

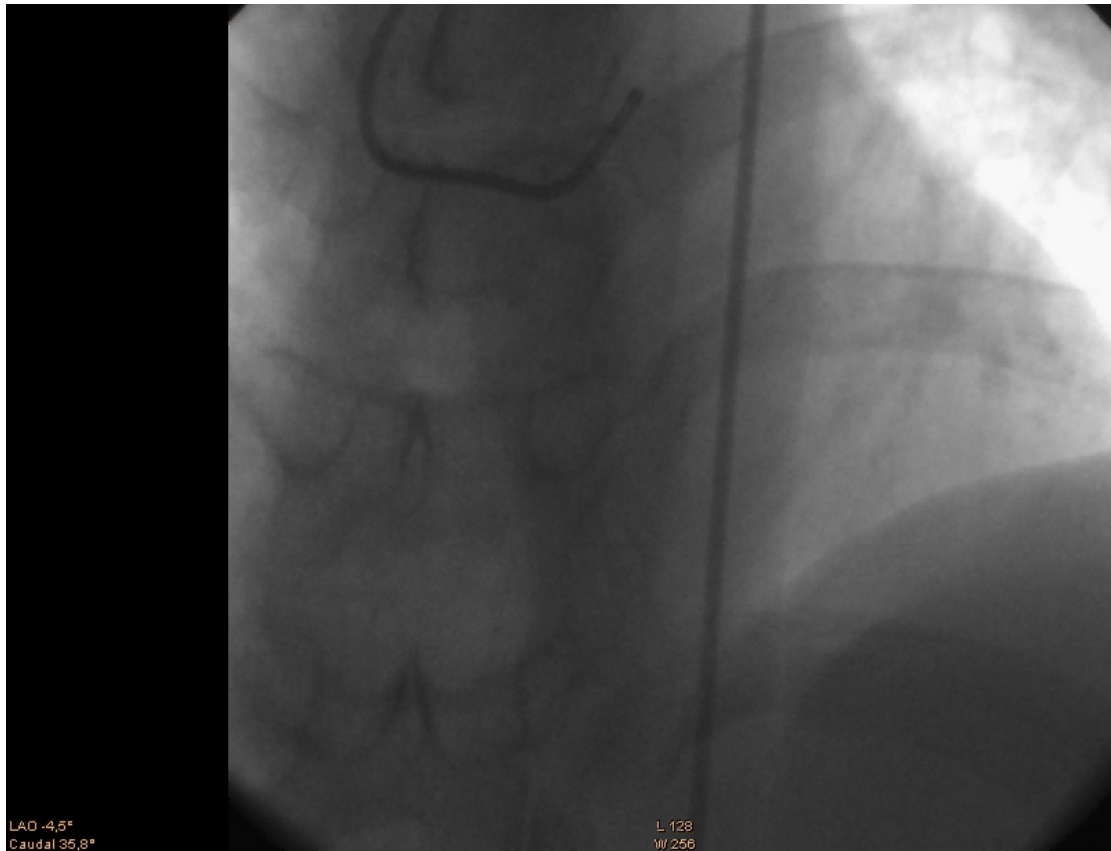
6th JONT MEETING WITH MAYO CLINIC

SHOULD TROMBECTOMY BE ROUTINE FOR ALL PRIMARY PCI ?

Sebastiano Marra MD FESC



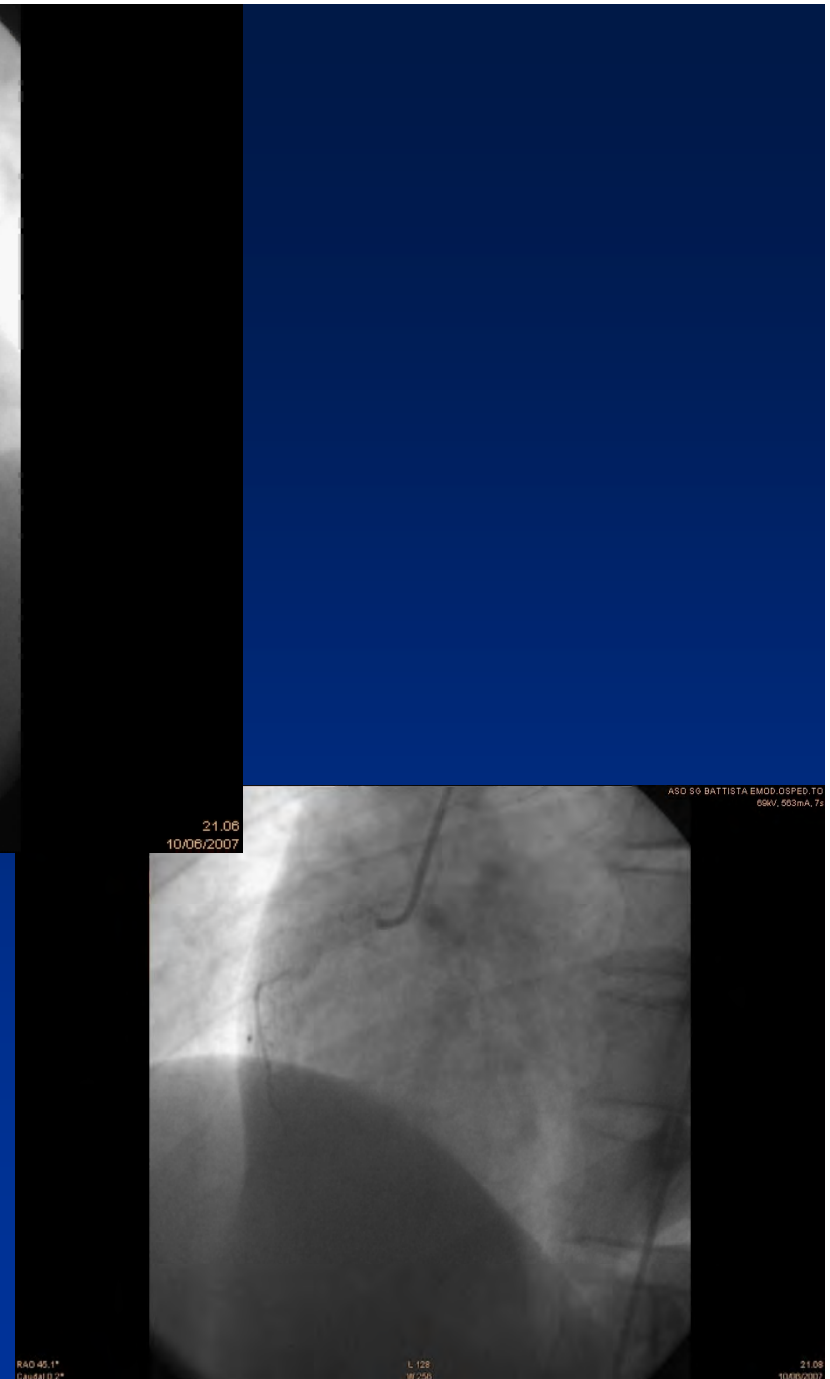
*Struttura Complessa di Cardiologia Ospedaliera
Azienda Ospedaliera S.G. Battista, Molinette di Torino*



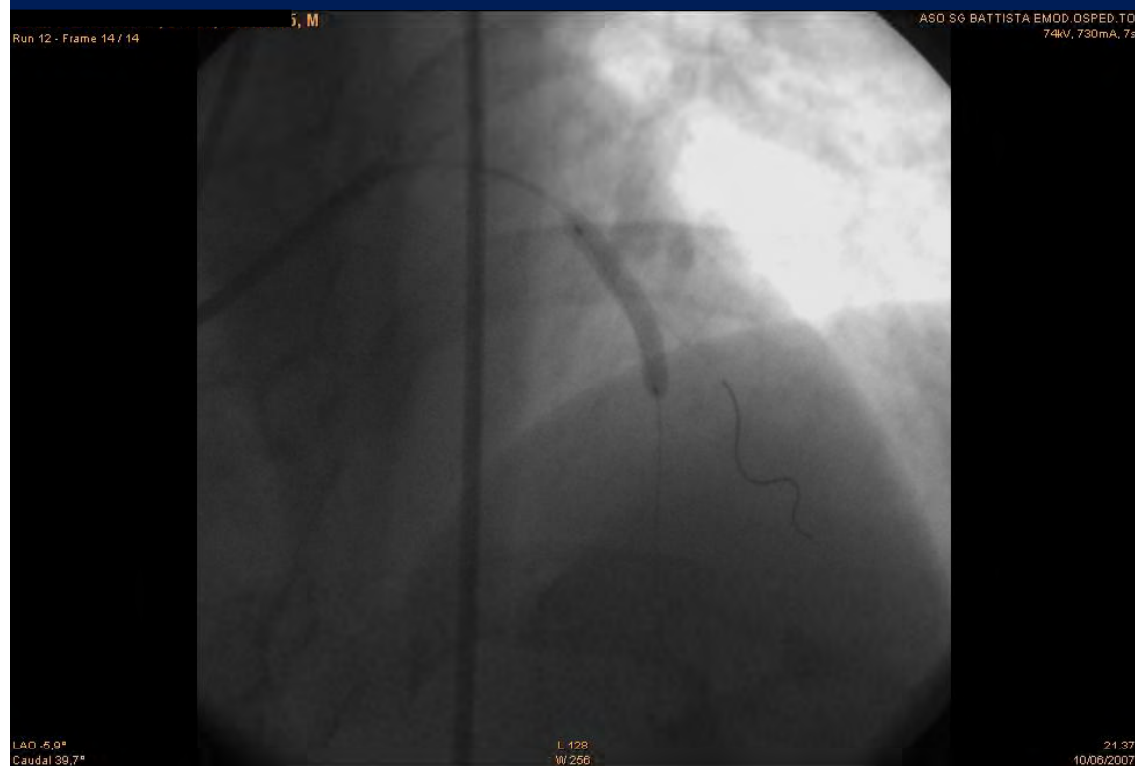
42 y. Male. Smoker. Anterolateral
STEMI. 2h onset symptoms



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Direct stenting. Kissing balloon LAD/D1



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RAO 51,3°
Caudal 27,5°

L 128
VV 256

21.40
10/06/2007

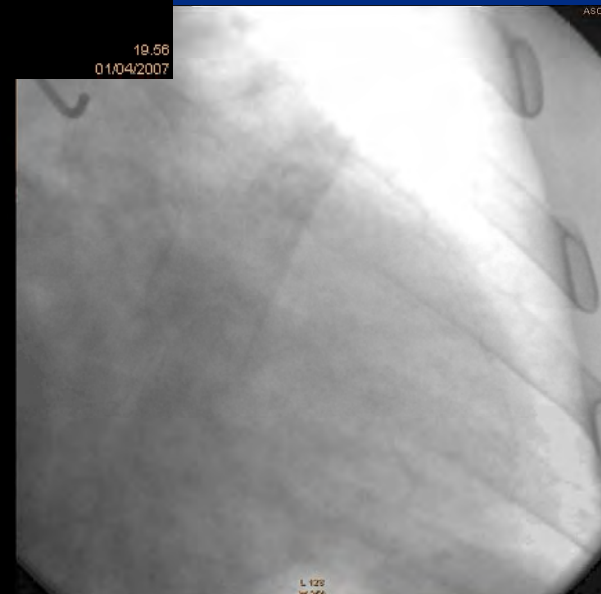
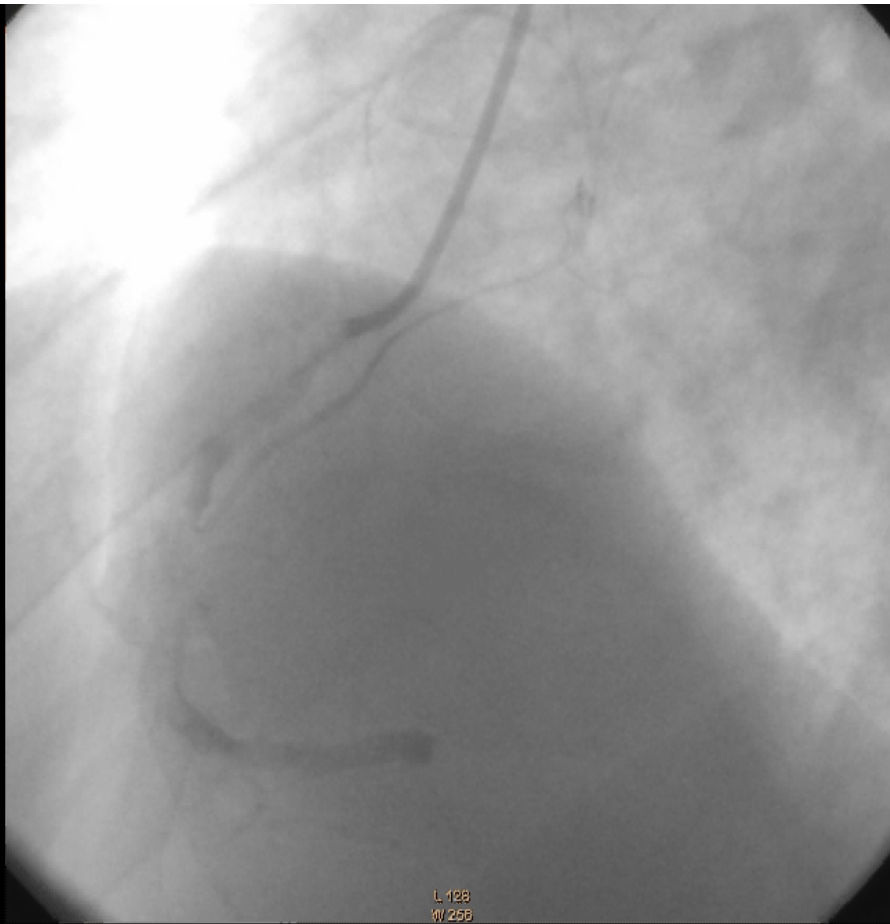


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68 yo. Male. Diabetic.
Inferior STEMI. 6 h onset
symptoms.



