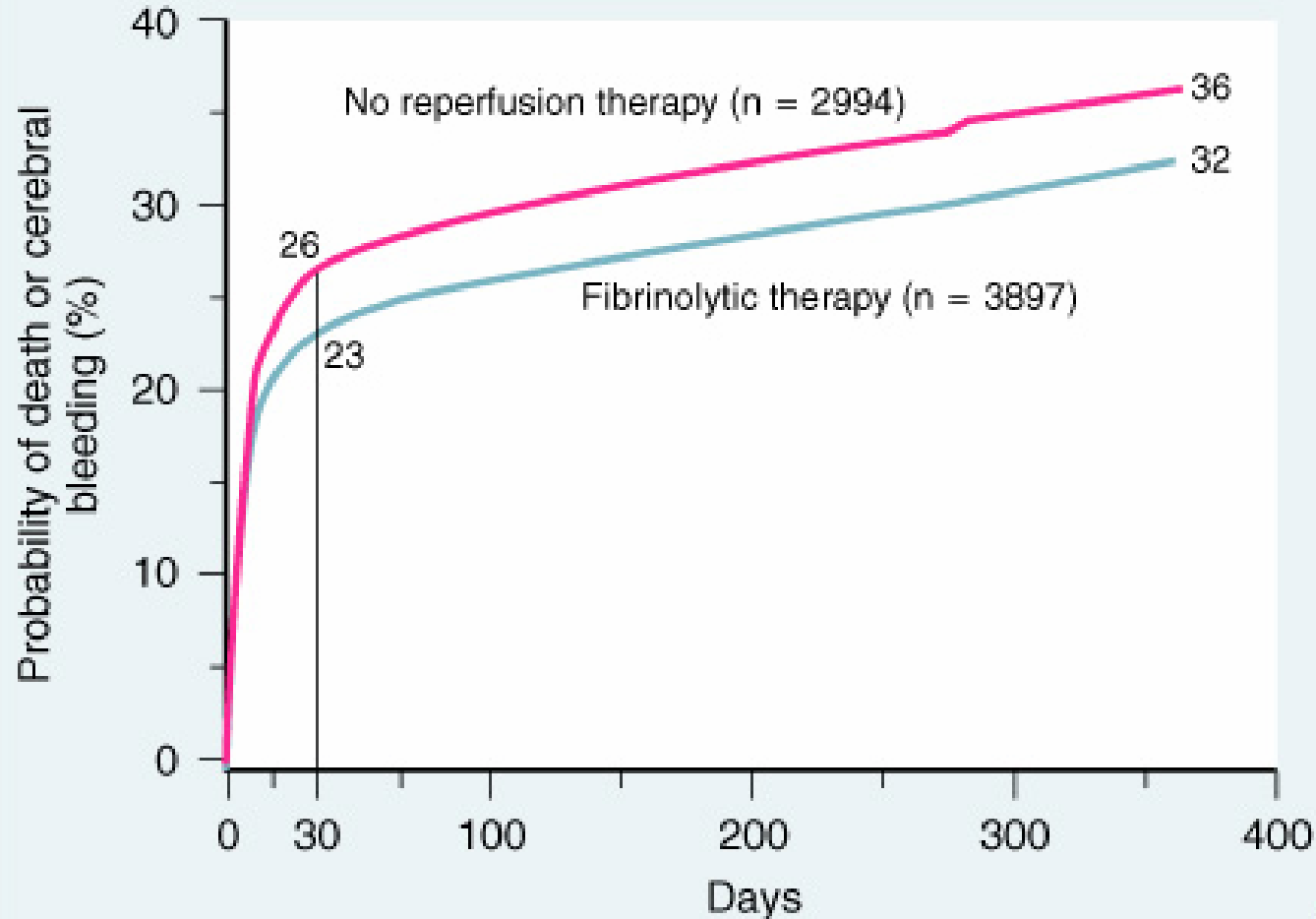
Class I

1. In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and ST elevation greater than 0.1 mV in at least 2 contiguous precordial leads or at least 2 adjacent limb leads. (*Level of Evidence: A*)
2. In the absence of contraindications, fibrinolytic therapy should be administered to STEMI patients with symptom onset within the prior 12 hours and new or presumably new LBBB. (*Level of Evidence: A*)

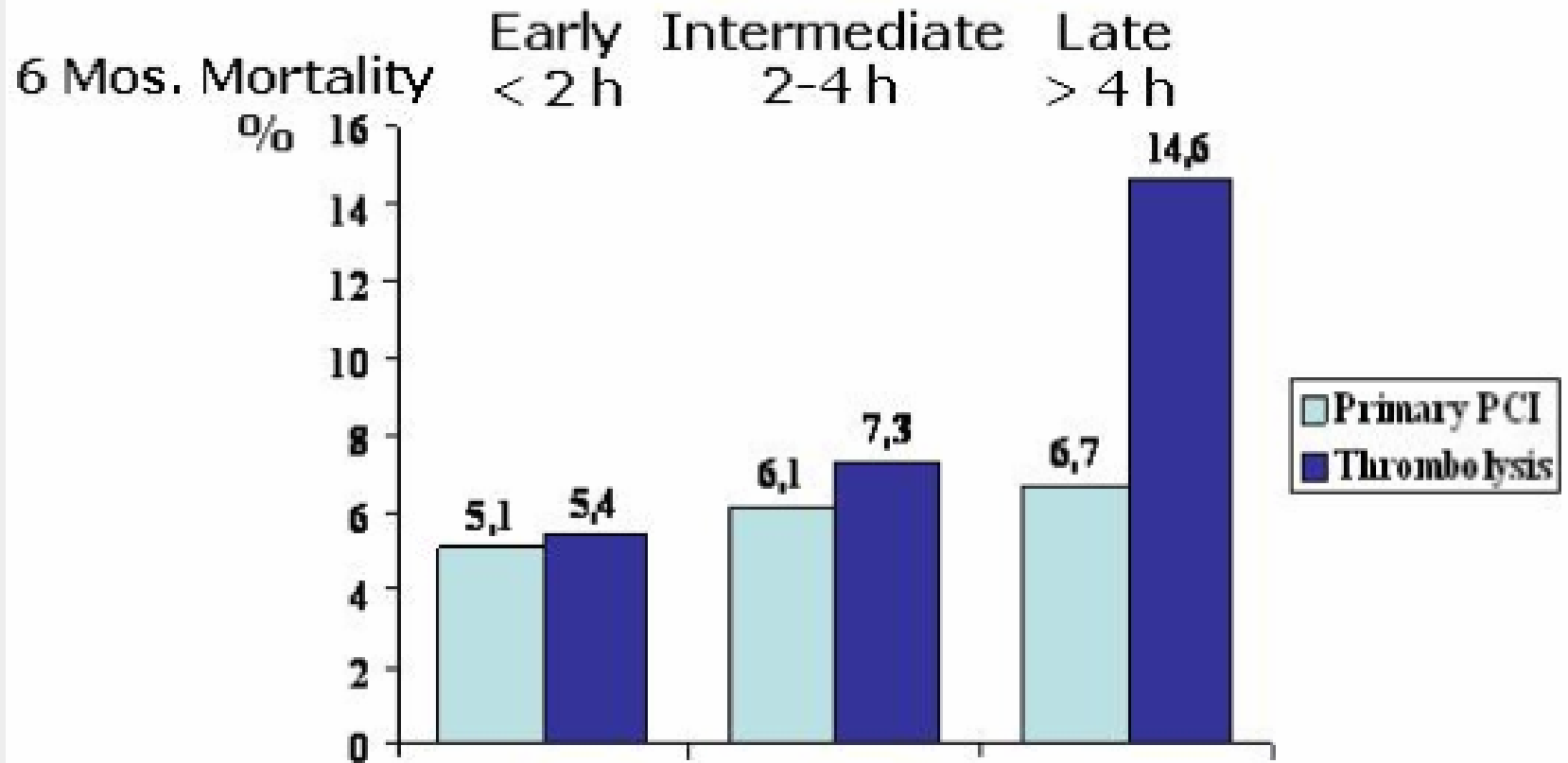
Importance of time to reperfusion in patients receiving thrombolytic therapy



Effect of thrombolytic therapy on death and cerebral bleeding (RR = 0.87)



Importance of time to PCI & lysis





Fibrinolysis > PCI

- Early presentation < 3hr
- PCI is not an option
 - Cath lab occupied/not available
 - Vascular access difficulties
 - Lack of access to a skilled PCI lab
- Delay to invasive strategy
 - Prolonged transport
 - (door-to-balloon) - (door-to-needle) > 1hr
 - Door-to-balloon time > 90min



Thrombolysis with IIb/IIIa blocker

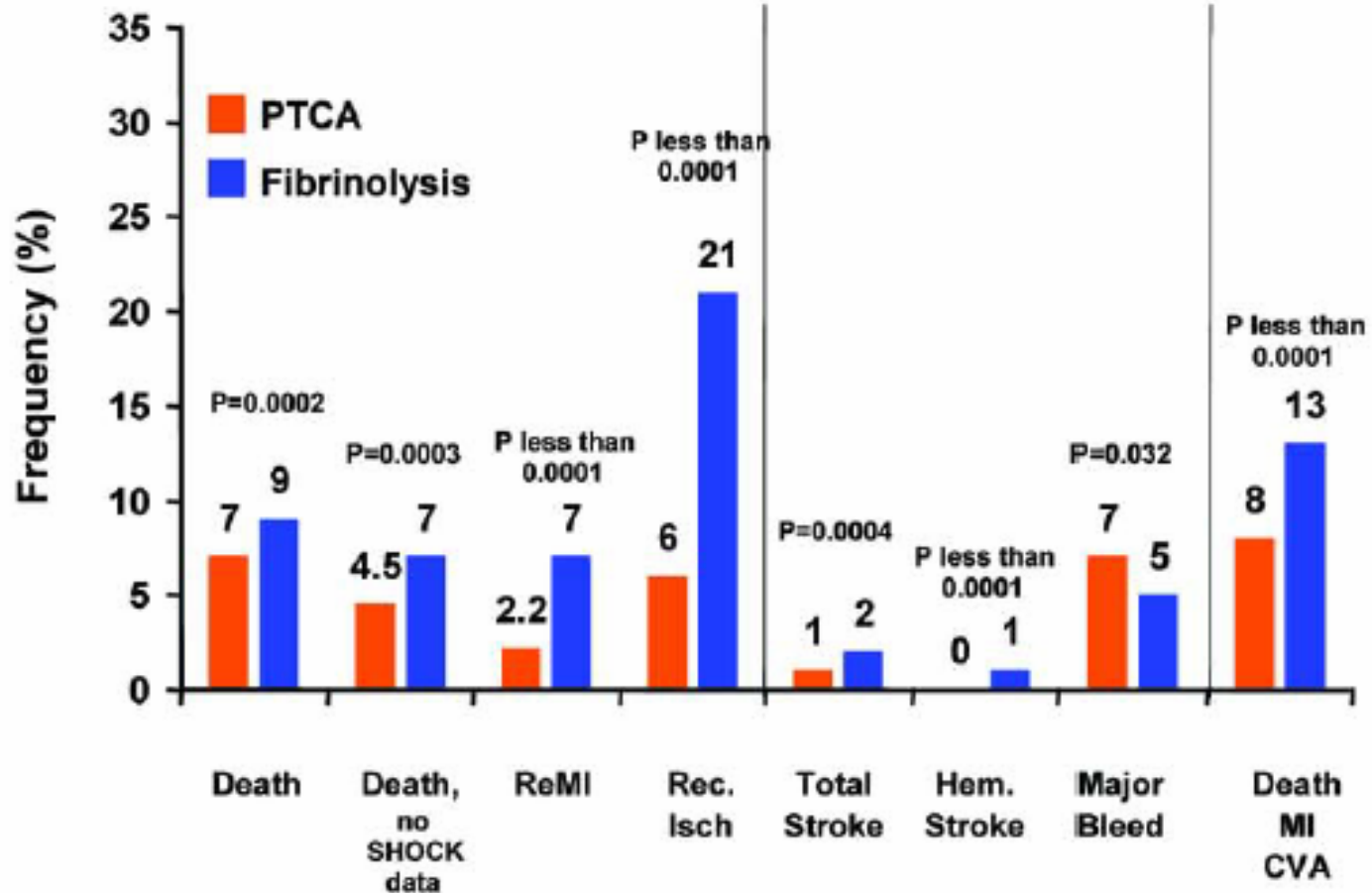
Class IIb

Combination pharmacological reperfusion with abciximab and half-dose reteplase or tenecteplase

