

# Thrombosuction in AMI

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# Advances in Primary PCI for AMI

Reducing door to balloon times is essential for saving lives and reducing infarct size

Mortality increases 7.5% for every 30 min increase in time from symptom onset to PCI

*Target D2B Time < 90 mins*

*Target D2N Time < 30 mins*

- D2B time  $\neq$  TIMI3 distal flow!!
- Epicardial coronary artery reperfusion  
 $\neq$  Myocardial reperfusion

**D2B Time is an Established  
Performance Measure Which is  
Publicly Reported as a Quality Indicator  
for Hospital Performance**

# Importance of Aspiration Thrombectomy in STEMI

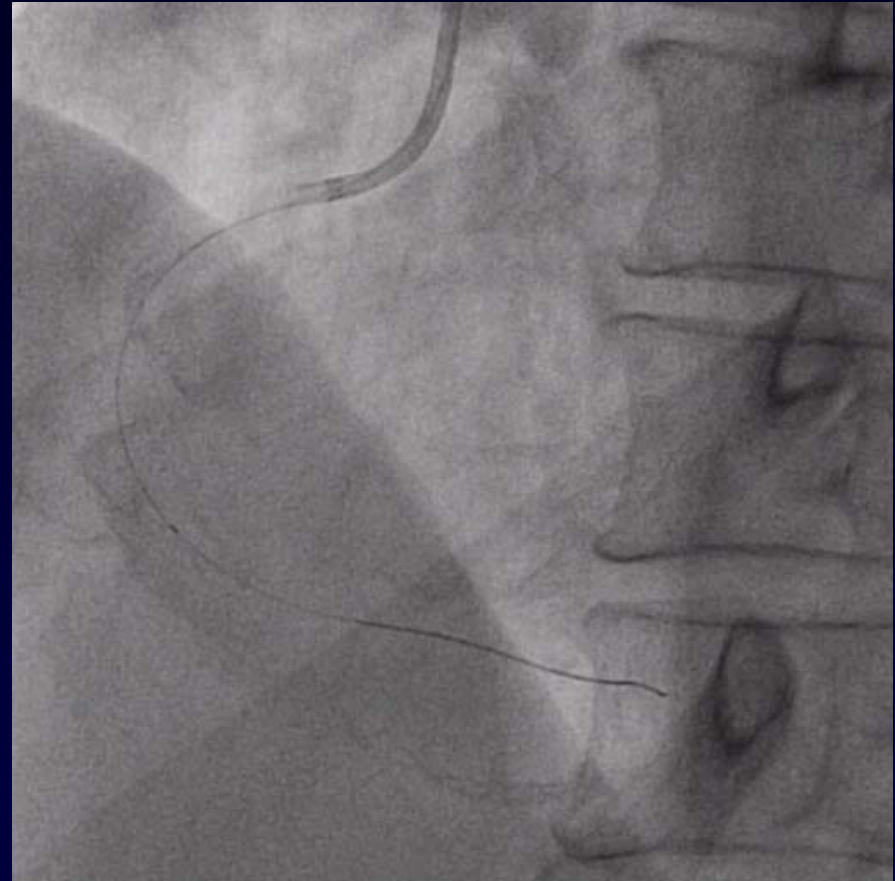
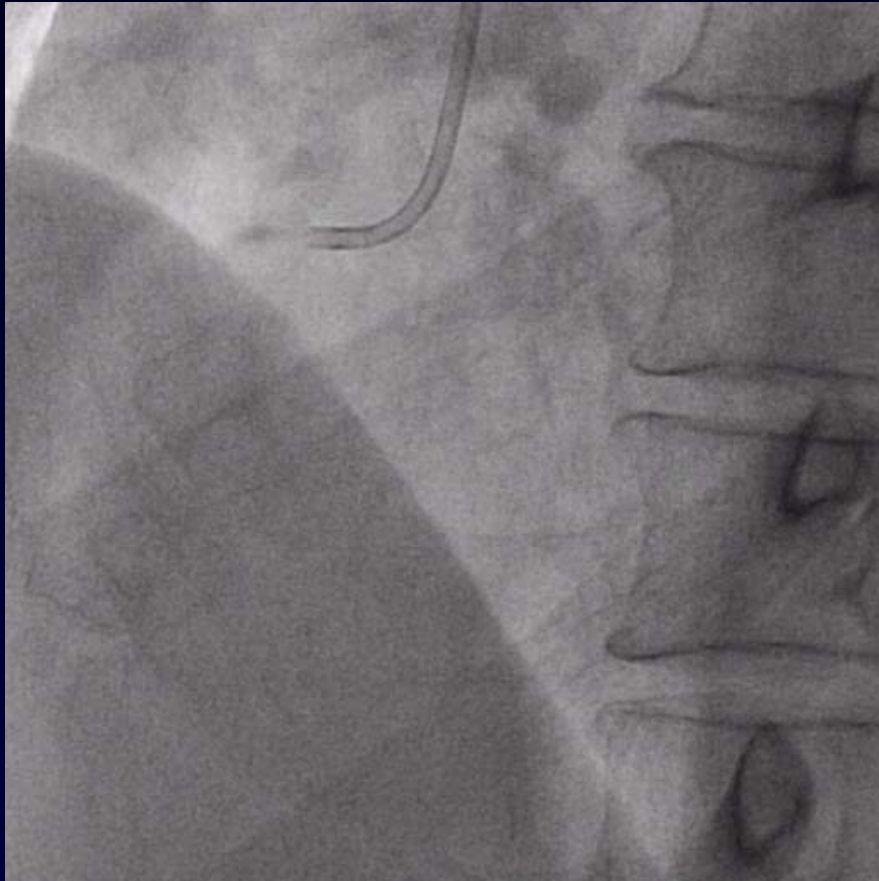
## “No-Reflow”