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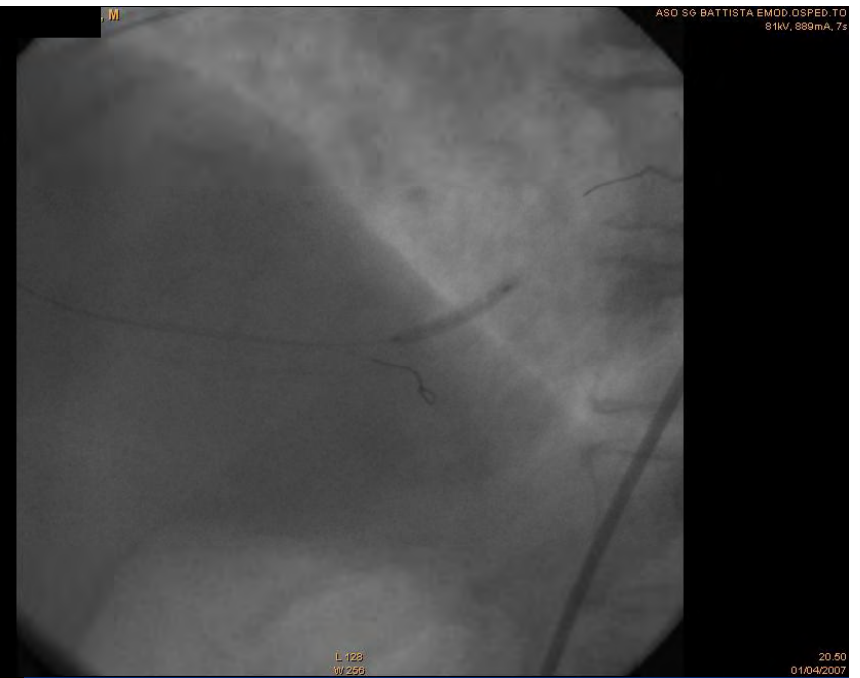
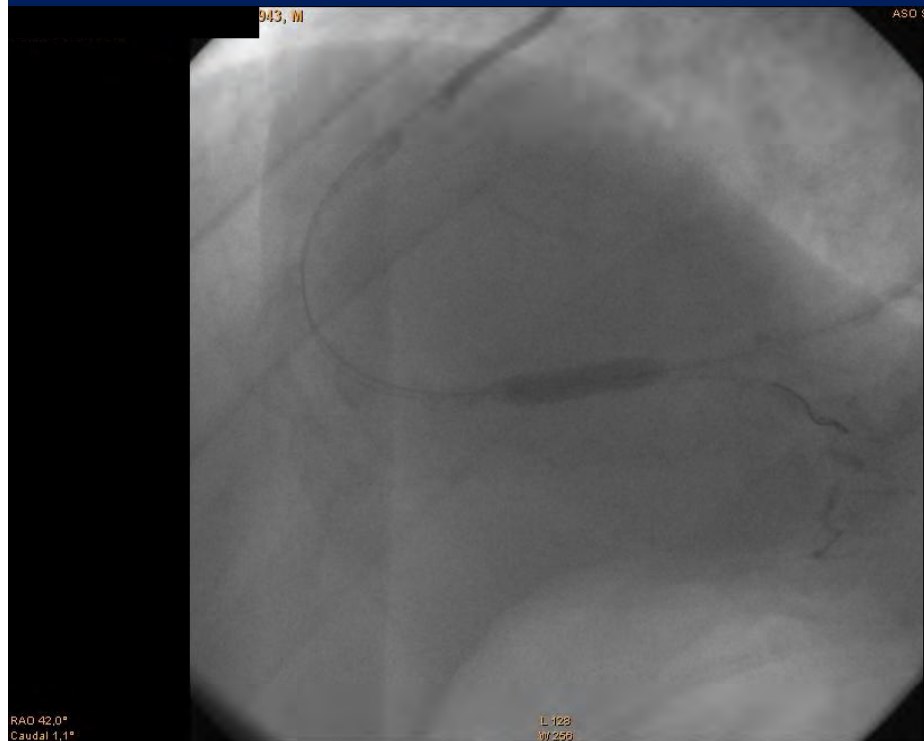


ASO S.G. BATTISTA EMQD. OSPED. TO
78kV, 703mA, 7.3

19.56
01/04/2007

19.53
01/04/2007

Reo-Pro. Diver aspiration. Predilatation and stenting



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Run 53 - Frame 1 / 131

92kV, 784mA,

RAO 45.0°
Caudal 1.1°

L 128
W 258

21.8
01/04/200



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NO REFLOW

The background of the slide is a reproduction of the painting 'Napoleon Crossing the Alps' by Jacques-Louis David. It depicts Napoleon Bonaparte on a white horse, wearing a red cloak and a bicorne hat, leading his army over a mountain range. The scene is dramatic, with a storm brewing in the background and soldiers visible in the distance.

Definition and clinical relevance

Pathogenic components

Predictors

Diagnosis

Prevention and treatment



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Definition

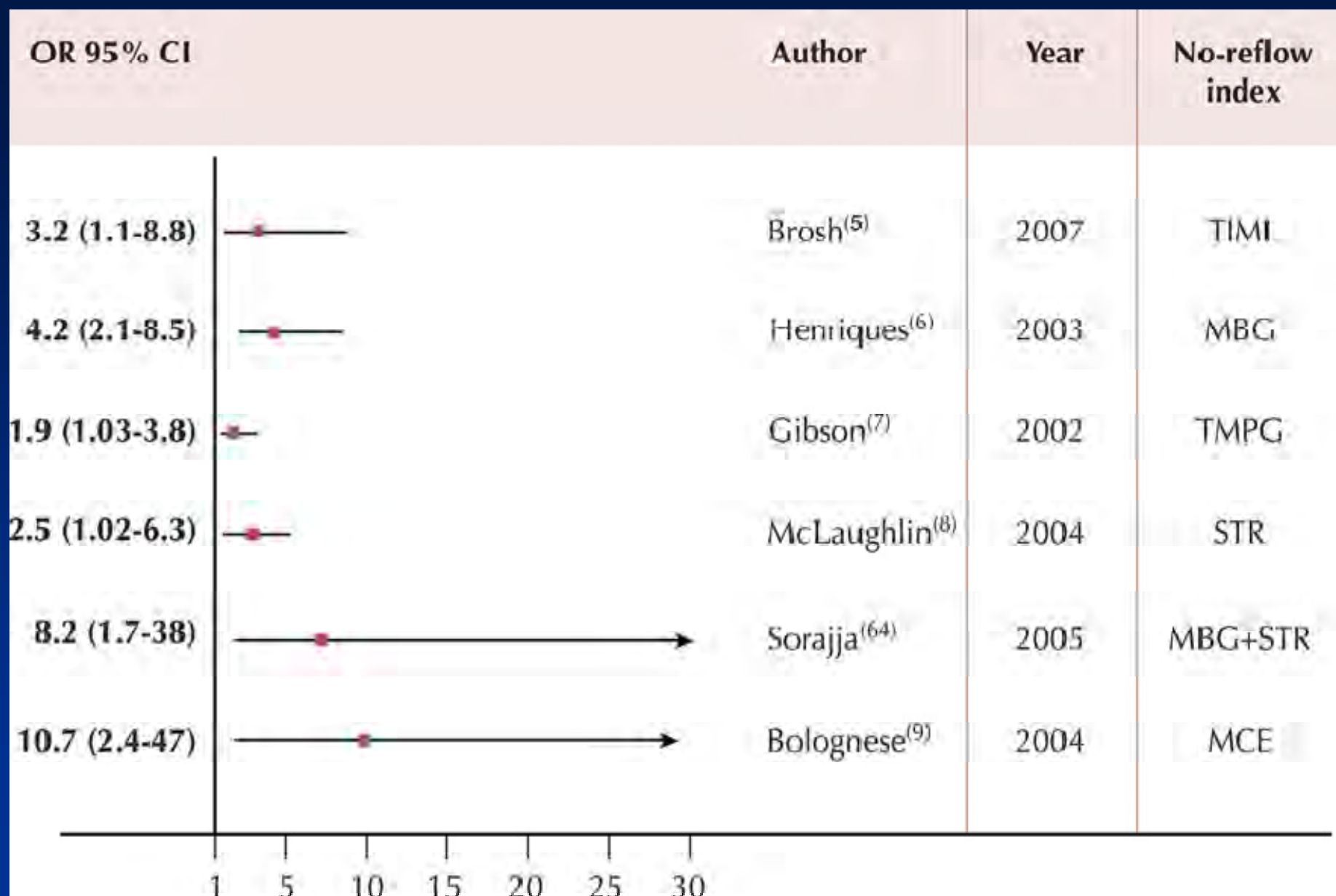
no-reflow”

microvascular obstruction and reduced myocardial flow after opening an occluded artery