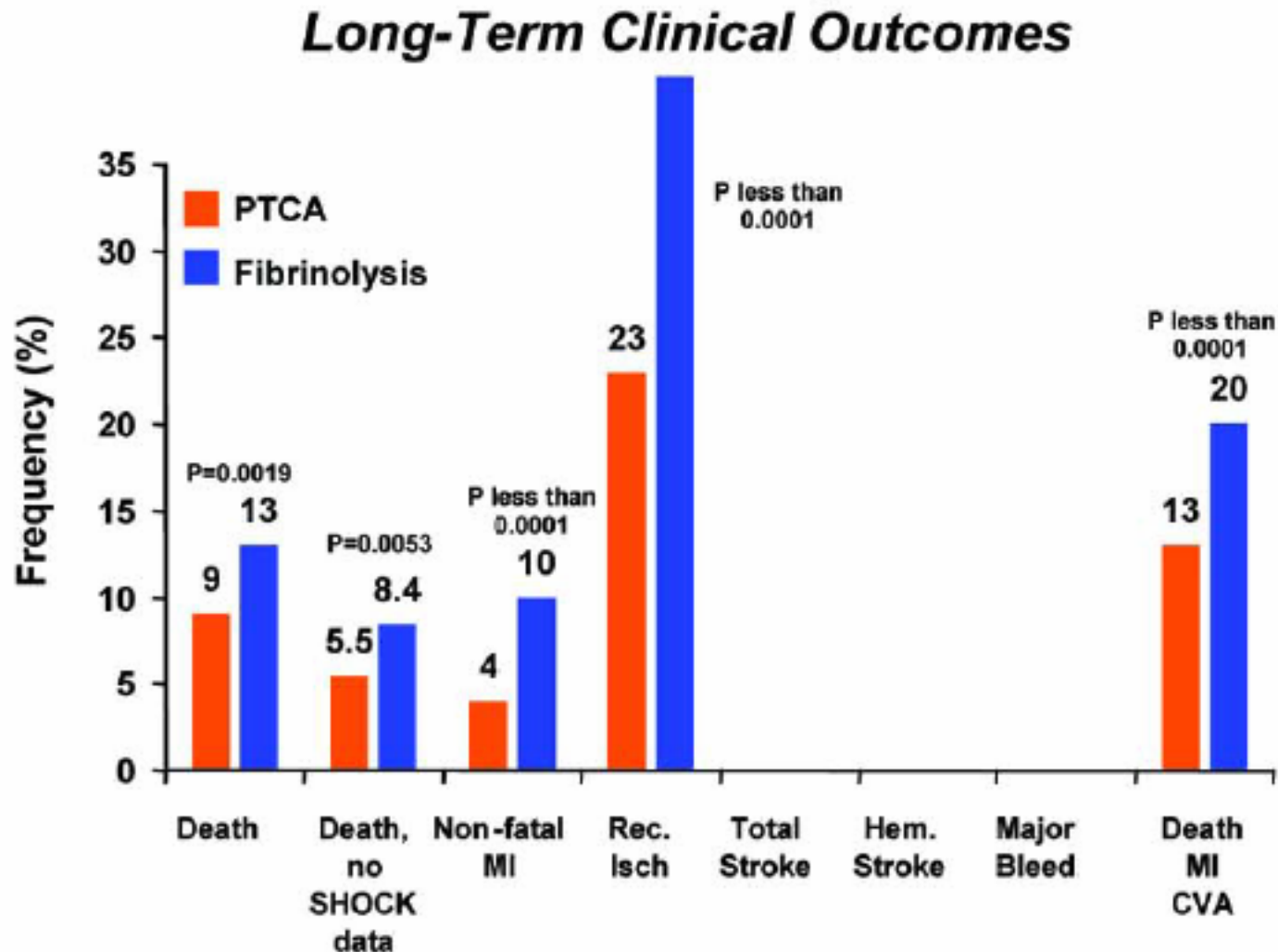
1. for **prevention of reinfarction** (*Level of Evidence: A*) and other complications of STEMI in selected patients: **anterior location of MI, age less than 75 years, and no risk factors for bleeding**. In two clinical trials of combination reperfusion, the prevention of reinfarction **did not translate into a survival benefit** at either 30 days or 1 year (*Level of Evidence: B*).
2. for prevention of reinfarction and other complications of STEMI in selected patients: anterior location of MI, age less than 75 years, and no risk factors for bleeding in whom an early referral for angiography and PCI (i.e., **facilitated PCI**) is planned. (*Level of Evidence: C*)

PCI vs. Thrombolysis (1)

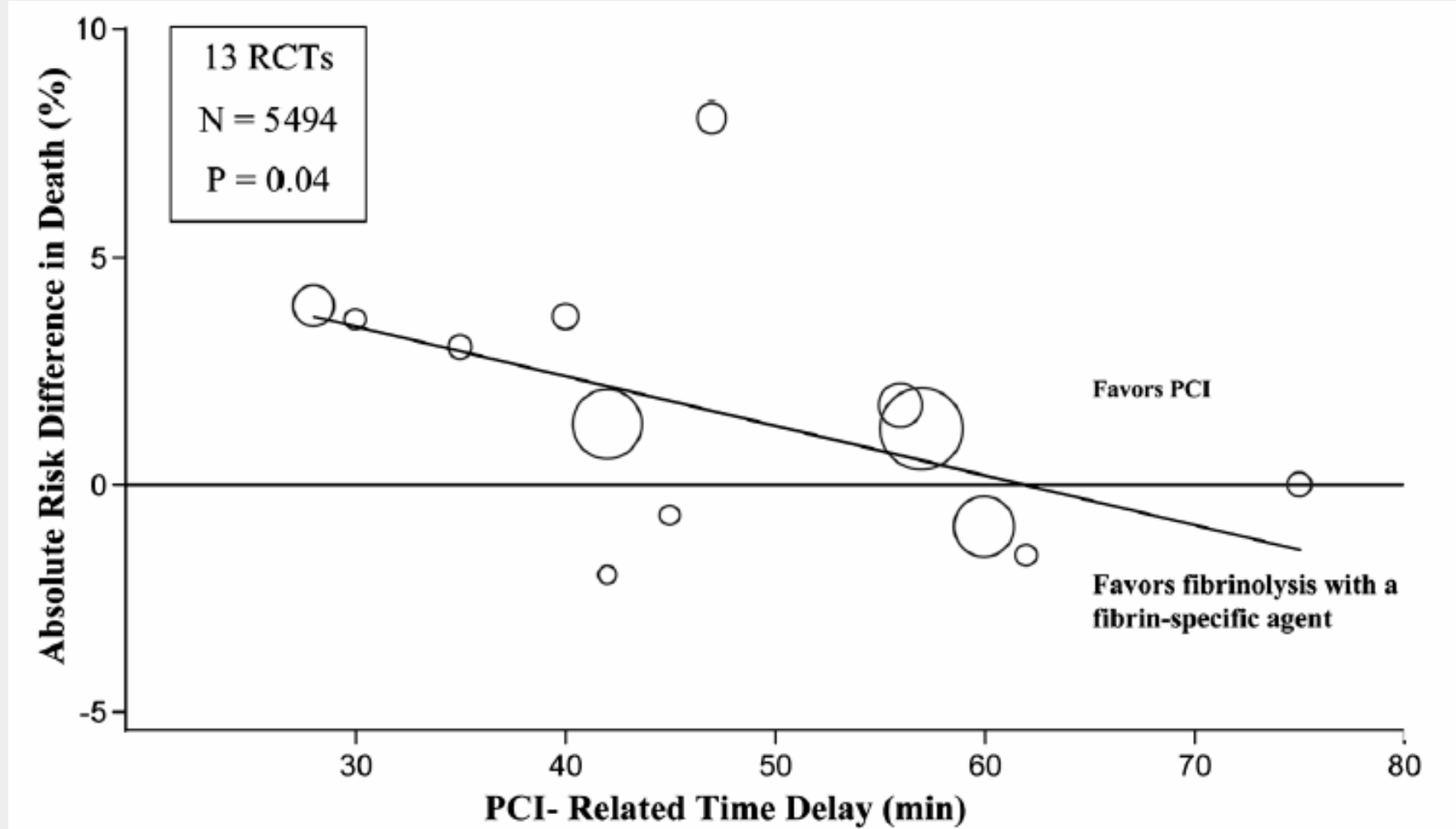
Short-Term Clinical Outcomes



PCI vs. Thrombolysis (2)

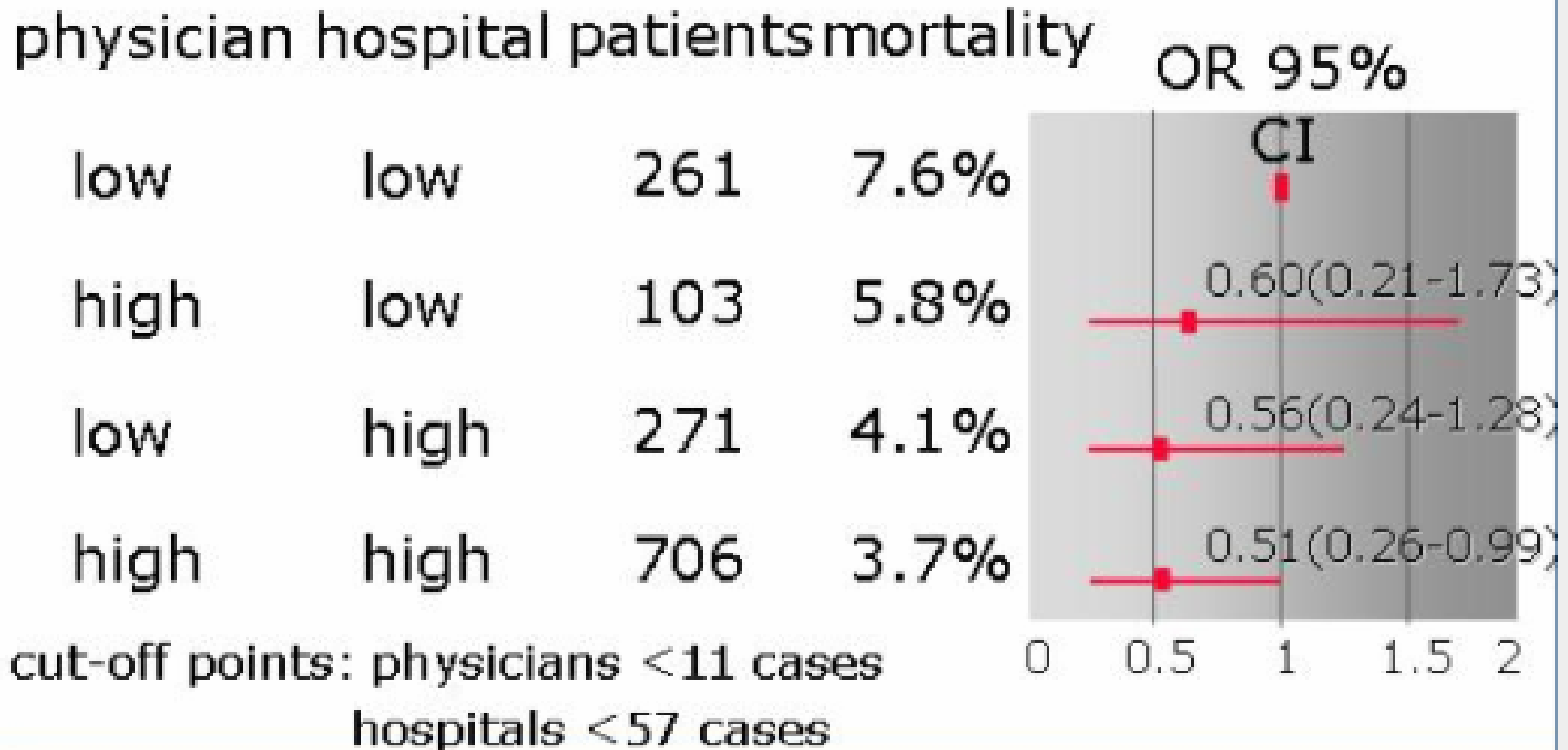


PCI vs. Lysis : Timing is Everything



1995 NY primary PCI registry (n=1342)

Case load and 30-day mortality





PCI > fibrinolysis

- Skilled PCI lab available with surgical backup
 - (door-to-balloon) - (door-to-needle) < 1hr
 - Door-to-balloon time < 90min
- High risk from STEMI
 - Cardiogenic shock
 - Killip class ≥ 3
- Contraindication to lysis: bleeding risk, ICH
- Late presentation ≥ 3 hr
- Diagnosis of STEMI is in doubt