- Microvascular obstruction and reduced myocardial flow after opening an occluded epicardial artery.
- Prevalence: variable, 5% ~ 50%

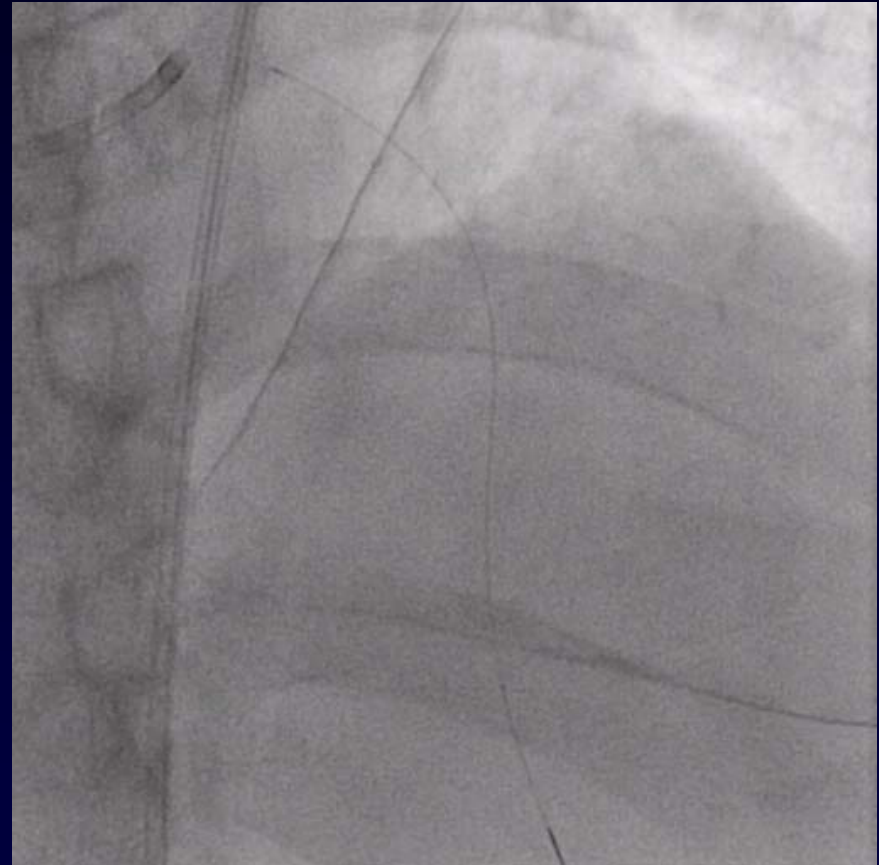
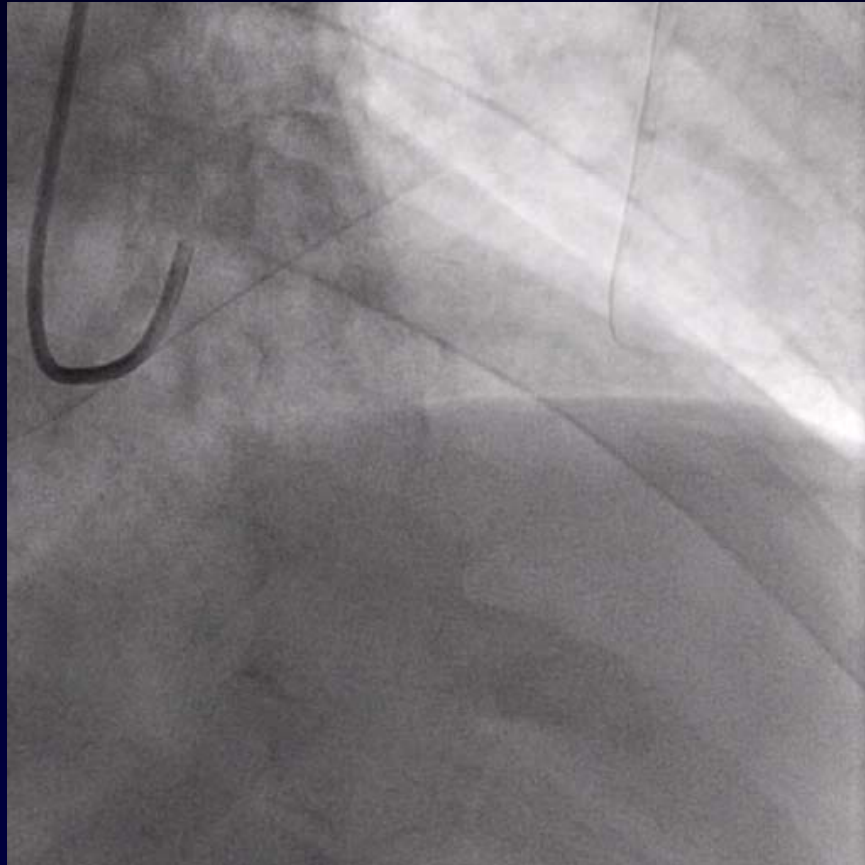
## “Optimal Reperfusion”

- a rapid, complete, & sustained coronary recanalization with adequate myocardial tissue perfusion
- 25% or less at thrombolytic era, vs. approximately 35% at PPCI era