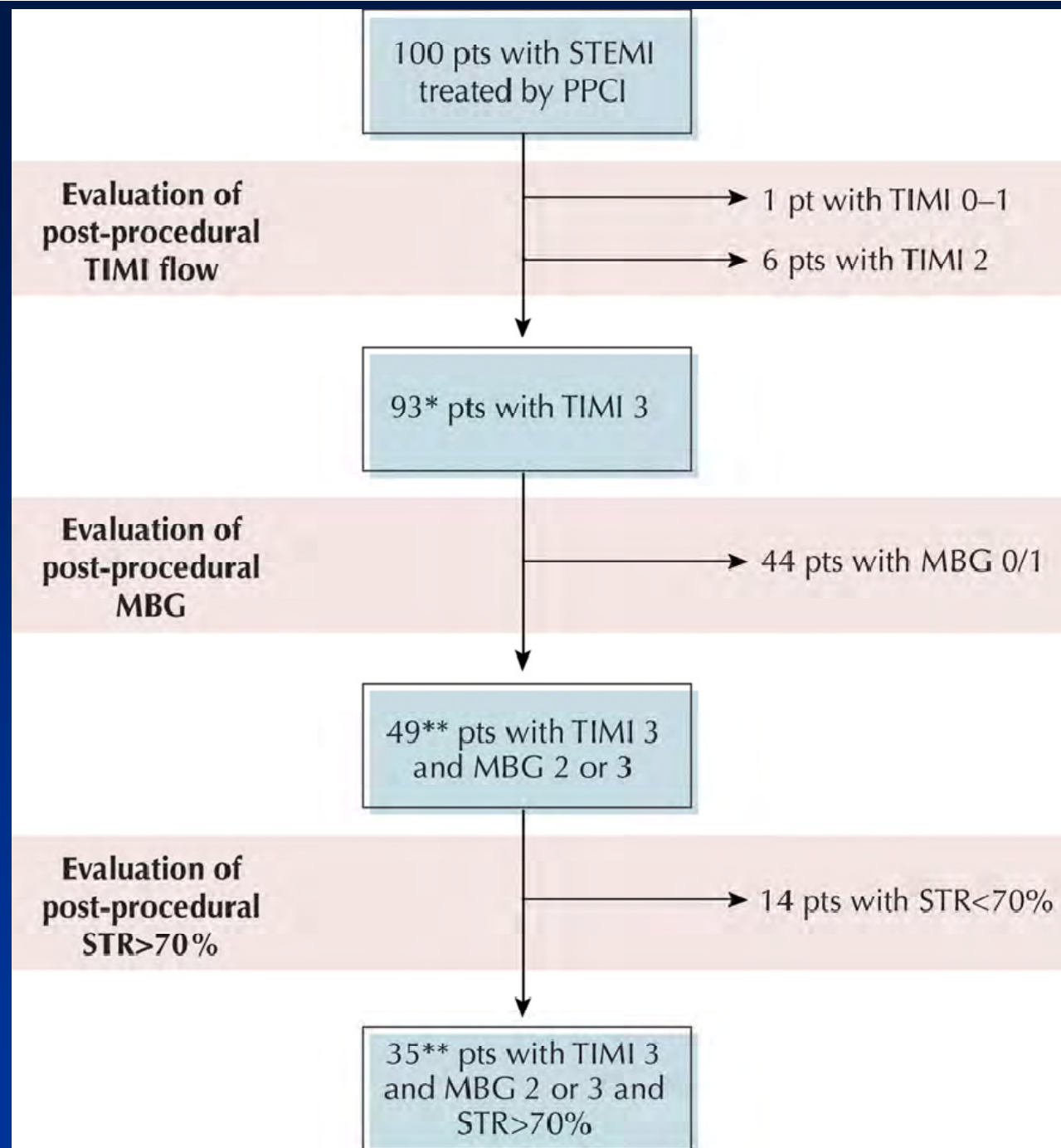


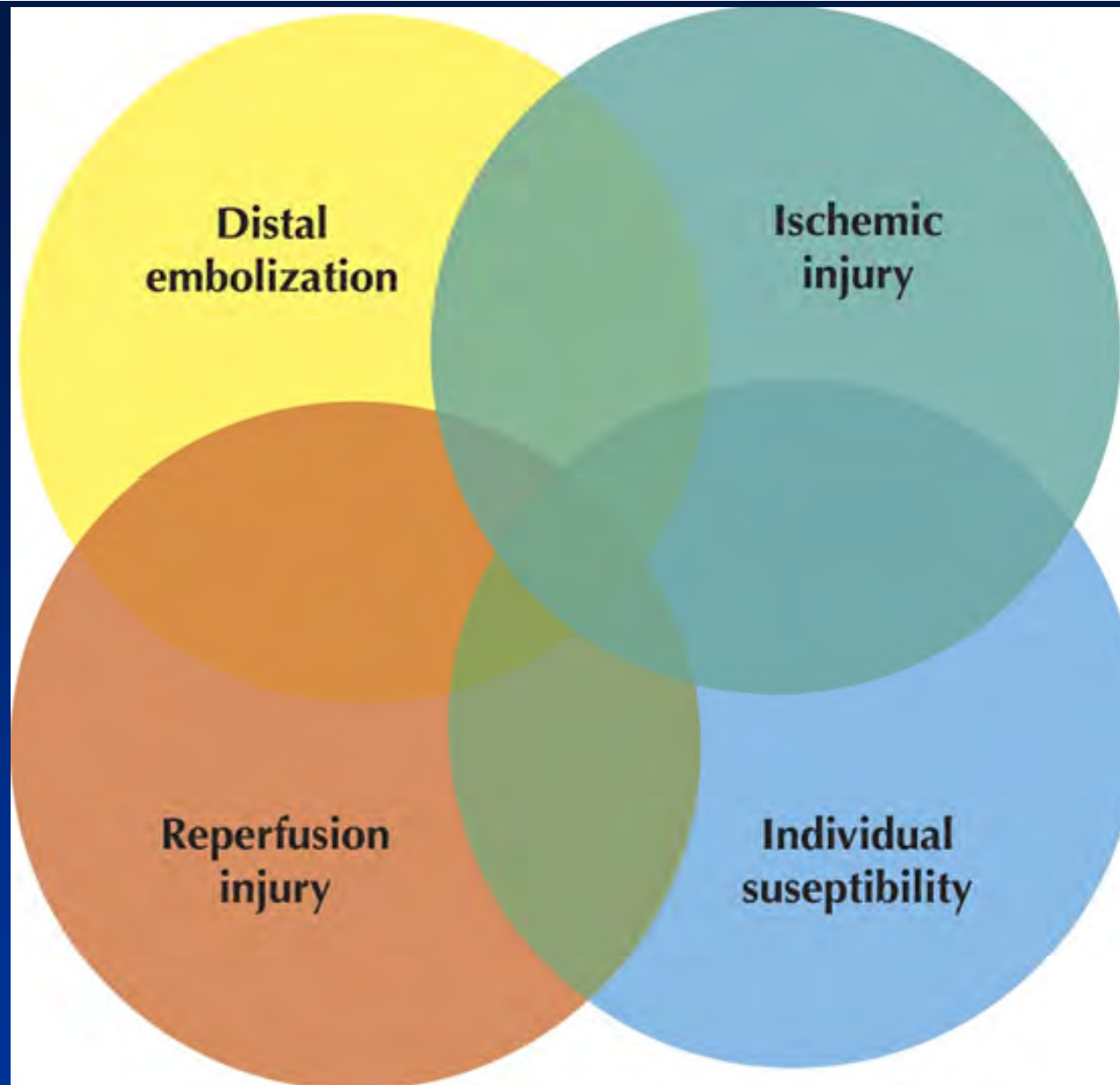
- 1) very early postinfarction complications (arrhythmias, pericardial effusion, cardiac tamponade, early congestive heart failure)
- 2) left adverse ventricular remodeling
- 3) late repeat hospital stays for heart failure
- 4) mortality





Prognostic Value of No-Reflow According to Angiographic, Electrocardiographic, and Echocontrastographic Indexes





Mechanisms Responsible for No-Reflow

Pathogenic components

Distal embolization. Emboli of different sizes can originate from epicardial coronary thrombus and from fissured atherosclerotic plaques, in particular during PPCI

Ischemia-related injury. Changes in endothelial cells are visible after prolonged ischemia

Reperfusion-related injury. A massive infiltration of coronary microcirculation by neutrophils and platelets occurs at the time of reperfusion

Individual predisposition of coronary microcirculation to Injury. Predisposition might be genetic and/or acquired.



Predictors of No-Reflow

Predictors of distal embolization

- 1) an angiographic thrombus with the greatest linear dimension more than 3 times the reference lumen diameter
- 2) cutoff pattern (lesion morphology with an abrupt cutoff without taper before the occlusion);
- 3) presence of accumulated thrombus (5 mm of linear dimension) proximal to the occlusion
- 4) presence of floating thrombus proximal to the occlusion
- 5) Persistent contrast medium distal to the obstruction
- 6) referencelumen diameter of the infarct-related artery (IRA) 4.0 mm.

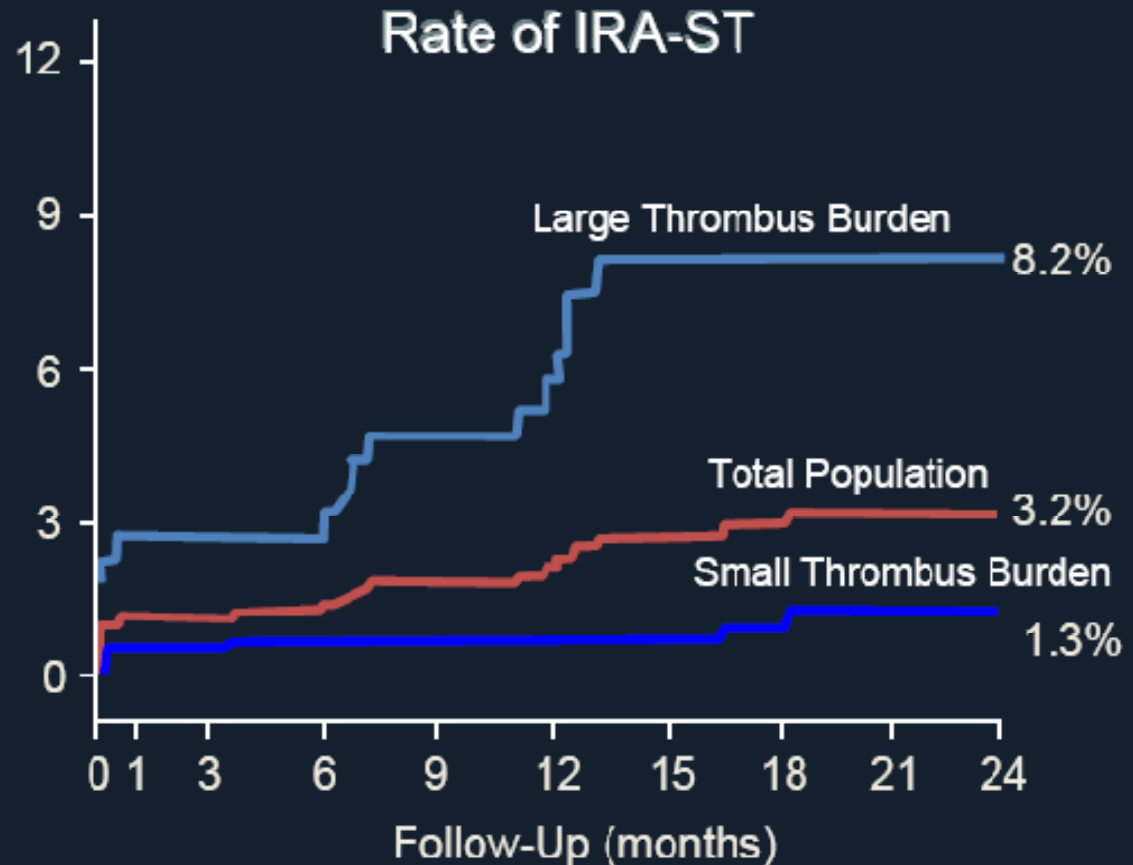


Impact of Thrombus Burden with DES in AMI

792 STEMI Patients with DES

	Small	Large
Final TIMI 3	94.9%	83.6%*
TMPG-3	53.2%	35.4%*
No-reflow	0.5%	4.0%*
Distal Embol.	3.5%	17.3%*

*P<0.001



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Sianos G et al, J Am Coll Cardiol 2007; 50:573-83

Predictors of No-Reflow

Predictors of ischemia-related injury

- 1) A longer time to reperfusion is associated with a higher prevalence of no-reflow and with a larger no-reflow region.
- 2) The extent of the ischemic region is another important determinant of no-reflow

Predictors of reperfusion-related injury

Neutrophil count , ET-1 levels TXA2 levels Mean platelet volume or reactivity

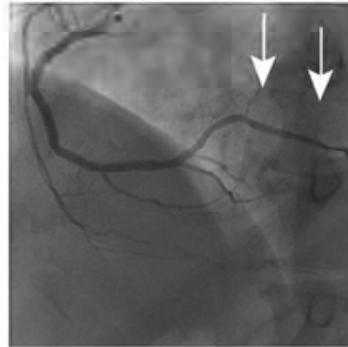
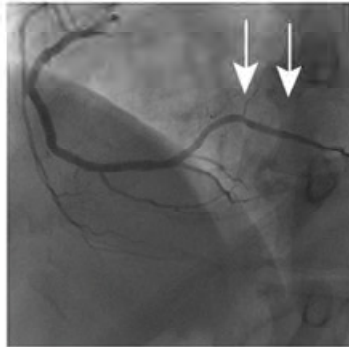


DIAGNOSIS

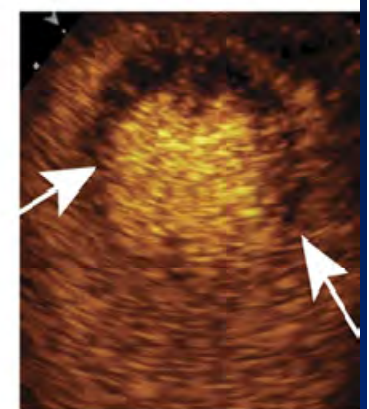
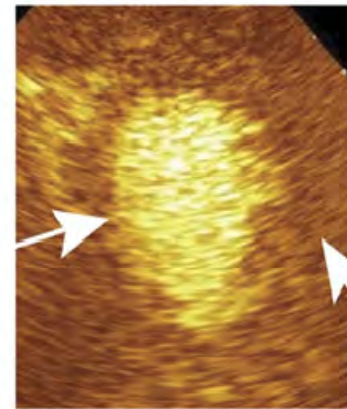
Reflow

No-reflow

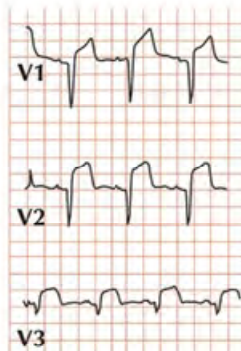
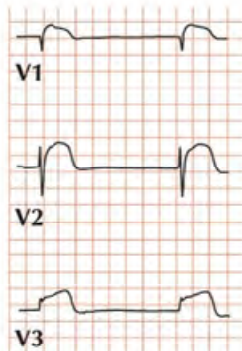
A



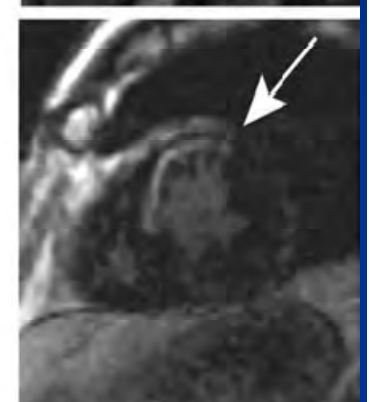
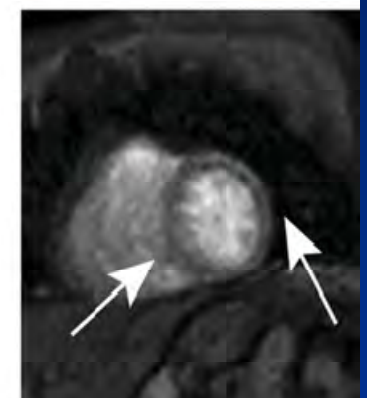
C