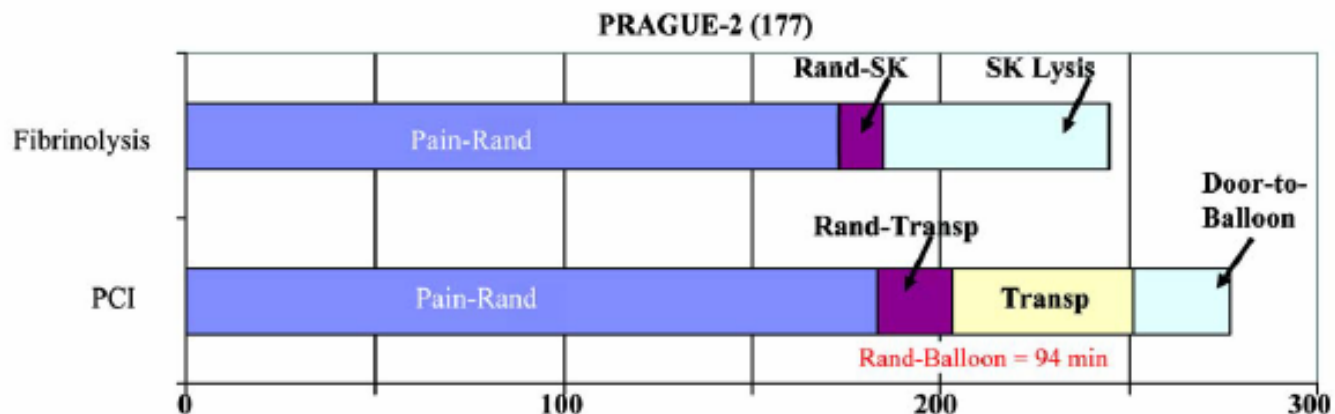
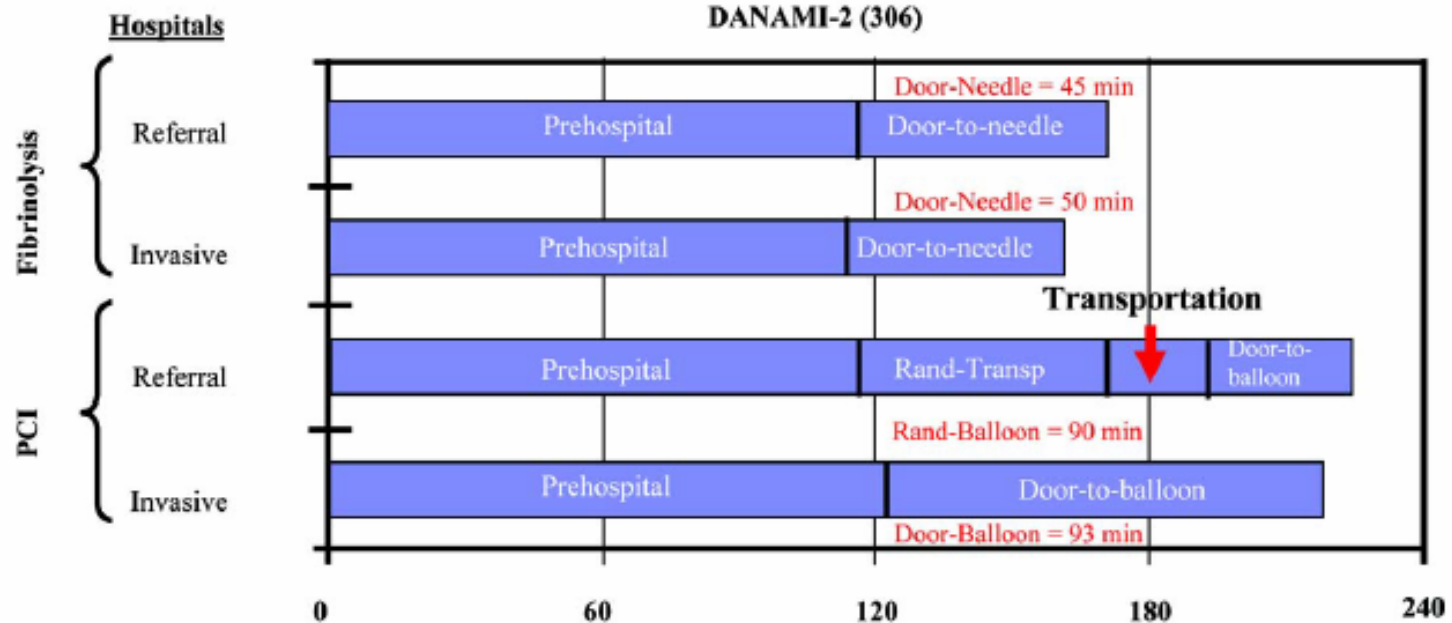
BRAVE-2

■ Asymptomatic AMI after 12 hrs

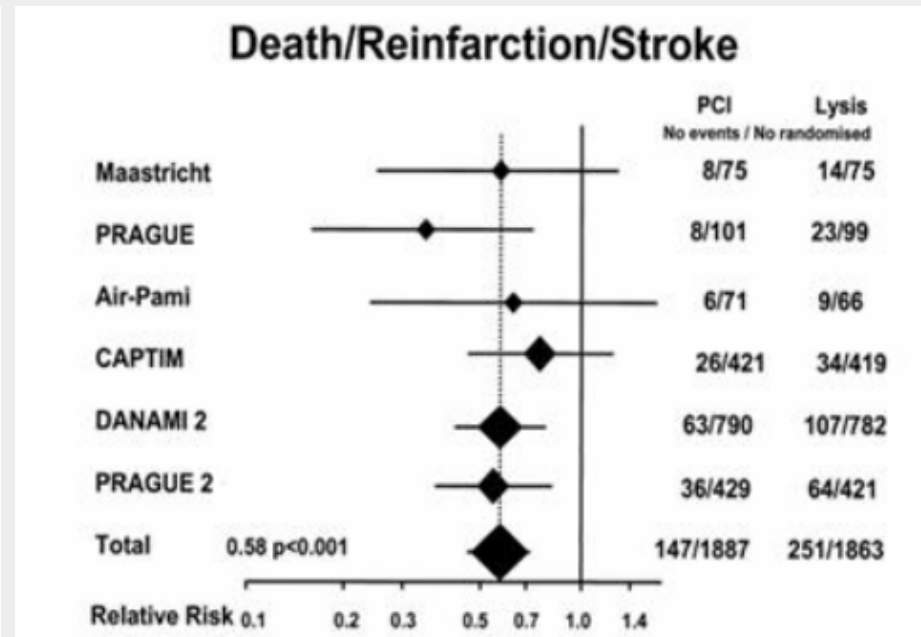
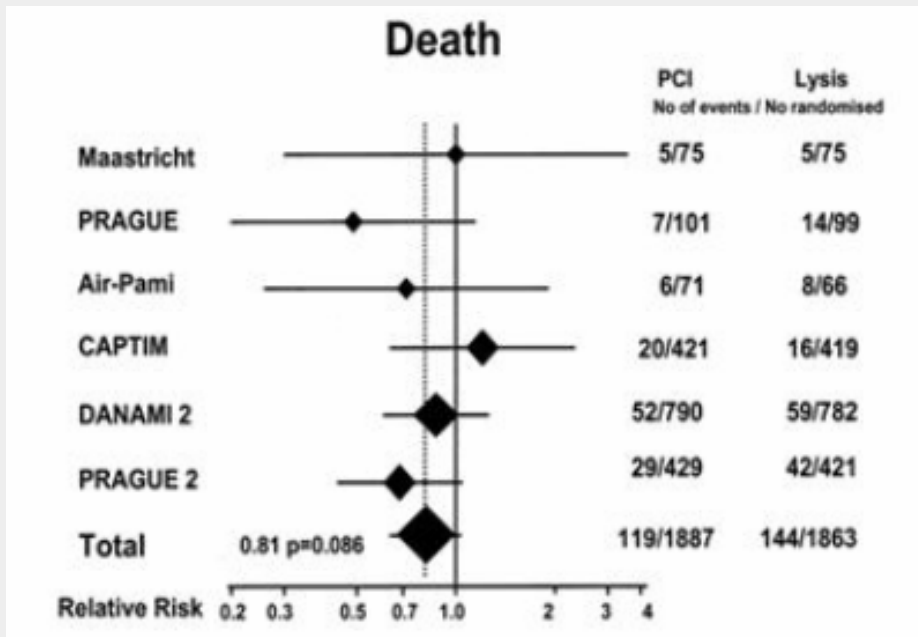
End points	Invasive	Conservative	p
Infarct size (% of LV)	8	13	0.002
30 day outcome			
death	2	4	0.21
Death/MI/stroke	4	6.6	0.37
Unplanned PCI	1	33	

Kastrati A, ACC 2005

Transfer for PCI vs. thrombolysis



Transfer for PCI vs. lysis: meta-analysis



Time delay in NRM1-4

1st Door to Data:
9 min. (4-16 min.)

Data (Transport) to
Cath Lab Arrival:
132 min. (88-219 min.)

Cath Lab to
Balloon:
37 min. (28-50 min.)

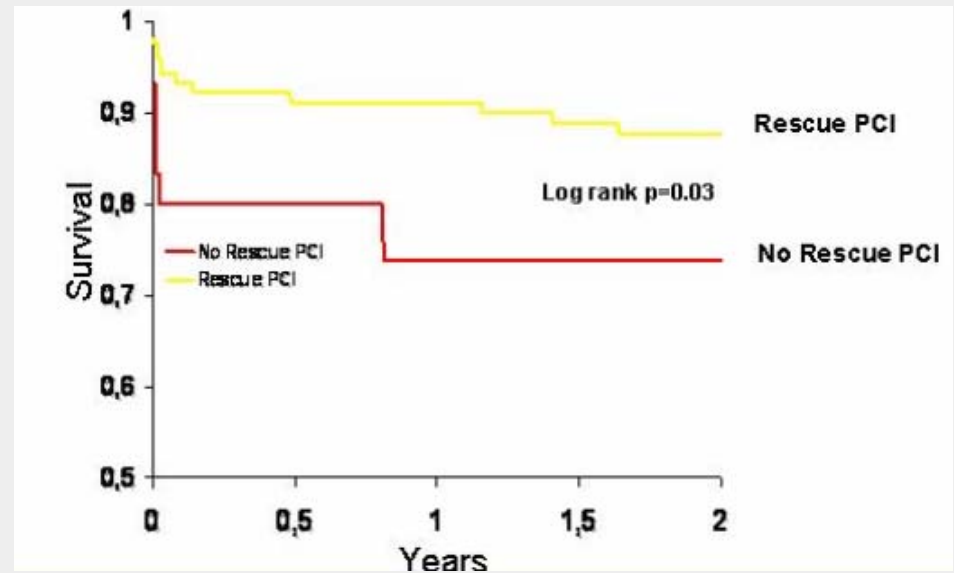


Total Door 1 to Balloon Time: 185 minutes (137-276 minutes)
Percent of Patients with Door-to-Balloon Time Less Than 90 Minutes: 3.0%