B



D



Prevention and treatment

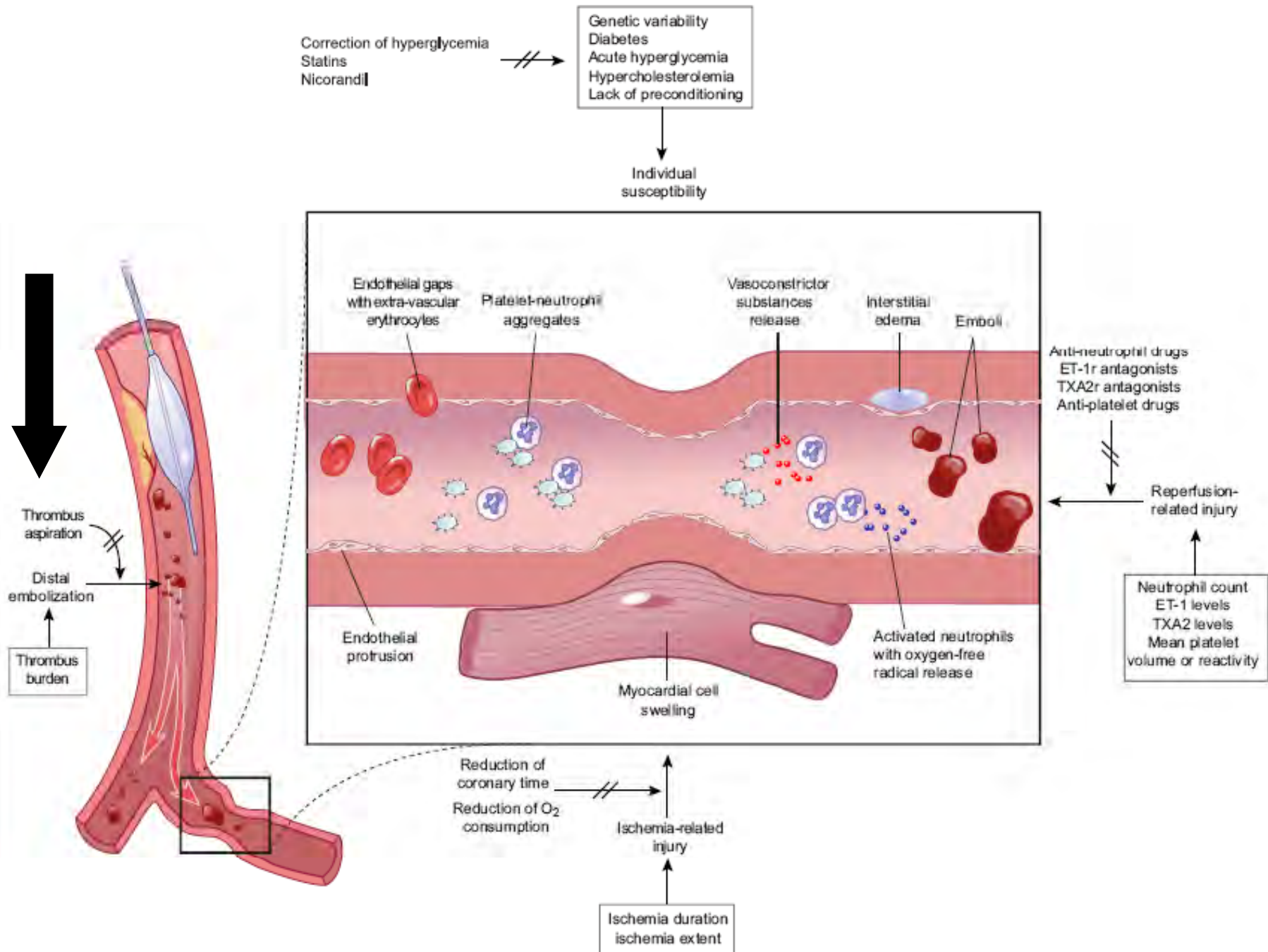
Table 1 Predictors of Pathogenetic Components of No-Reflow and Therapeutic Implications

Pathogenetic Mechanism of No-Reflow	Predictor	Therapeutic Implications
Distal embolization	Thrombus burden (40)	Thrombus aspiration
Ischemia	Ischemia duration (42,43)	Reduction of coronary time
	Ischemia extent (44,45)	Reduction of oxygen consumption
Reperfusion	Neutrophil count (46)	Specific antineutrophil drugs
	ET-1 levels (51)	ET-1r antagonists
	TXA2 levels (49)	TXA2r antagonists
	Mean platelet volume or reactivity (47,48)	Antiplatelet drugs
Individual susceptibility	Diabetes (37)	Correction of hyperglycemia
	Acute hyperglycemia (57)	Correction of hyperglycemia
	Hypercholesterolemia (38)	Statin therapy
	Lack of pre-conditioning (58)	Nicorandil

ET = endothelin; TXA2 = thromboxane A2.



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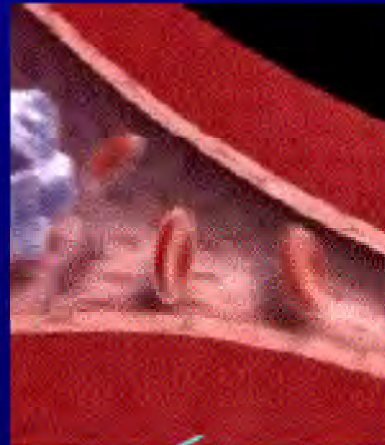
Implications of PCI

Atheroembolism



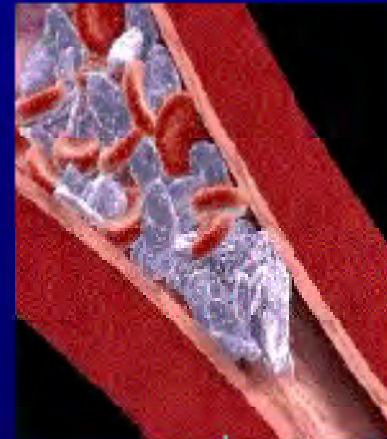
**Macrovascular
obstruction**

Thromboembolism



**Microvascular
obstruction**

**Vasoactive mediator
release**



**Microvascular
spasm**

Thrombectomy



Manual thrombectomy

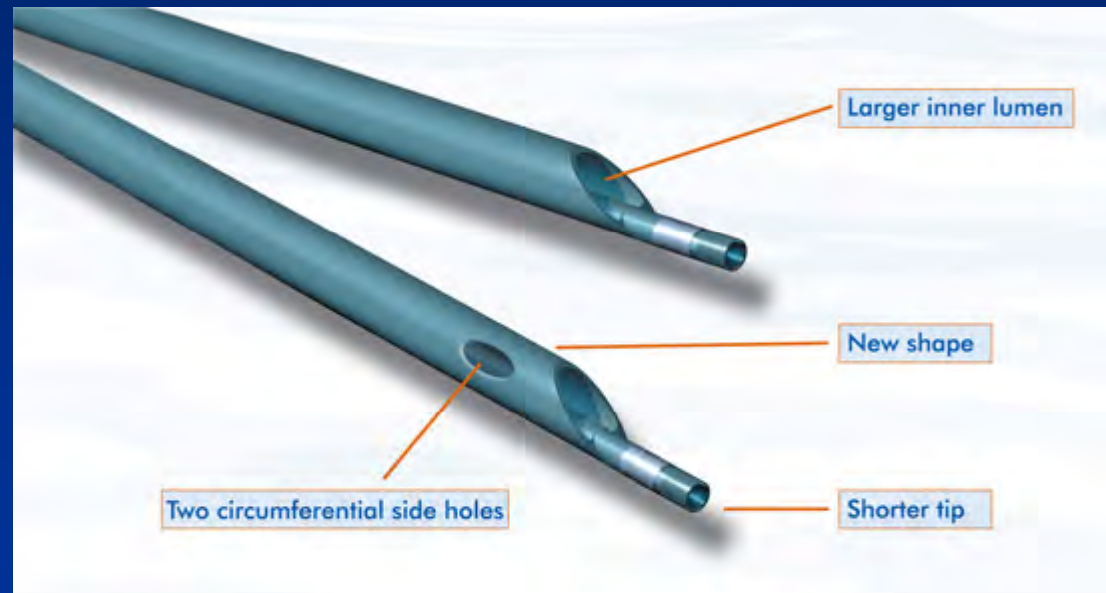
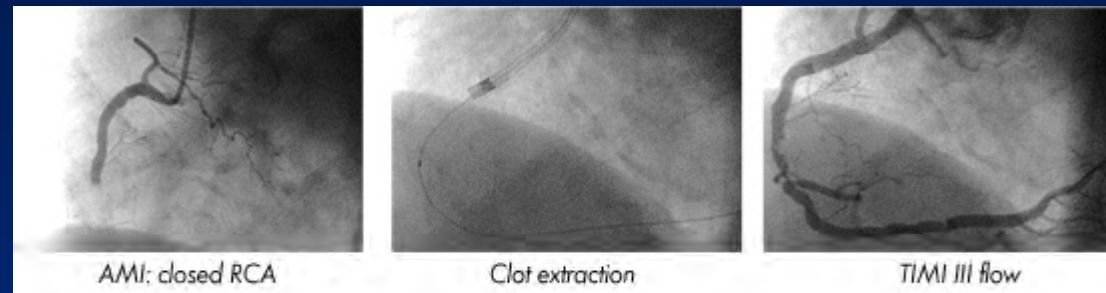
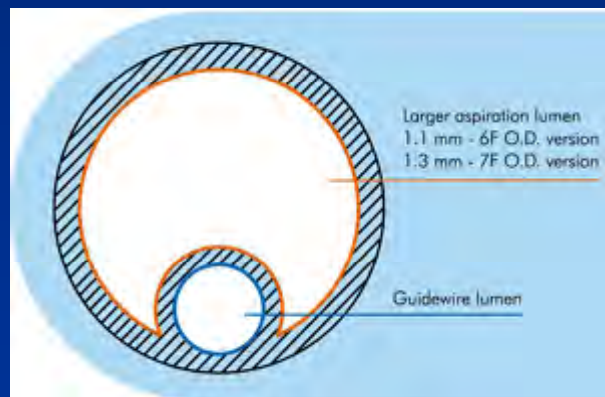


OPTIMIZED TIP DESIGN

Soft tip for increased deliverability



Forward-facing short tip for effective particle capture



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Filter Based Distal Protection