Sample Size: 1346; Time Period: January 2002 – December 2002

PCI & thrombolysis

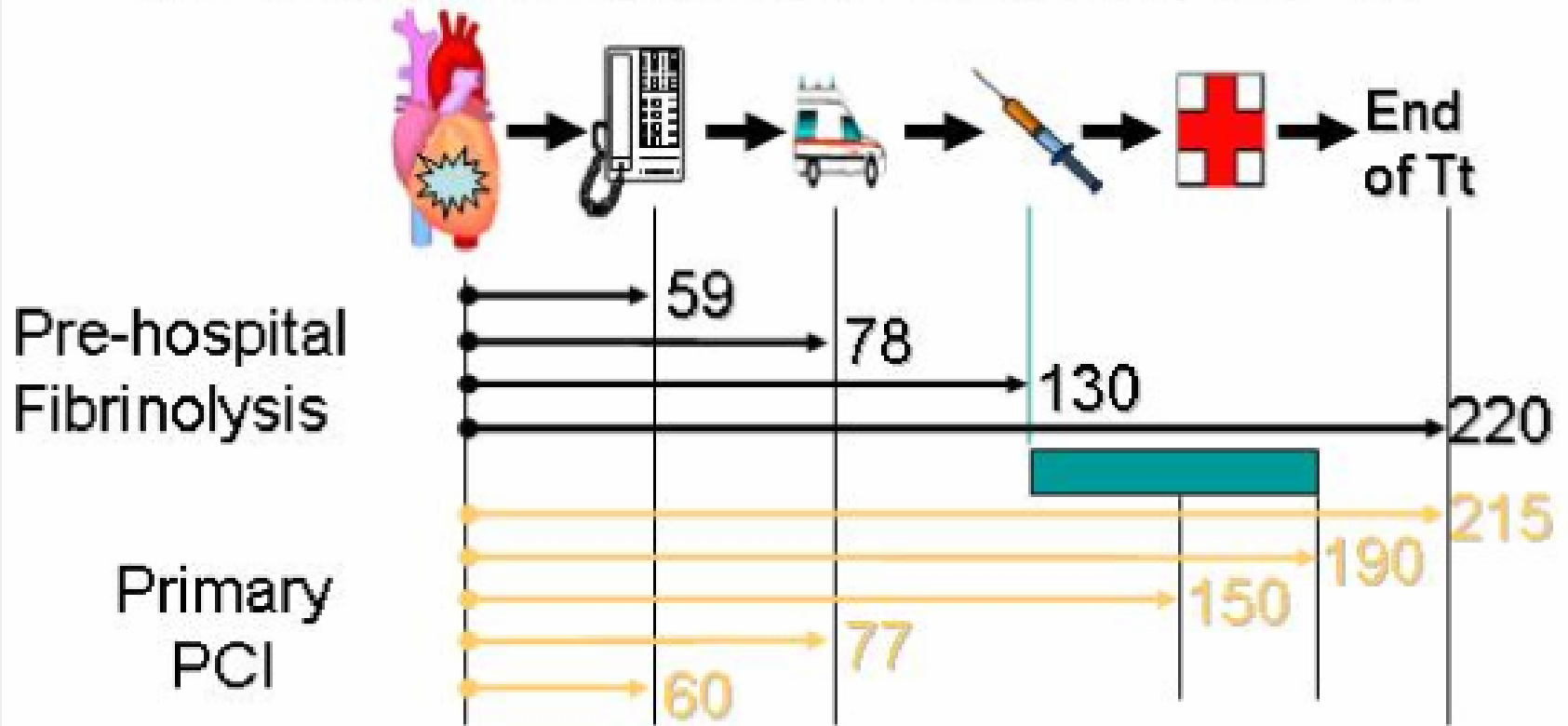
- PCI aids lysis:
rescue PCI
 - 2 year survival of
rescue PCI in failed
thrombolysis
(*Gibson, Circulation 2002*)



- Lysis aids PCI:
facilitated PCI

Potential advantages of facilitated PCI

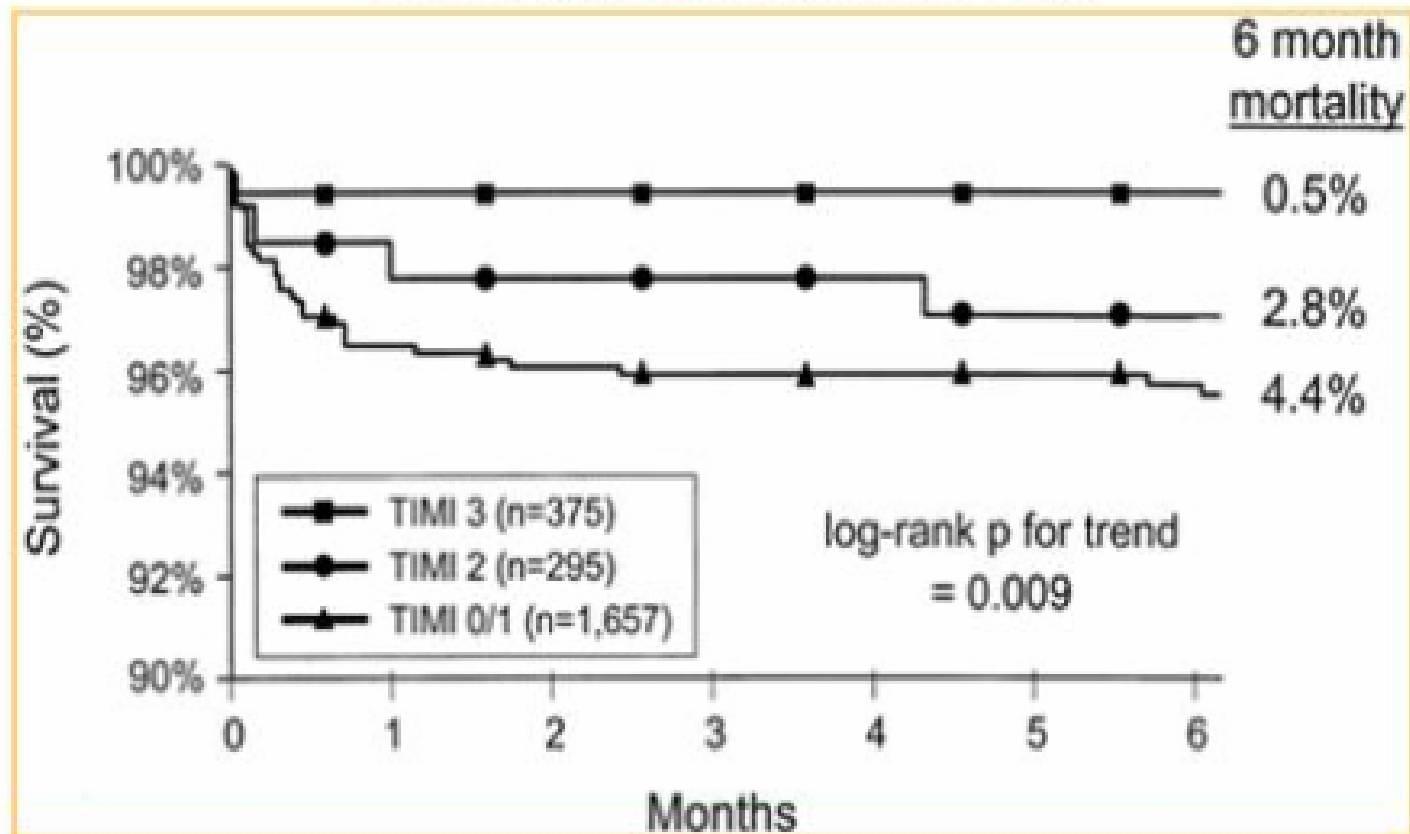
1 Fibrinolysis Initiates Reperfusion Early : CAPTIM



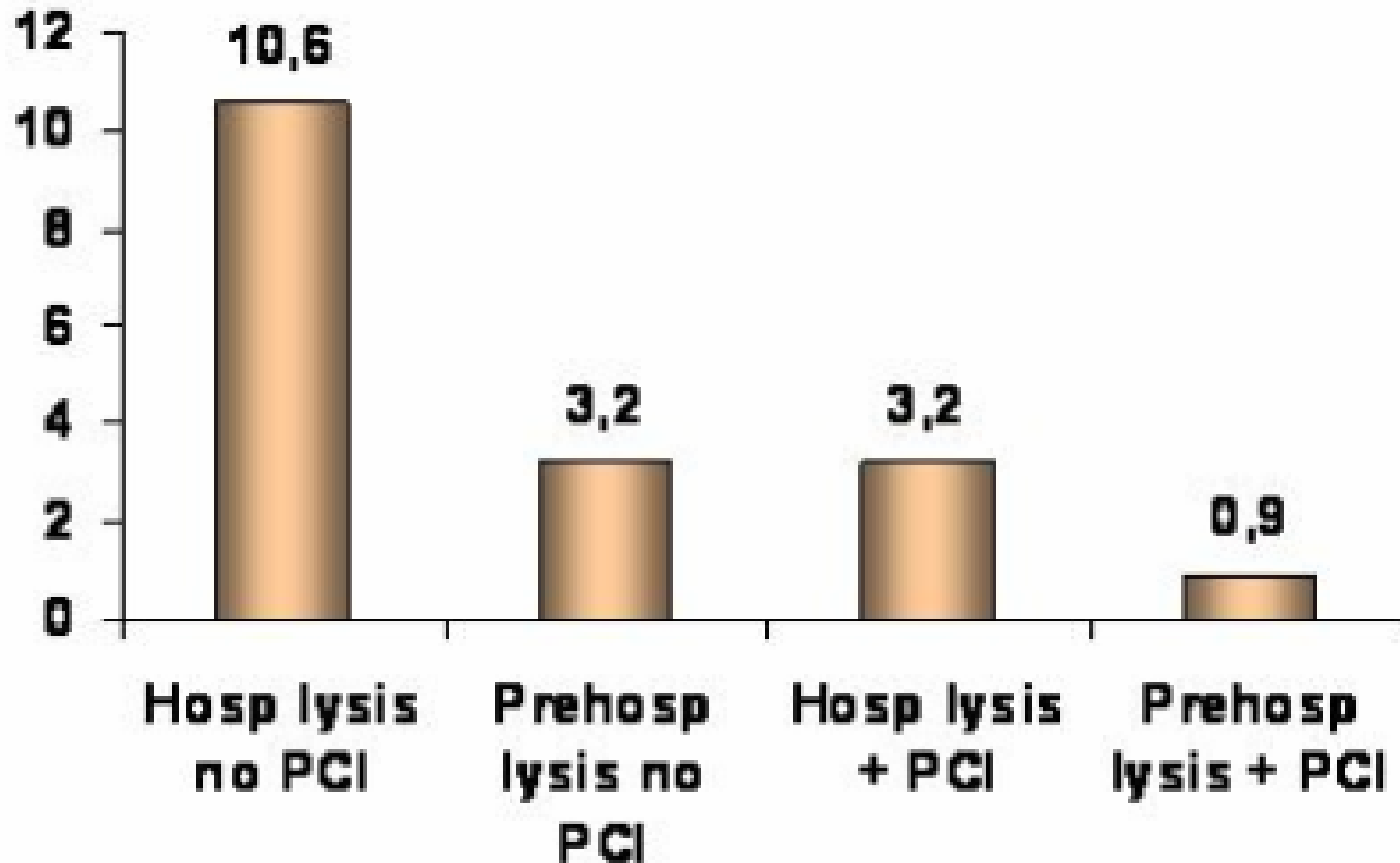
Delays are expressed as median (min)