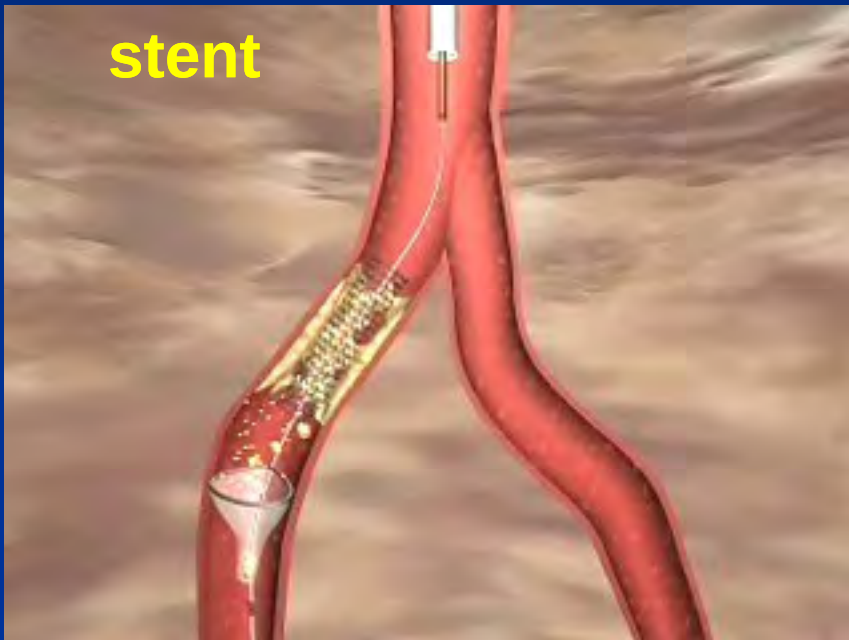
insertion



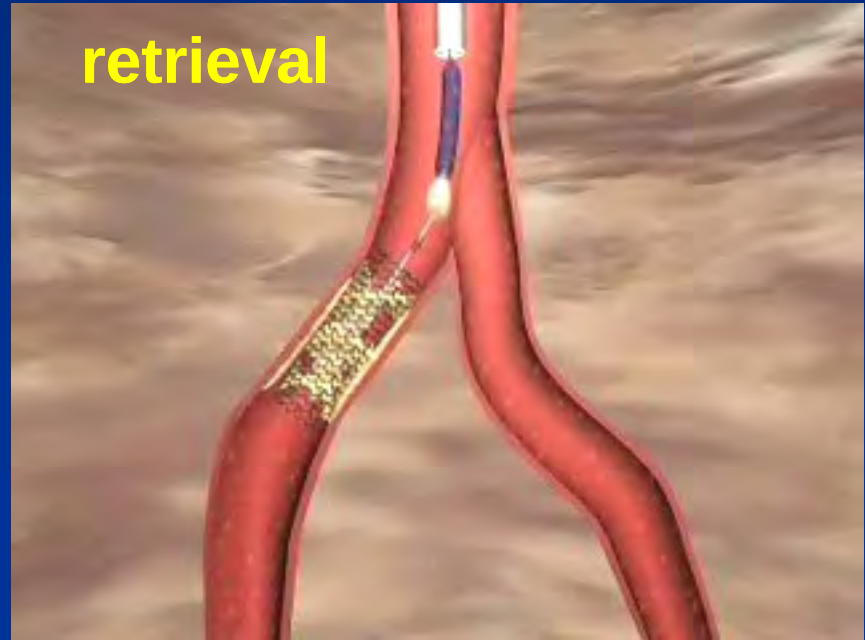
Deployment
and PTCA



stent



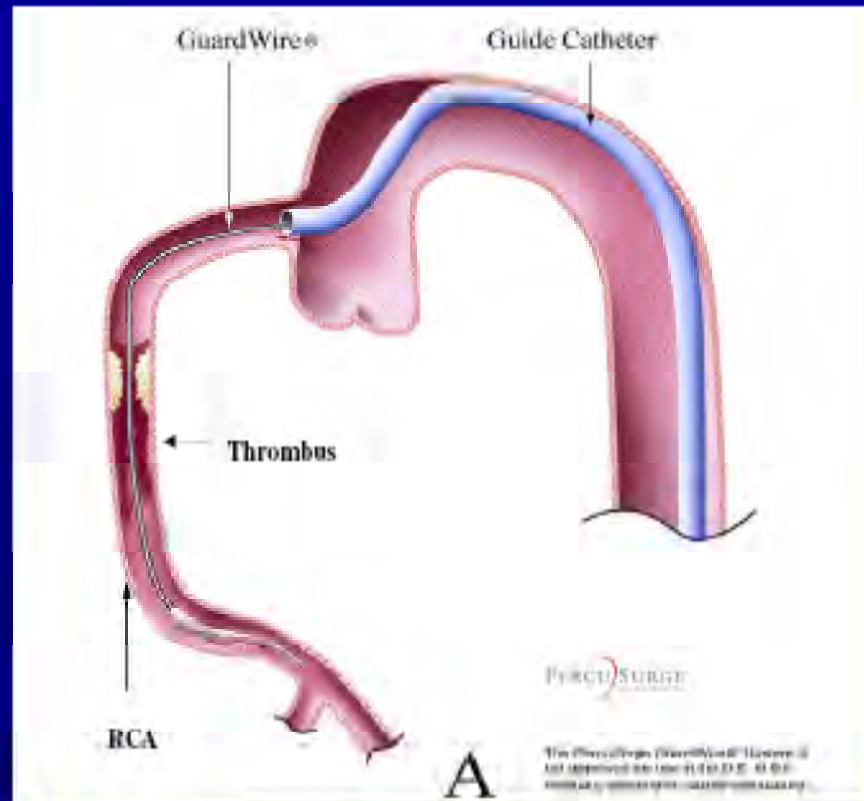
retrieval



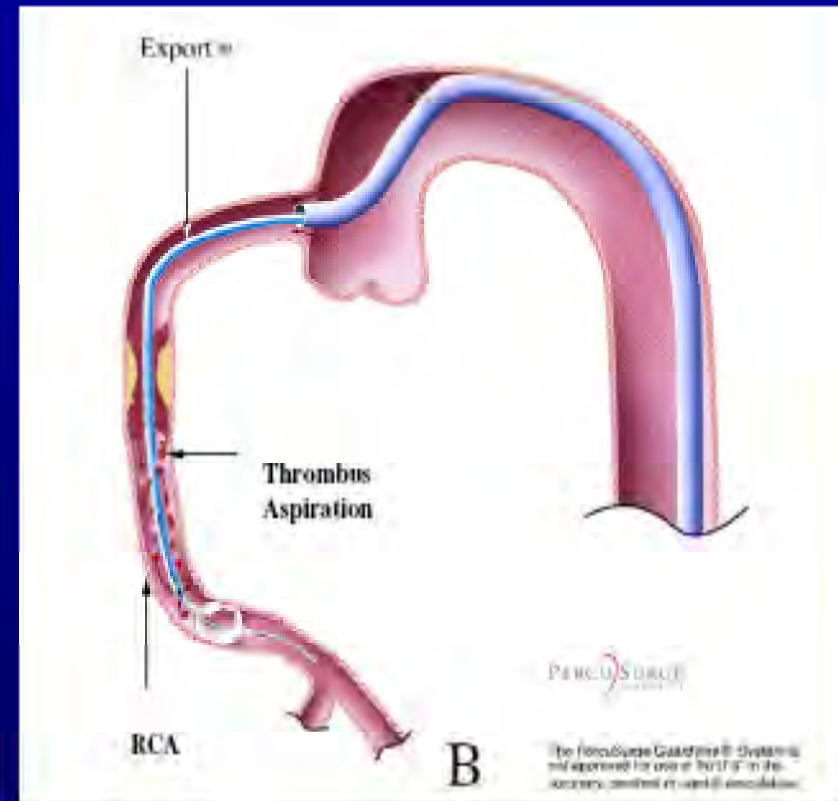


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Use of the GuardWire Plus™ in AMI



A. The occlusion is first crossed with the GuardWire®.

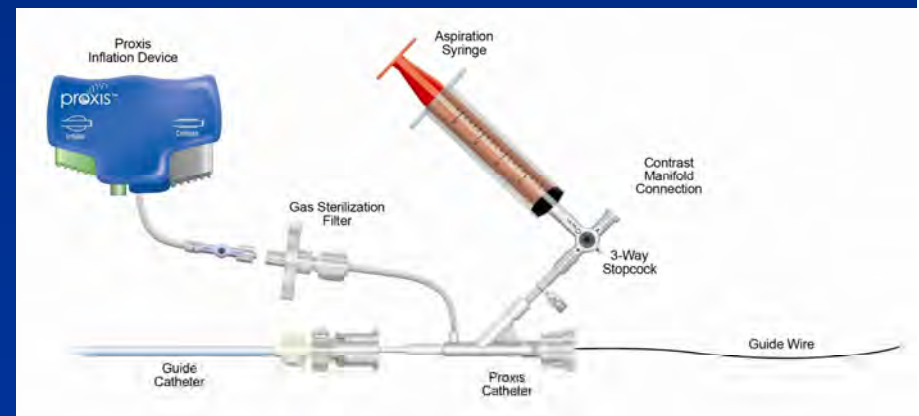
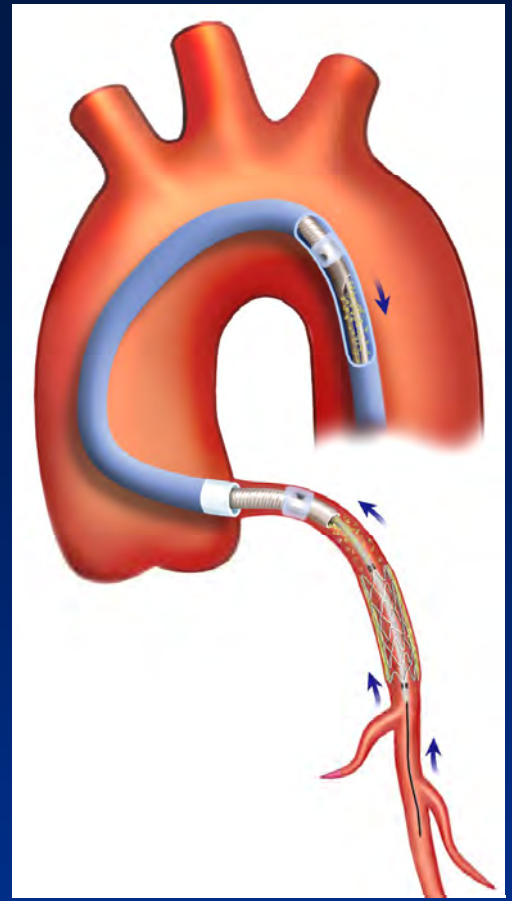
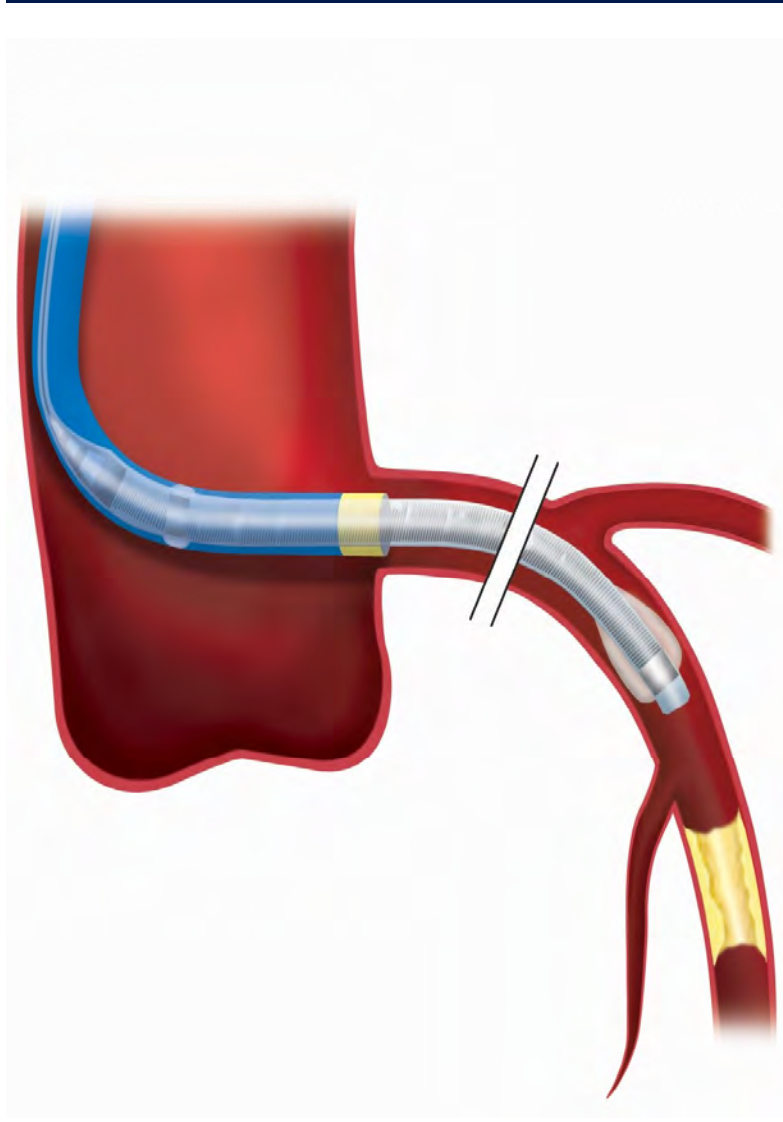


B. The GuardWire® is inflated in the distal vessel. The Export® Catheter is advanced to aspirate thrombus.



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Proxis™ Proximal Protection



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a Ospedaliera Universitaria S.G. Battista, Molinette di Torino

X-SIZER® Catheter System

Single-use, disposable medical device intended for the mechanical removal of thrombus from synthetic hemodialysis access grafts.

The device consists of a dual-lumen hydrophilic coated catheter shaft connected to a hand-held Control Module.

The inner lumen of the catheter contains a hollow torque cable with a helical cutter housed within the distal tip.

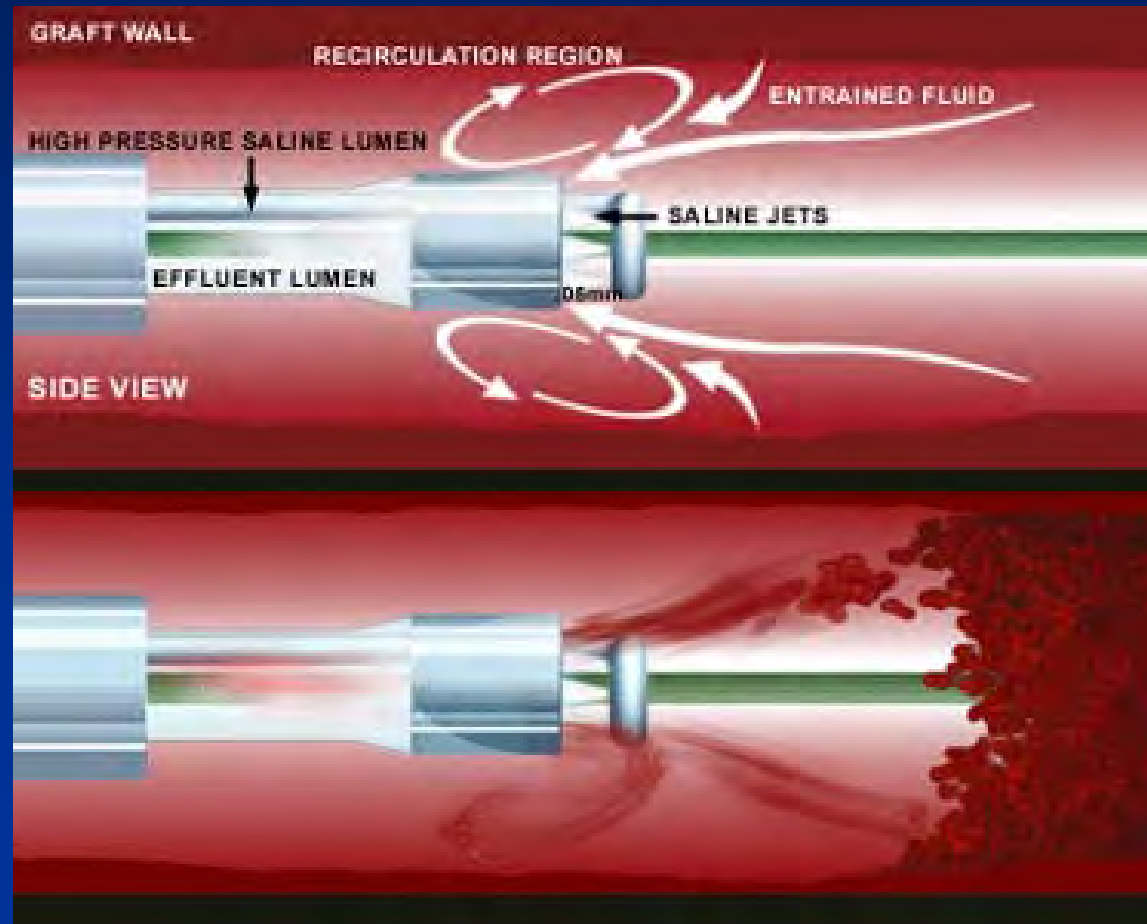
The outer lumen of the catheter is the path in which the excised debris is removed by vacuum.