Background of facilitated PCI

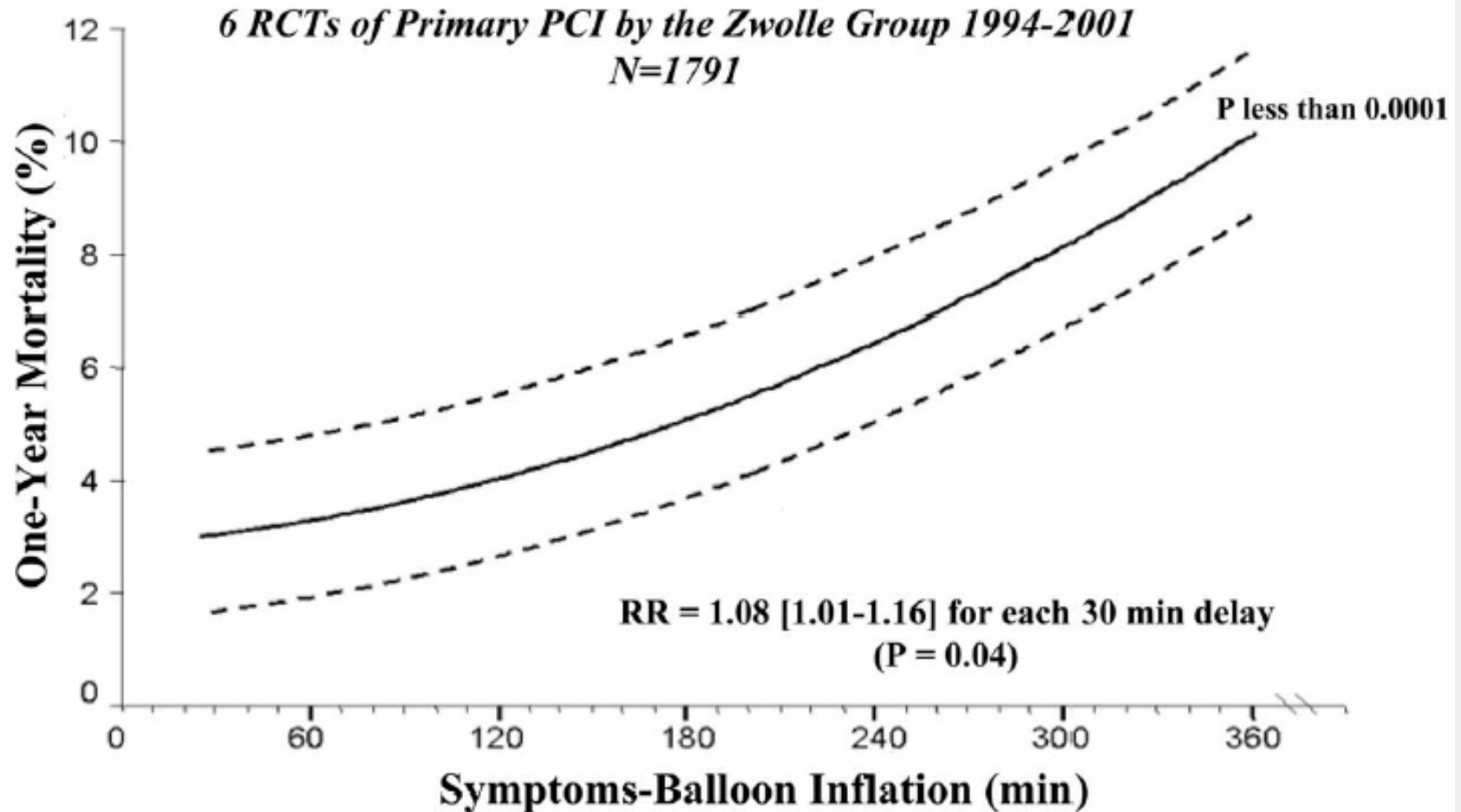
Normal Flow (TIMI-3) Before PCI is an Independent Determinant of Survival



Facilitated PCI in 2000's: 5 day mortality



Time to PCI is critical!





Stenting in AMI

- **Benefit or hazard of stenting**
 - Stent > balloon: immediate results, late outcome
 - Stent PAMI trial:
 - Lower TIMI 3 flow after stenting
 - 6 month mortality: 4.2%(stent) vs. 2.7%(balloon)
 - 6 month TVR: 7.7% vs. 17%
- **Stent trials in AMI**
 - Benefit: early and late TVR
 - No benefit on mortality
 - Exclusion of high risk patients (TVF → death)



PCI for AMI

- **Routine stent implantation for AMI**
 - better procedural success rate and clinical outcome than POBA
 - in-stent restenosis & vessel reocclusion
- **DES**
 - Virtually abolish in-stent restenosis in elective patients with relatively simple lesions and clinical subsets
- **? specific information about DES for AMI**
 - Safety and clinical efficacy



DES in AMI (STEMI): RESEARCH

- *Circulation 2003;108:1927-9*
- *F Saia, PA Lemos, C-H Lee, et al.*
- **96 patients with STEMI underwent PCI and routine SES implantation**
 - Primary PCI : 92.7%
 - Cardiogenic shock : 12.5%
 - Multivessel disease : 46.9%
 - Ant wall AMI : 42.7%
 - DM: 12.5%
- **6 month follow-up**
 - No stent thrombosis
 - **Late loss : -0.04 ± 0.25 mm**
 - No binary restenosis

Clinical benefit of SES compared to BMS for patients with AMI

- *J Am Coll Cardiol. 2004 Feb;43(4):704-8*
- *Lemos PA, Saia F, Hofma SH, et al.*
- **STEMI with primary PCI**
 - 186 patients with SES & 183 with BMS
- **30-days**
 - rate of death, reinfarction, or repeat revascularization: **7.5% vs. 10.4% (p=0.4)**
 - Stent thrombosis: 0% vs. 1.6% (p=0.1)
- **300-days**
 - rate of combined adverse events: **9.4% vs. 17% (hazard ratio 0.52; p=0.02)**
 - repeat intervention: 1.1% vs. 8.2% (HR 0.21; p=0.01)

Study Protocol : DES in AMI

66 STEMI for PCI May 2003 – Feb 2004

Single de novo lesion coverable by 1 stent

$2.5 < \text{RVD} < 4.0 \text{ mm}$

Lesion length $< 30 \text{ mm}$

↓
Randomize 1:1 (before pre-dilatation)

←
DES:
TAXUS or Cypher stent

→
Any BMS available

Angiographic F/U at 6 months

2005 SNUH



Clinical characteristics: DES in AMI

	DES (32)	BMS(34)	P value
Primary PCI (%)	90.6	85.3	0.51
LAD(%)	53.1	55.9	0.82
2 or 3 vss ds(%)	62.5	61.8	0.95
Shock(%)	9.3	0	0.11
ReoPro(%)	6.3	14.7	0.27
Peak CK-MB(ng/ml)	246±225	312±260	0.28
Pain to door (min)	265±260	279±236	0.83
LVEF (%)	49.2±11.1	50.0±10.6	0.86

2005 SNUH

6 mo CAG F/U : DES in AMI

	DES	BMS	P value
FU PRD (mm)	3.23	3.09	0.15
FU DRD (mm)	3.07	2.82	0.06
FU MLD (mm)	2.80	1.92	<0.001
FU DS (%)	14.2	34.9	<0.001
Late loss (mm)	0.10	0.91	<0.001
Binary instent restenosis (%)	0	15.8	0.001
Subacute thrombosis	0	0	1.0

2005 SNUH



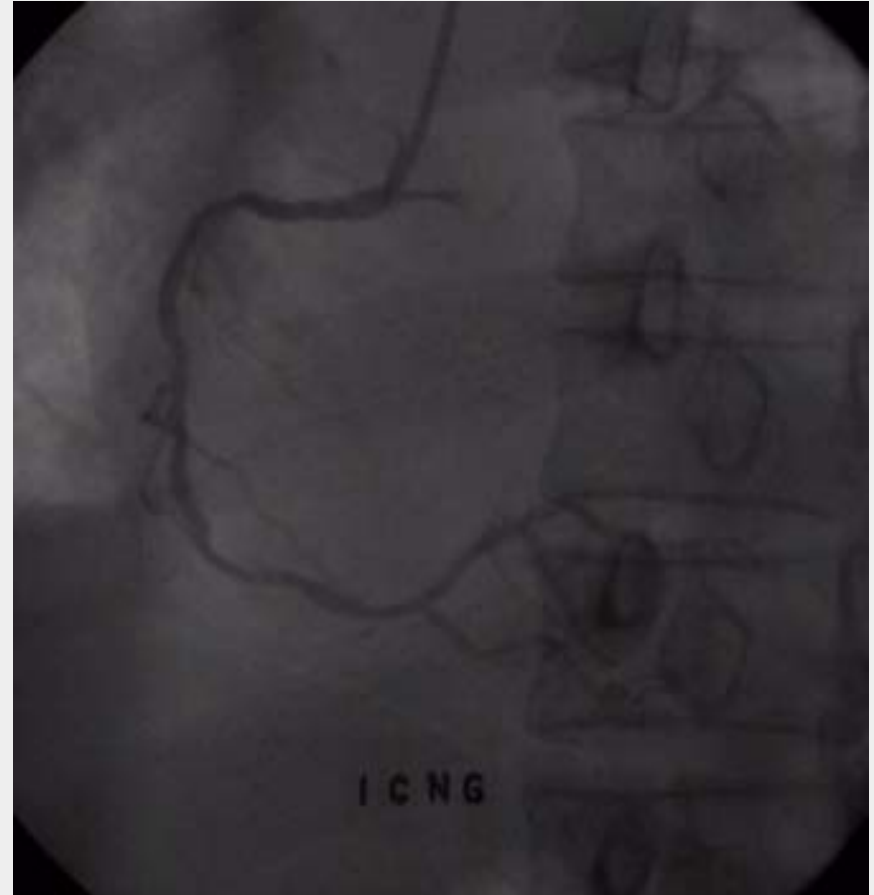
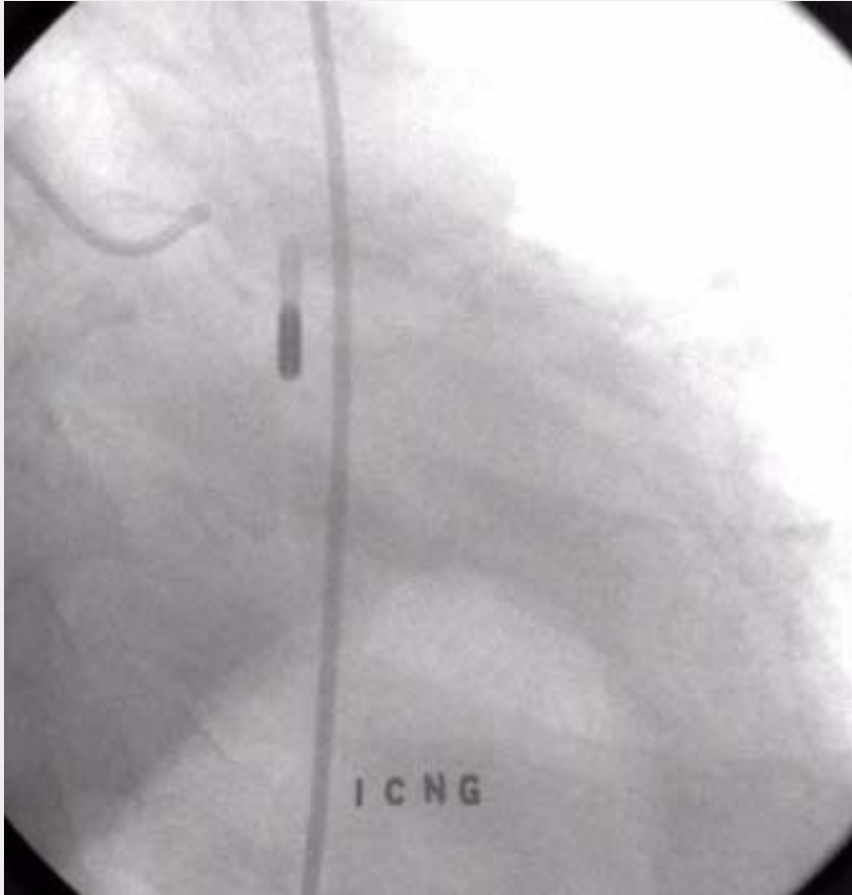
Clinical F/U: DES in AMI

	DES	BMS	P value
CCS class I (%)	96	84	0.17
LVEF (%)	52.0	54.6	0.63
Inhospital mortality (%)	3.1	3.2	0.98
6 mo mortality(%)	3.1	6.9	0.50
TVR(%)	3.1	6.9	0.50
MACE(%)	6.3	13.8	0.32

2005 SNUH

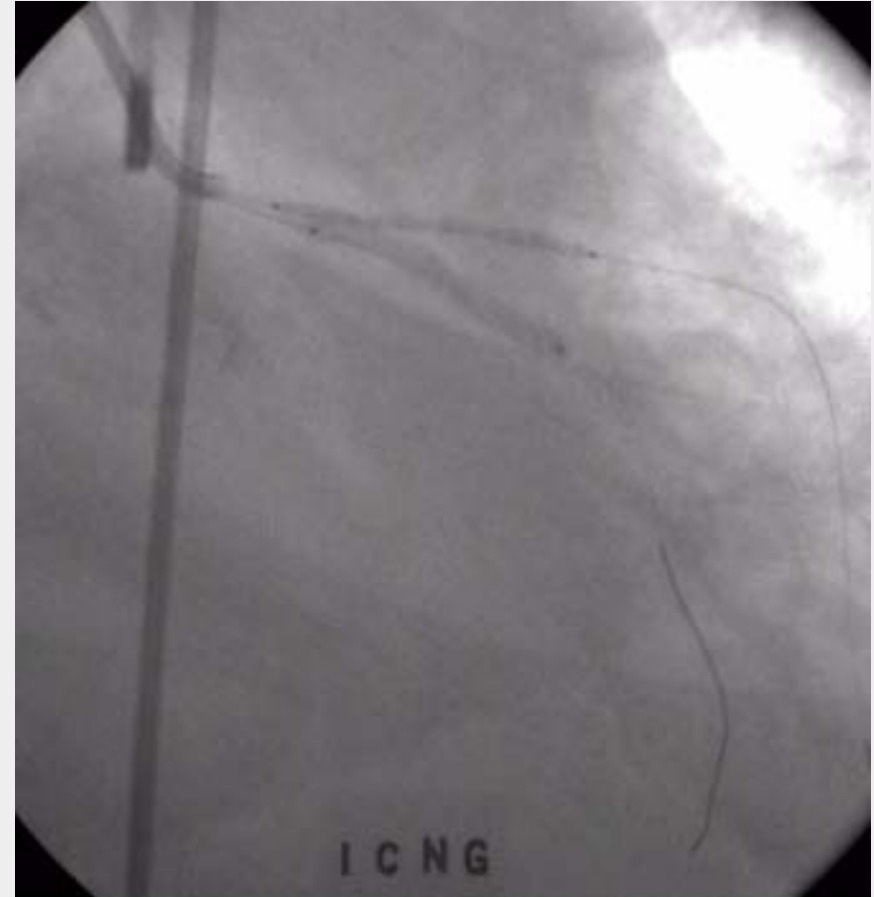
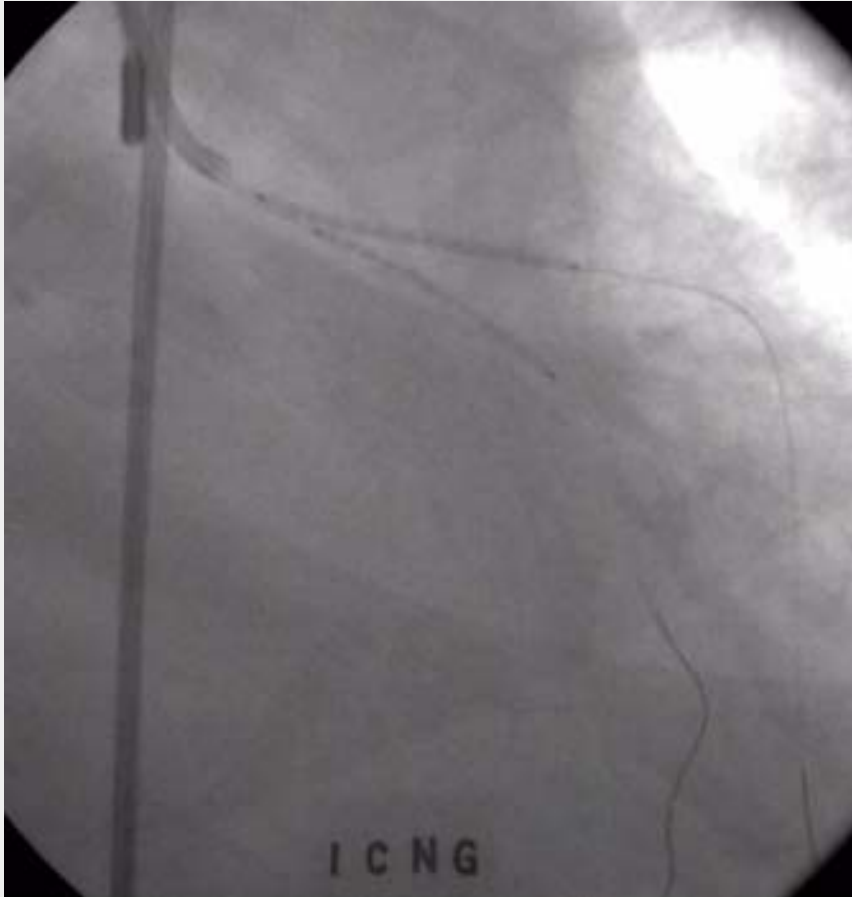