In use, the cutter is rotated at approximately 2,100 rpm by the motor, which is powered by a 9-volt alkaline battery



ANGIOJET

The catheter (with angiojet attached) is advanced to the peripheral artery containing the blood clot. Once properly positioned, the pump of the angiojet is activated, delivering a saline solution under high pressure, into the artery, and directly at the blood clot. These saline jets create a powerful vacuum within the artery, breaking up the clot, and removing clot pieces.

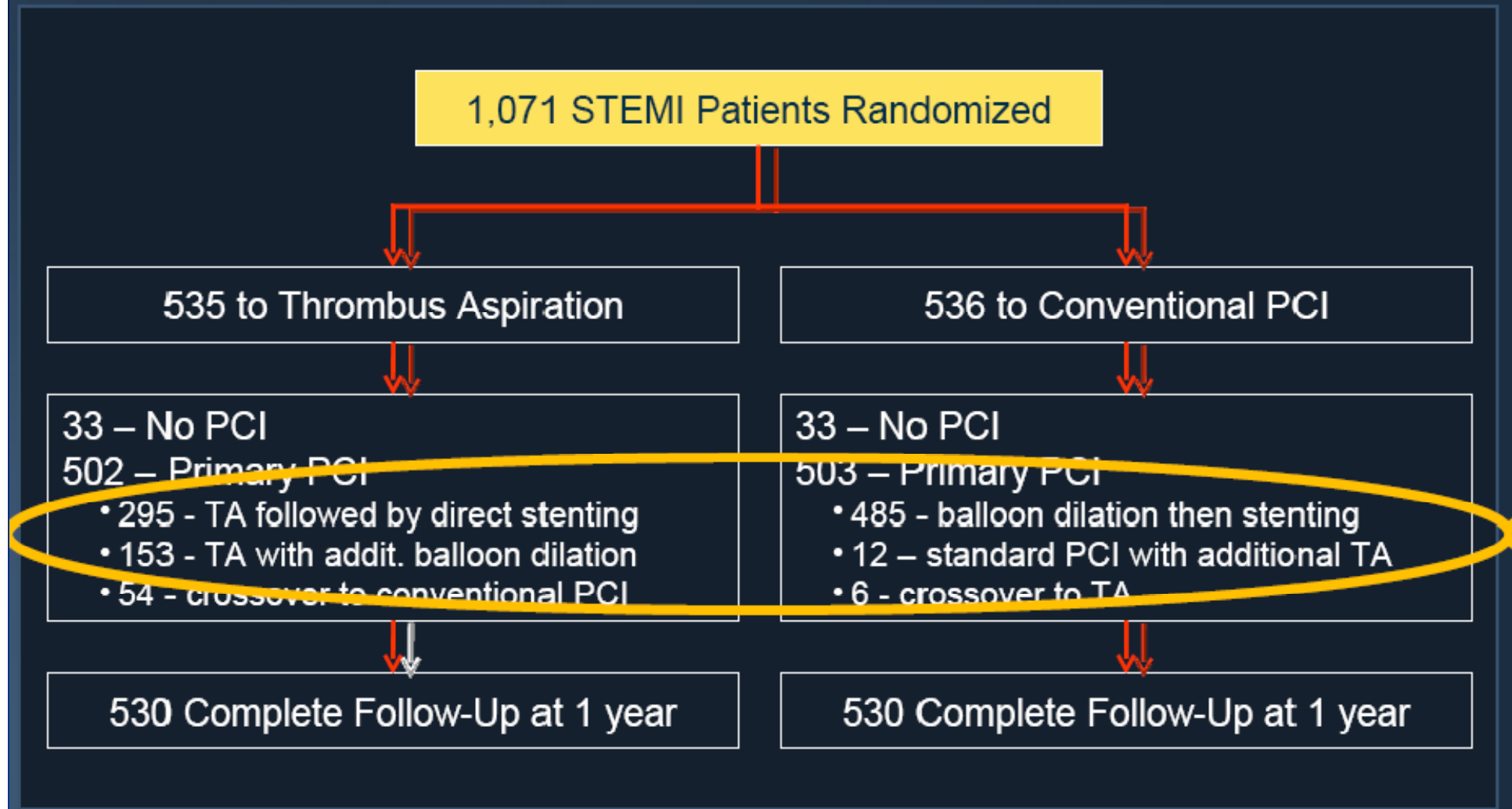


CLINICAL TRIALS

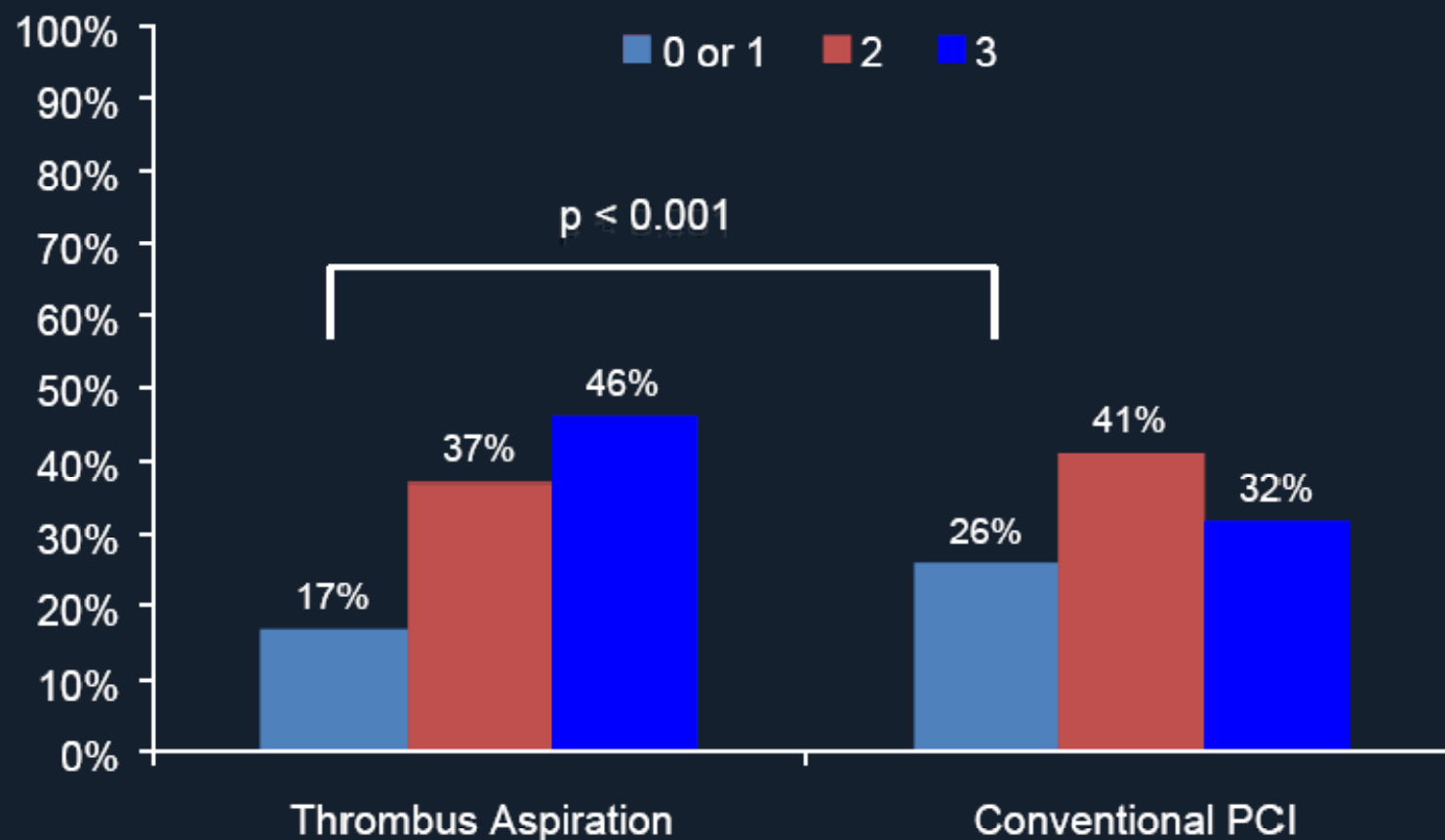


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TAPAS: Study Design



TAPAS: Primary Endpoint – MBG



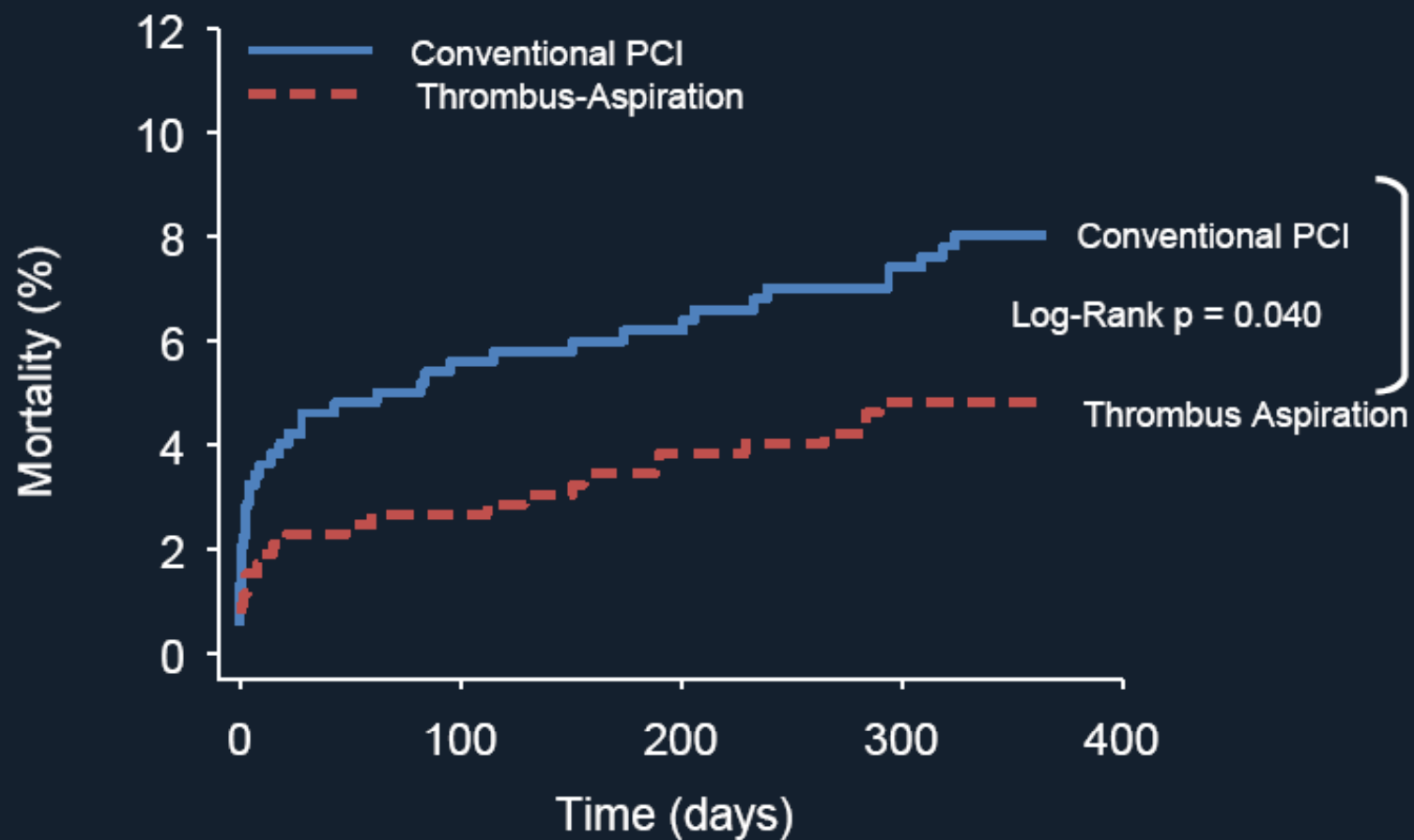
Reduction of Thrombus Burden &/or Facilitation of Direct Stenting?