Case - Baseline CAG

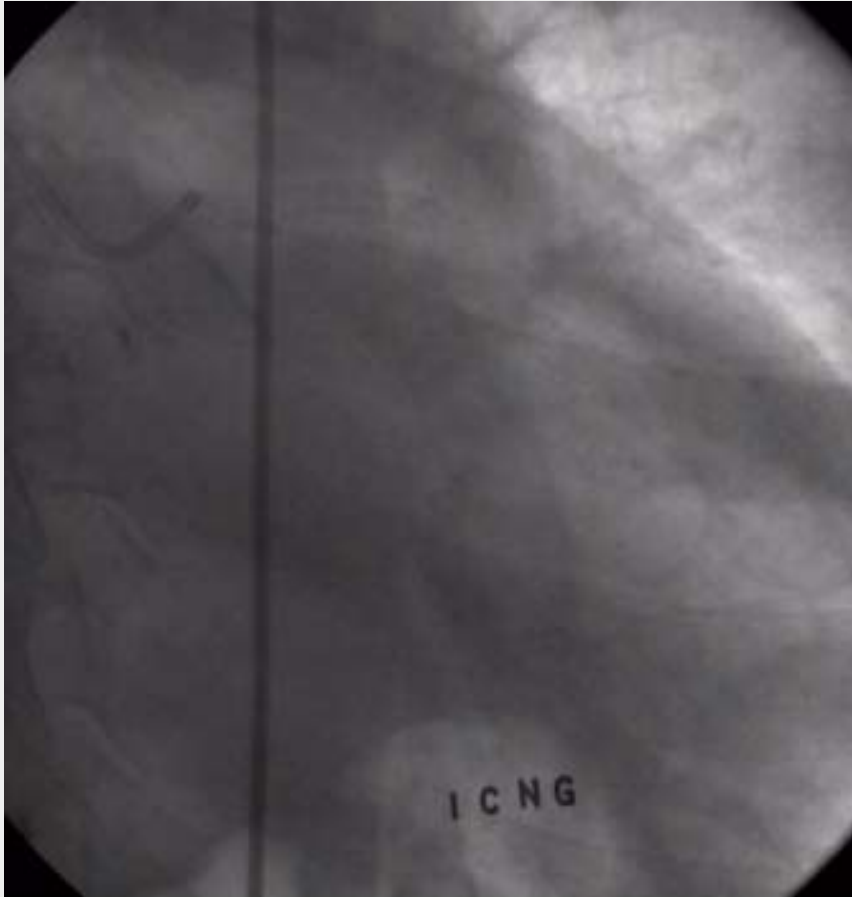




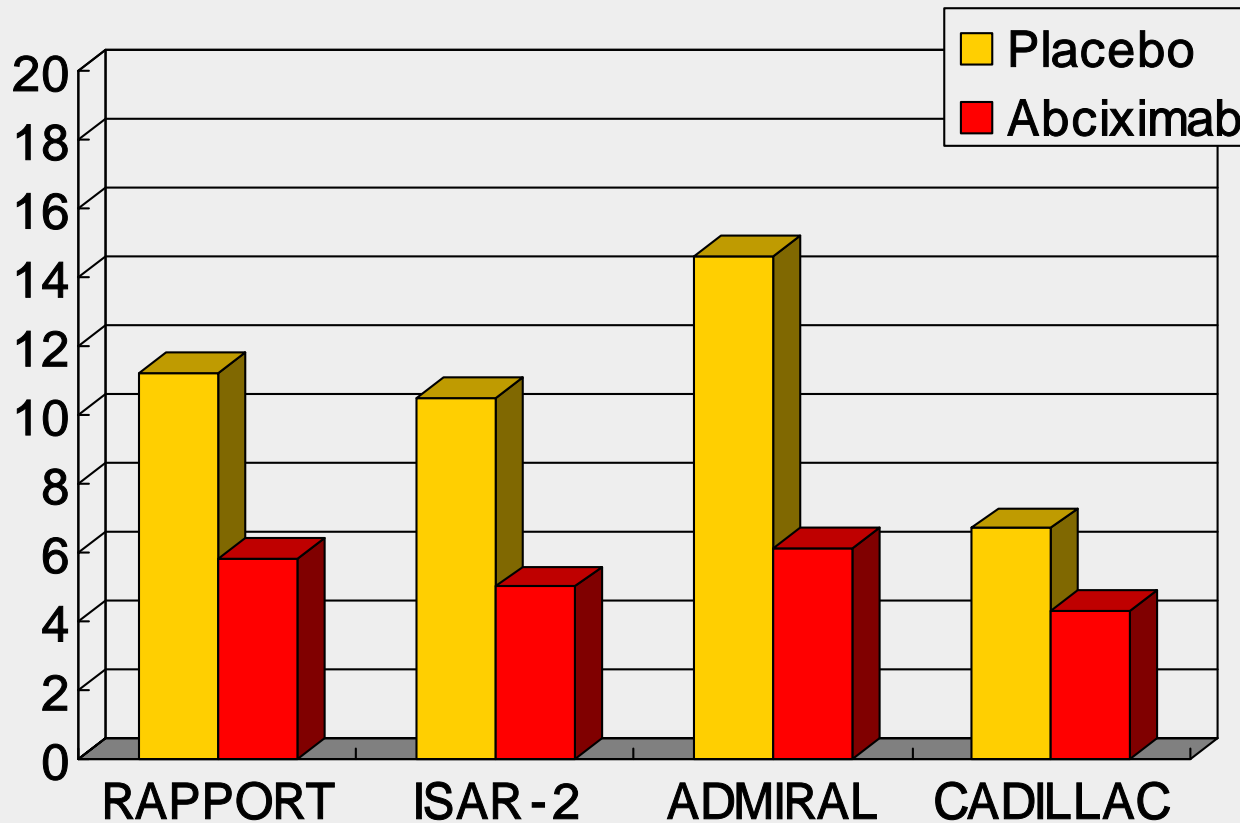
Case - PCI for LM equivalent lesion



Case - Nine month F/U CAG



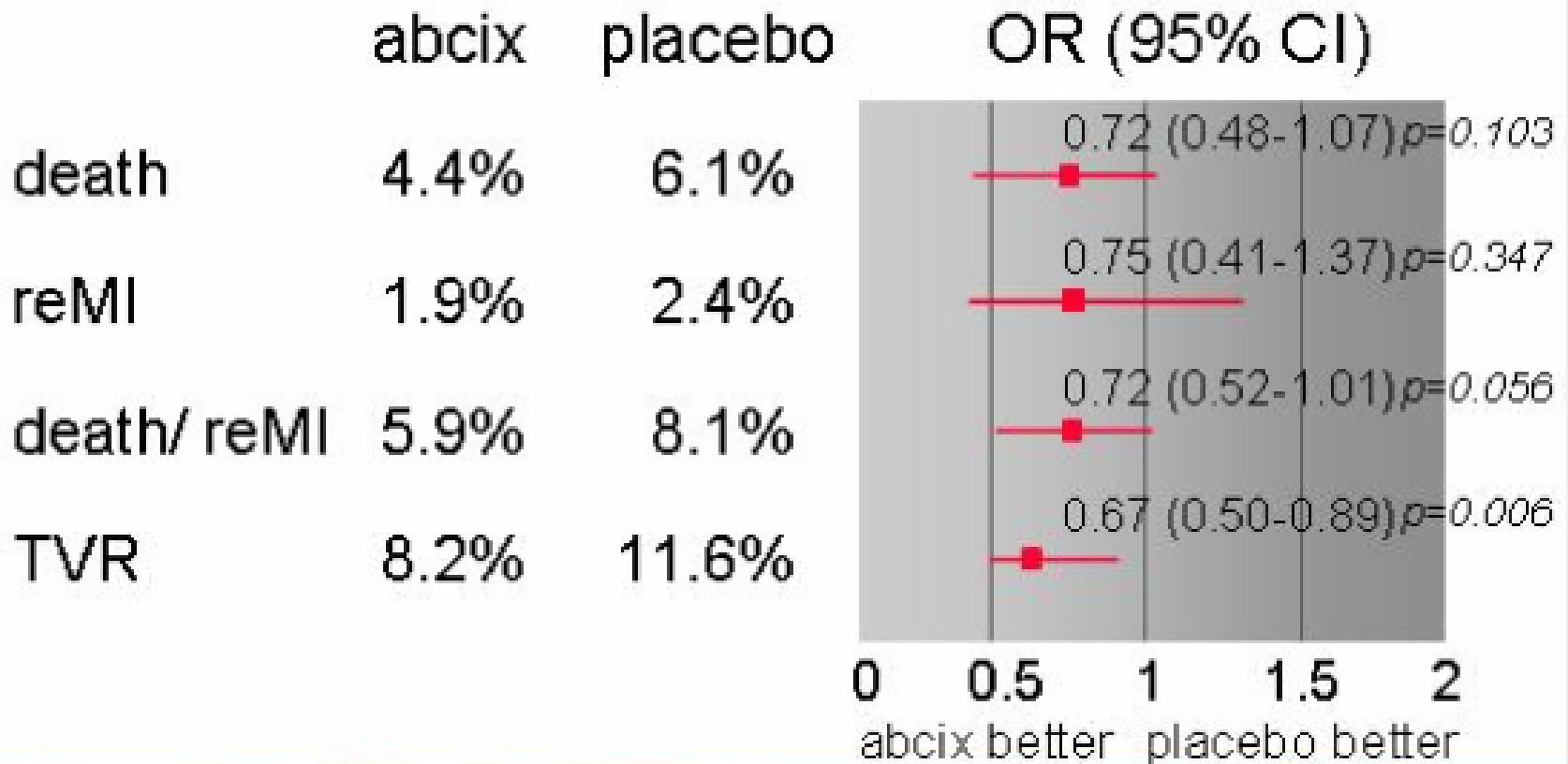
Iib/IIIa blocker with PCI in AMI



Comparison of clinical event reduction (death/MI/urgent TVR %) at 30 days

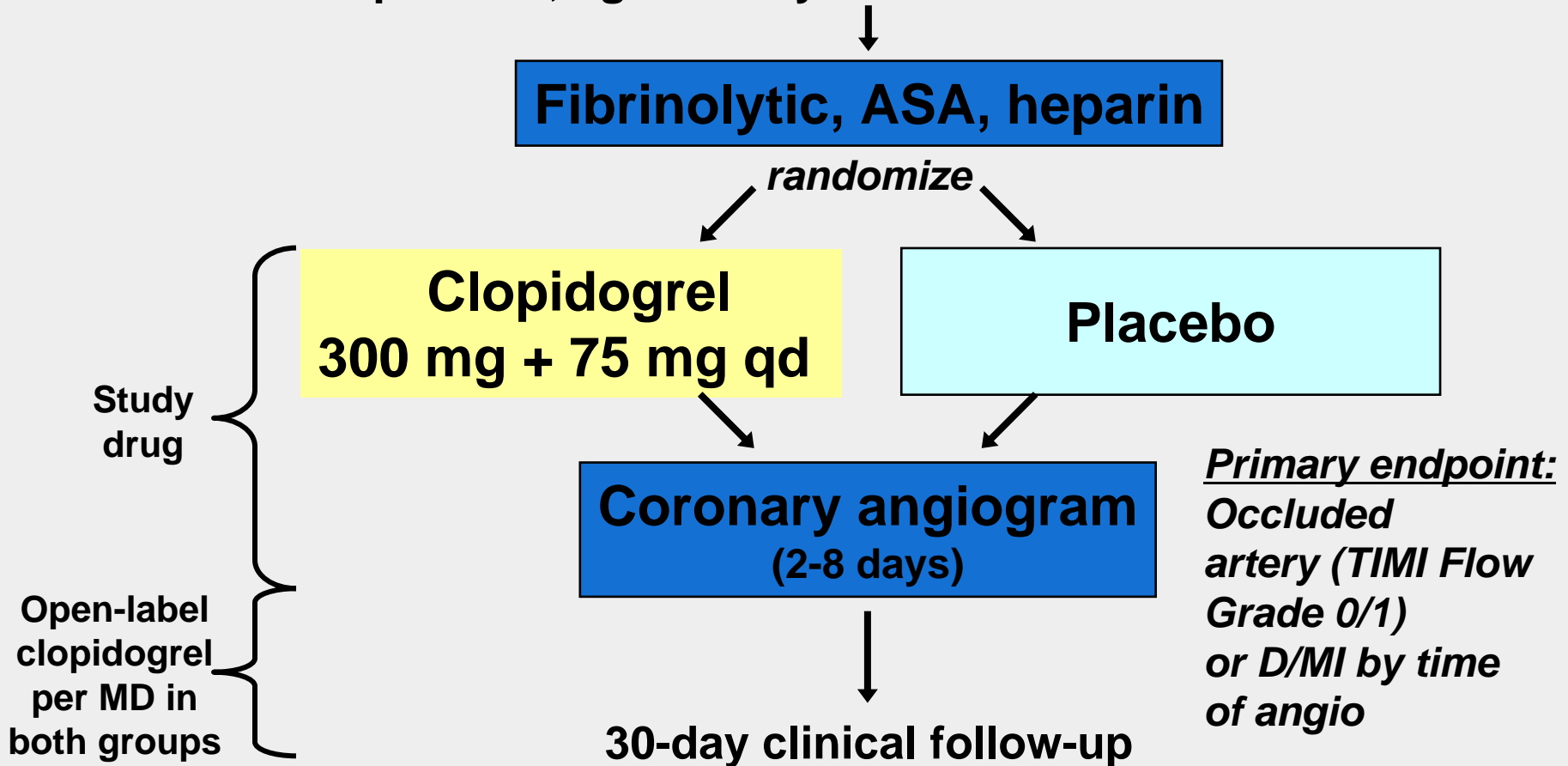
2b or not 2b : meta-analysis

6-month outcomes



Study Design of CLARITY Trial

Double-blind, randomized, placebo-controlled trial in 3491 patients, age 18-75 years with STEMI < 12 hours

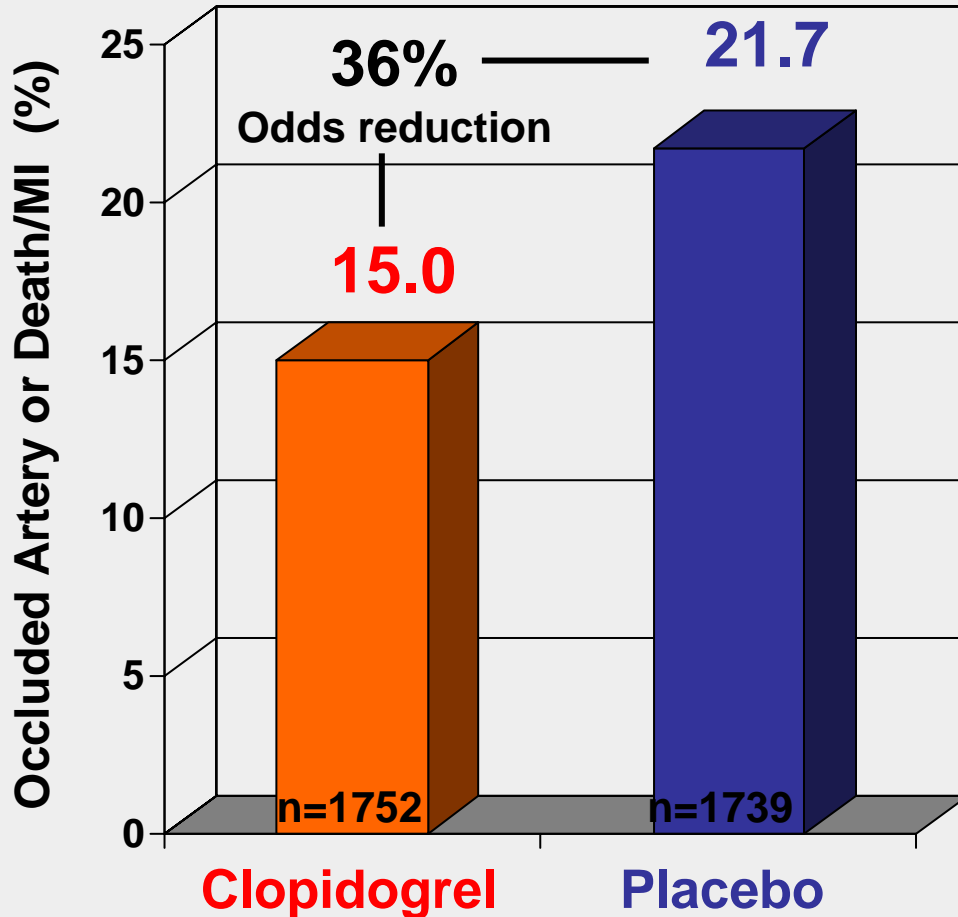


Sabatine et al. *NEJM* 2005;352:1179-1189.

Seoul National University College of Medicine

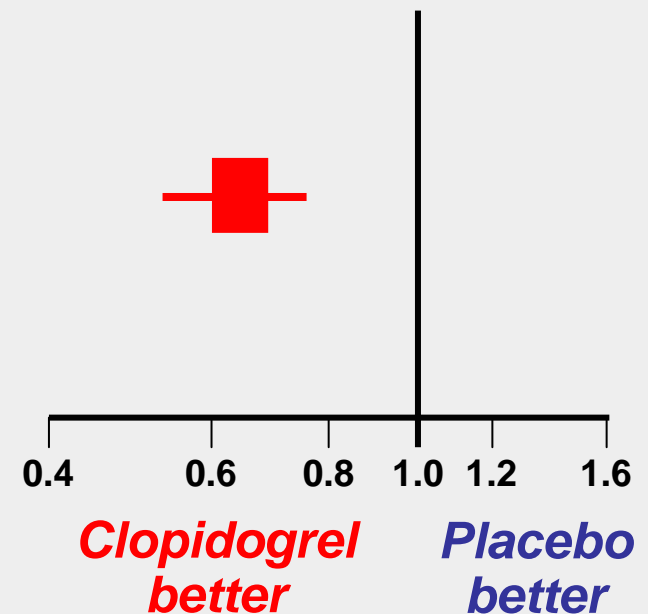
CLARITY Trial

Occluded Artery (or D/MI thru Angio/HD)



Odds ratio 0.64
(95% CI 0.53-0.76)

$P=0.00000036$



Sabatine et al. NEJM 2005;352:1179-1189.