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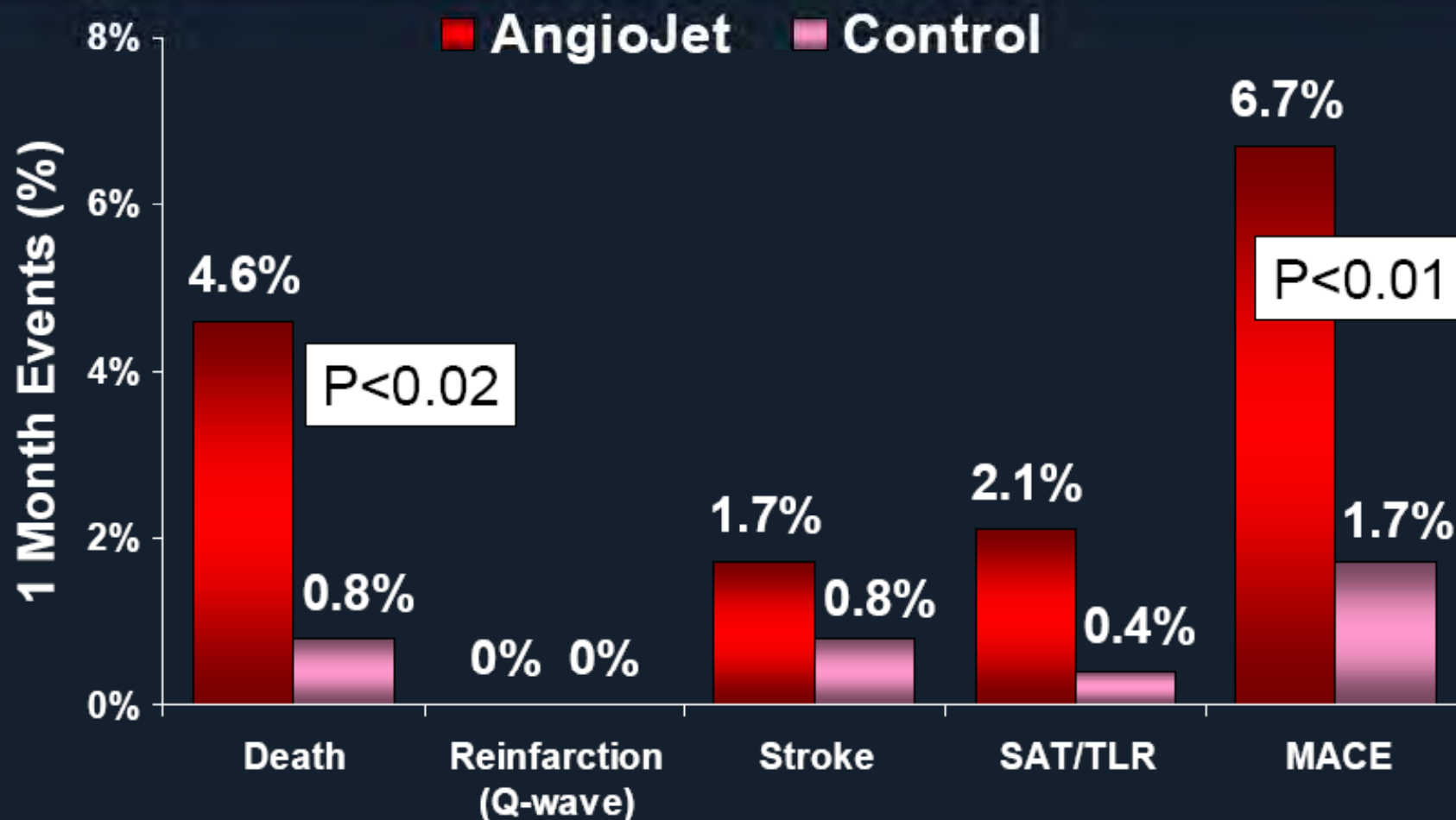
Vlaar PJ et al, *Lancet* 2008; 371: 1915-20

TAPAS: Mortality at 1 Year





MACE by 30 Days (N=480)



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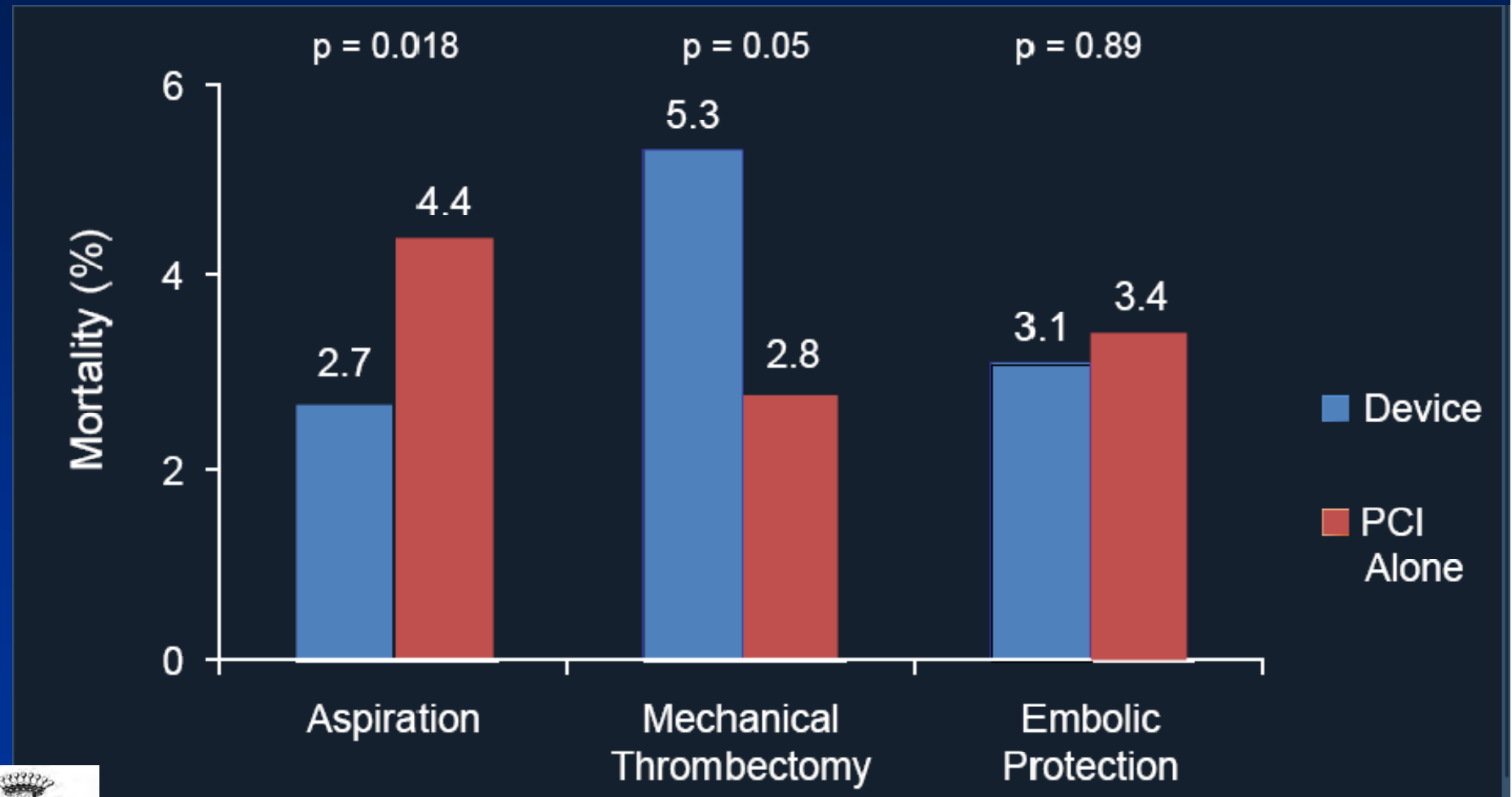
Meta-analysis



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Meta-analysis of the Impact of Thrombectomy and Distal Protection Devices on Mortality

30 Studies, 6415 patients, weighted mean FU of 5 months



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Bavry AA et al, Eur Heart J 2008; 29: 2989

ATTEMPT: 11 Included Trials

MANUAL
ASPIRATION

DIVER CE



REMEDIA

De Luca

PIHRATE

PRONTO



DEAR-MI

EXPORT



EXPORT

EXPIRA

TAPAS

NON-MANUAL
THROMBECTOMY

ANGIOJET



Antoniucci

X-SIZER



X-AMINE ST

RESCUE



Kaltoft

TVAC



VAMPIRE

2,686 Patients

Median Follow-Up: 365 Days
(significantly extended compared to published FU
of included trials: 135 days)

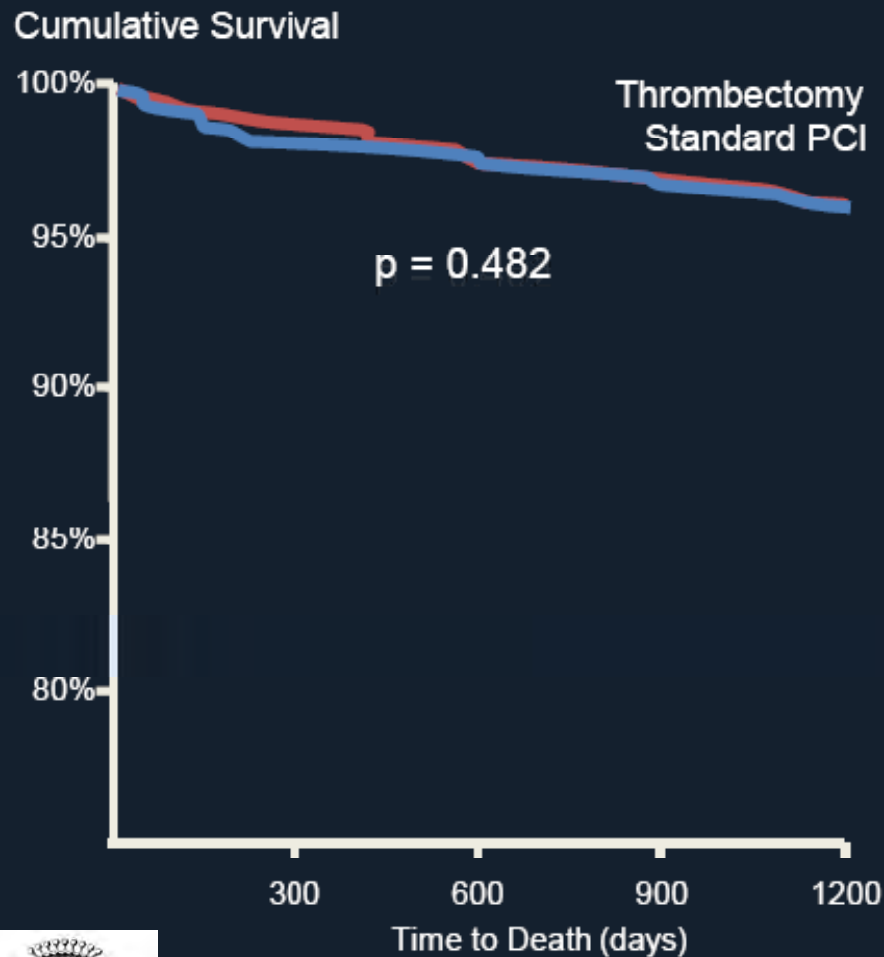


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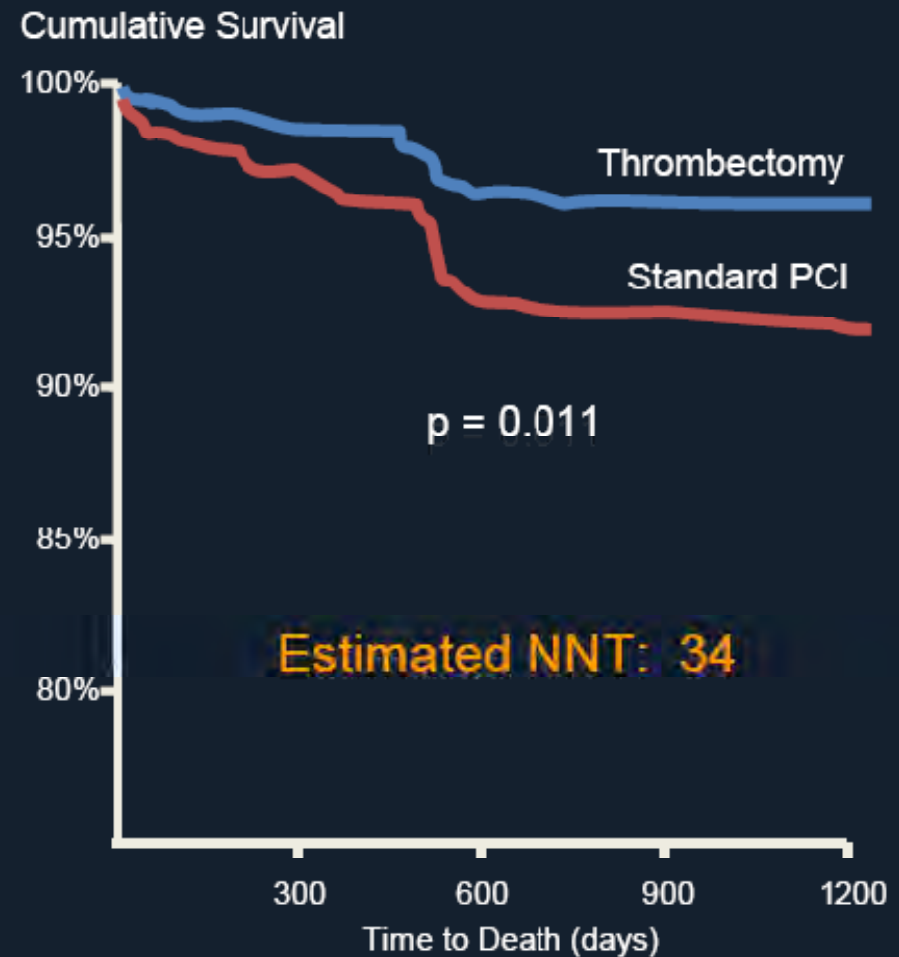
Burzotta, ESC 2009; *Eur Heart J* 2009 30(18):2193

ATTEMPT: Impact of Type of Thrombectomy Device on Mortality

NON-MANUAL THROMBECTOMY TRIALS

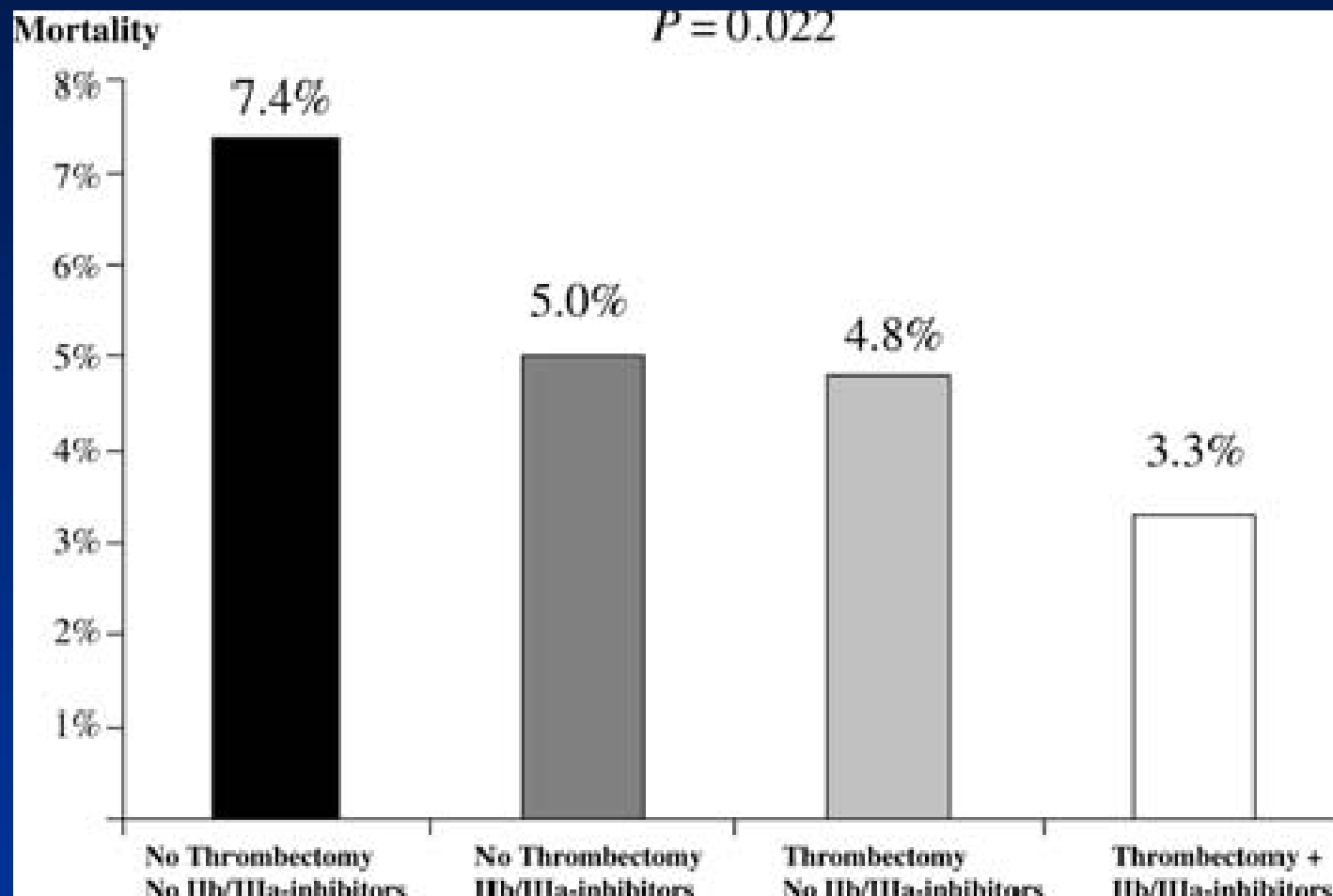


MANUAL ASPIRATION TRIALS



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Mortality rates observed in the ATTEMPT database according to thrombectomy and to administration of IIb/IIIa-inhibitors.



...BUT...

Almost half of population of manual
trombectomy group is from TAPAS trial
1071/2686

TAPAS trial limitations

- 1) Single Center trial
- 2) No aspiration in 10% of patient
- 3) Some benefit may be from direct stenting
- 4) No reduction in distal emboli (5,5% Vs 5,8%)
- 5) Not powered for clinical endpoint

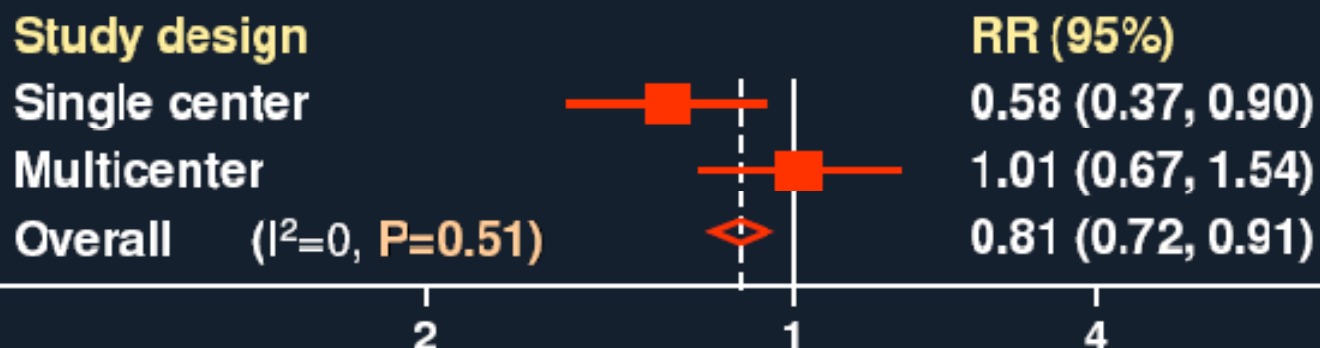


Embololic Protection During Primary PCI: Impact of single vs. multicenter studies

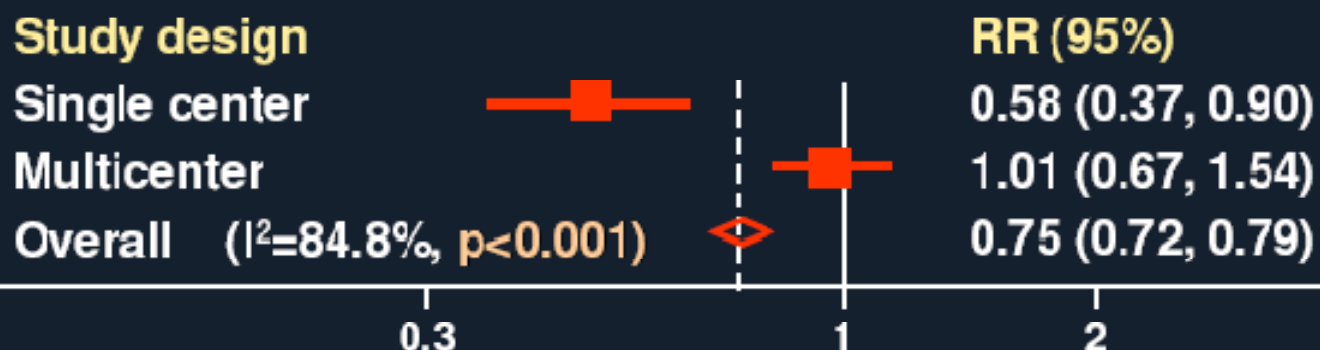
25 RCTs, 5919 pts

2460 pts in single center trials, 3459 pts in multicenter trials

Predictors of mortality



Predictors of ST resolution



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Inaba et al Eurointervention 2009; 5: 375

GUIDELINES

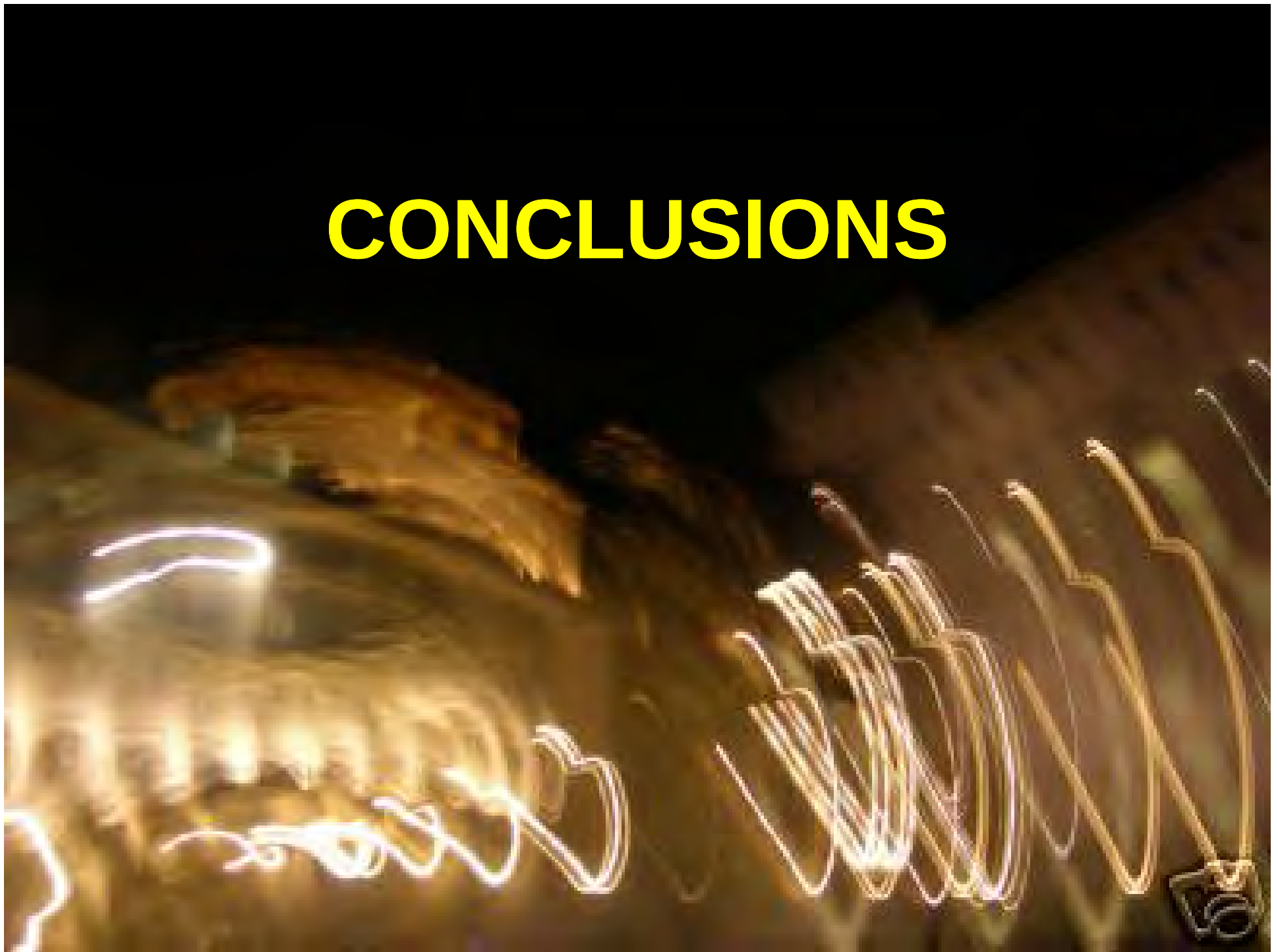


2009 ACC/AHA STEMI Guideline Update: Aspiration for Rx of STEMI

- **New Class Ila, Level of Evidence B recommendation for the use of aspiration thrombectomy for STEMI**
 - IIA - Treatment benefits > Risk, “It is reasonable to perform.”
 - B – Data from several non-randomized or a single randomized study.
 - This recommendation does NOT apply to mechanical thrombectomy (e.g., Angiojet)
- ACC/AHA guidelines cite:
 - 2 randomized clinical trials: TAPAS & EXPIRA
 - A meta-analysis by Bavry et al
 - A large pooled analysis of randomized trials: ATTEMPT



CONCLUSIONS



The understanding of the prevailing pathogenic mechanism(s) of no-reflow in the individual patient is probably important in the selection of the most appropriate therapeutic approach.



Conclusions

- Every PCI needs a selective strategy and an understanding of the possible pathogenetic mechanism-(s)
- Use manual thrombus aspiration for large thrombus burden
- Be a “single center trial” participant: acquire a great experience in a given device
- Do not expect a mortality reduction but a easier PCI



Aspiration devices have limitation...

- 10% of the time they can't be passed
- 30% of the time they don't retrieve thrombus
- They cannot remove all thrombus
- They can result in distal embolization
- We need better – but still user friendly – thrombectomy devices



Conclusions

Large thrombus burden is associated with poor procedural results and poor long term outcomes

Aspiration is inexpensive and easy to use

Aspiration is effective in removing thrombus but has limitation

Aspiration appears to improve surrogate endpoints in myocardial reperfusion

Improvement in clinical endpoints is not conclusive



**Thanks for your
attention !**