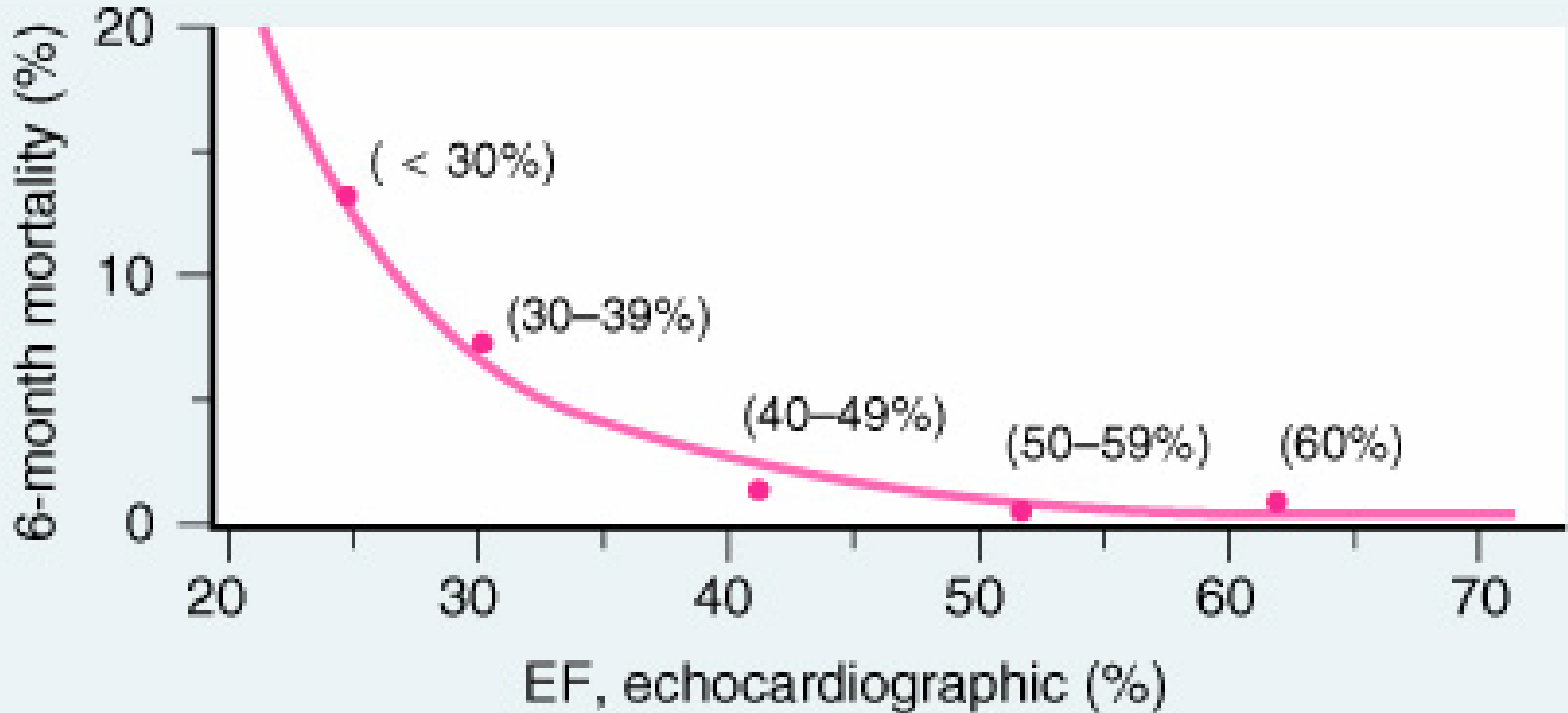
Seoul National University College of Medicine



Risk at hospital discharge

- **Prognostic factors for short- & long-term survival**
 - Resting LV function
 - Residual ischemic myocardium
 - Susceptibility to serious ventricular arrhythmia
 - Ventricular ectopic activity, electrical instability
 - Patency of infarct-related artery
 - Dx; EchoCG, stress test, EKG, CAG, etc

Impact of LV function on survival following AMI

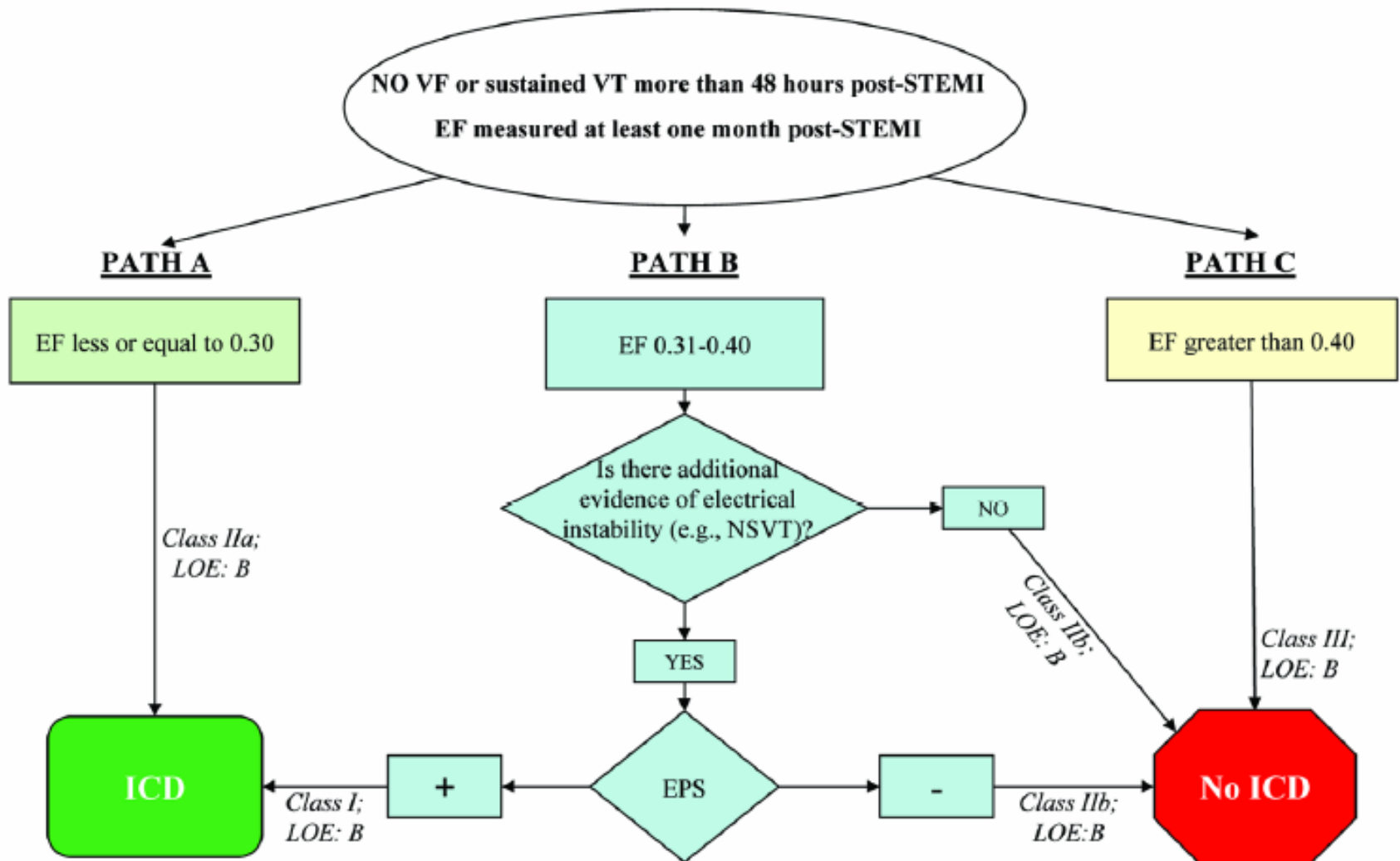




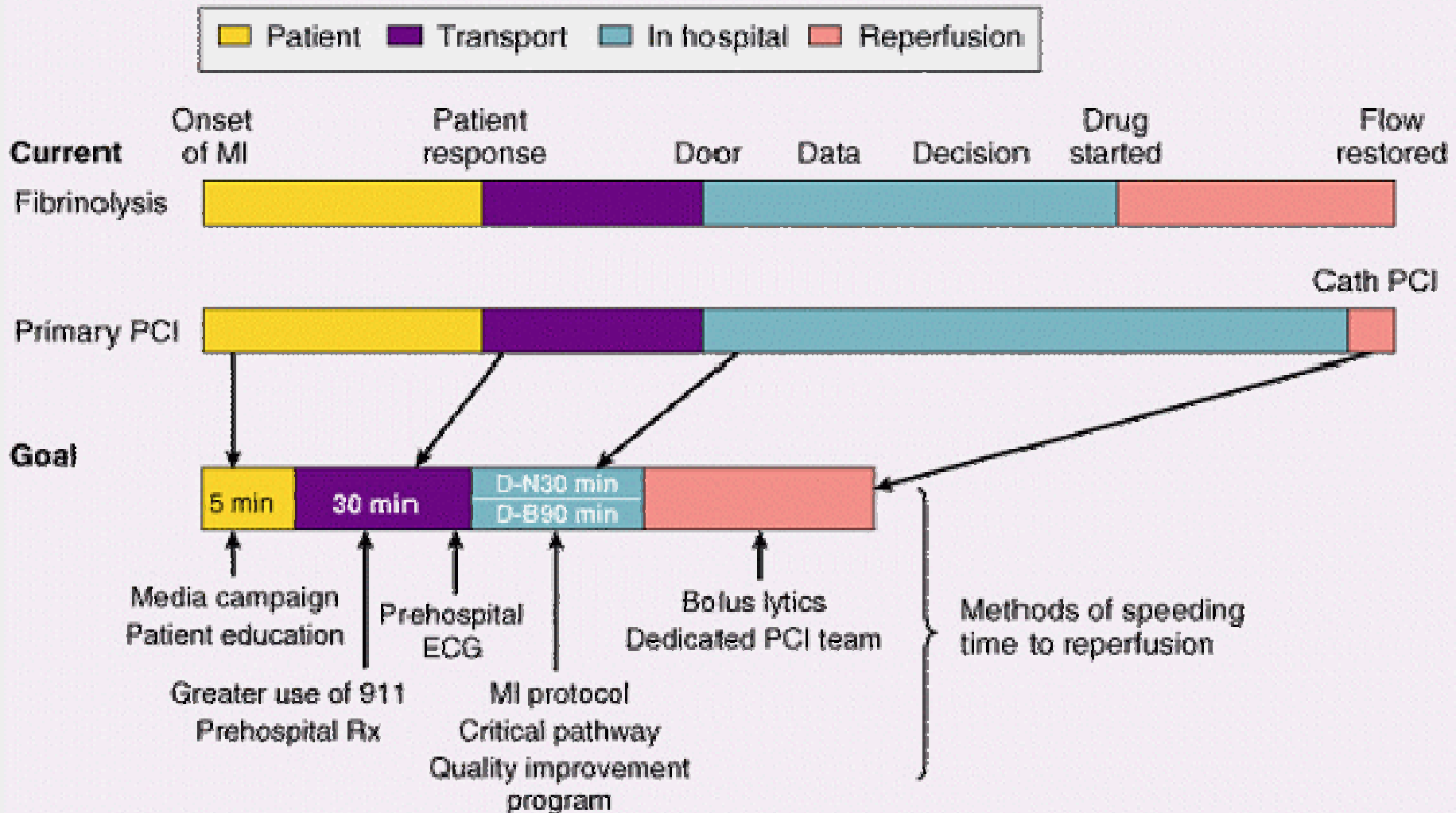
Secondary prevention of AMI

- Life style modification
- Lipid modification
- Antiplatelet agent
- ACE inhibitor
- Beta-adrenoreceptor blocker
- Antiarrhythmic
- Anticoagulant, nitrate, calcium antagonist
- Hormone replacement therapy

Prevention of SCD in post-STEMI patients



Methods of speeding time to reperfusion





Conclusion : management of STEMI

- **PCI should be the treatment of choice** in patients admitted to a hospital with a PCI facility
- Patients admitted to a hospital without on-site PCI who have contraindications to thrombolysis should be immediately transferred.
- Within the first three hours after onset of chest pain, thrombolysis is a "viable alternative" to PCI
- All patients who undergo thrombolysis even apparently successful thrombolysis should be referred for angiography (by hospital transfer if necessary) and receive revascularization if appropriate
- Clear answers on the facilitated-PCI question should come from the FINESSE and ASSENT 4 trials