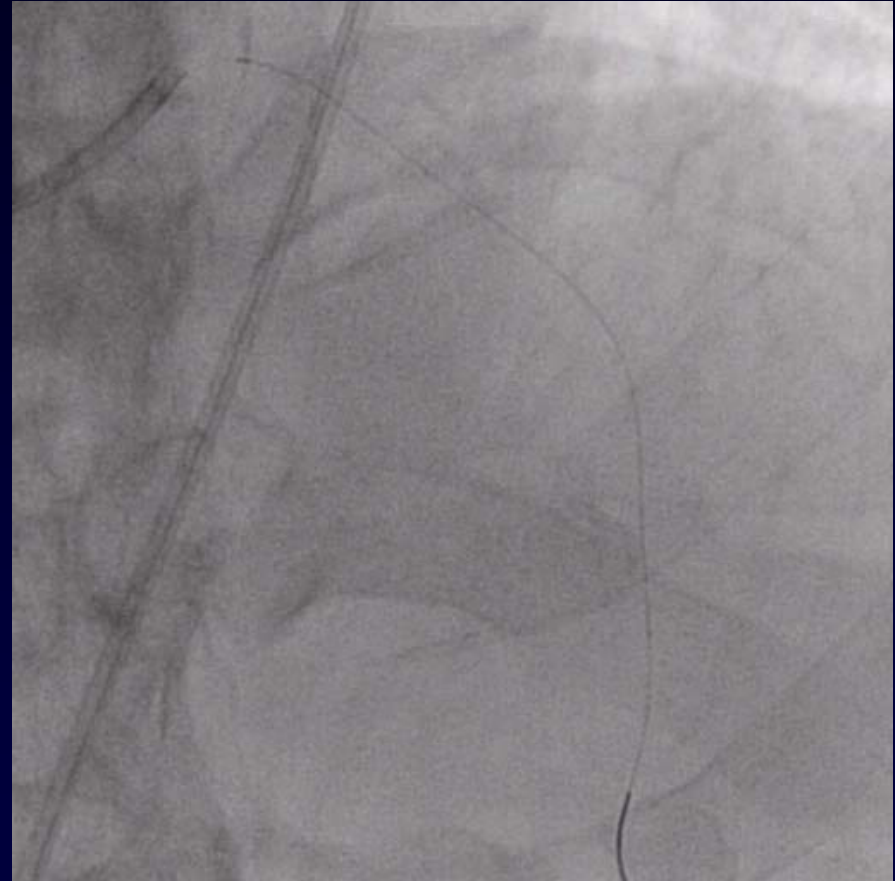
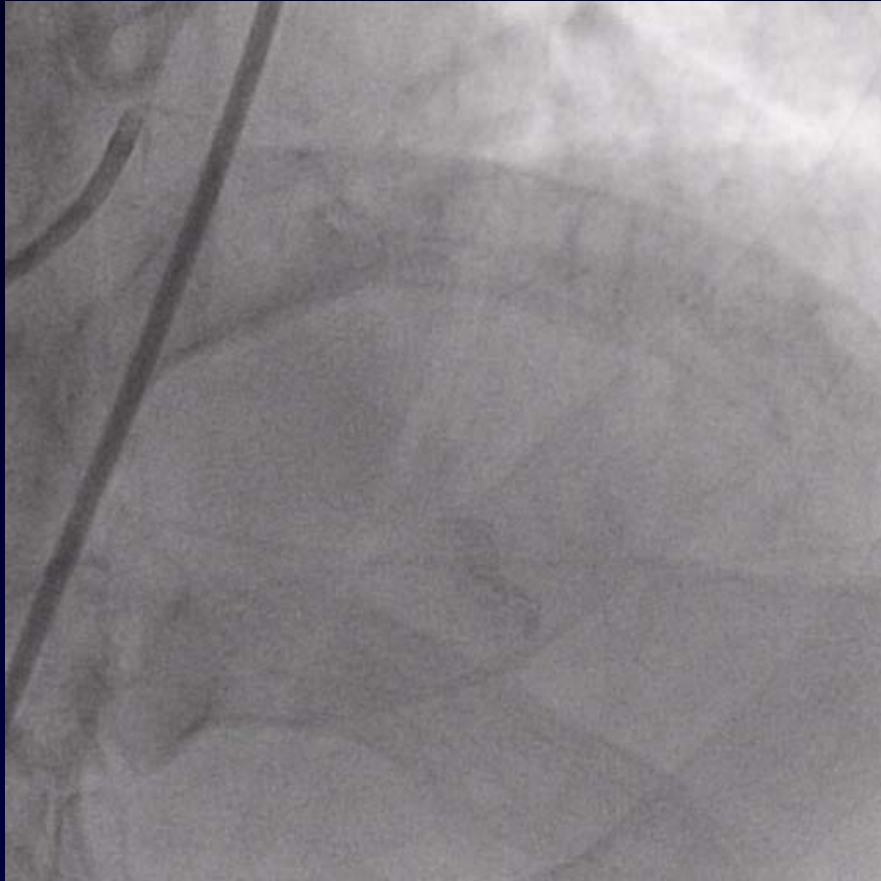
# Case



# Case



# Case



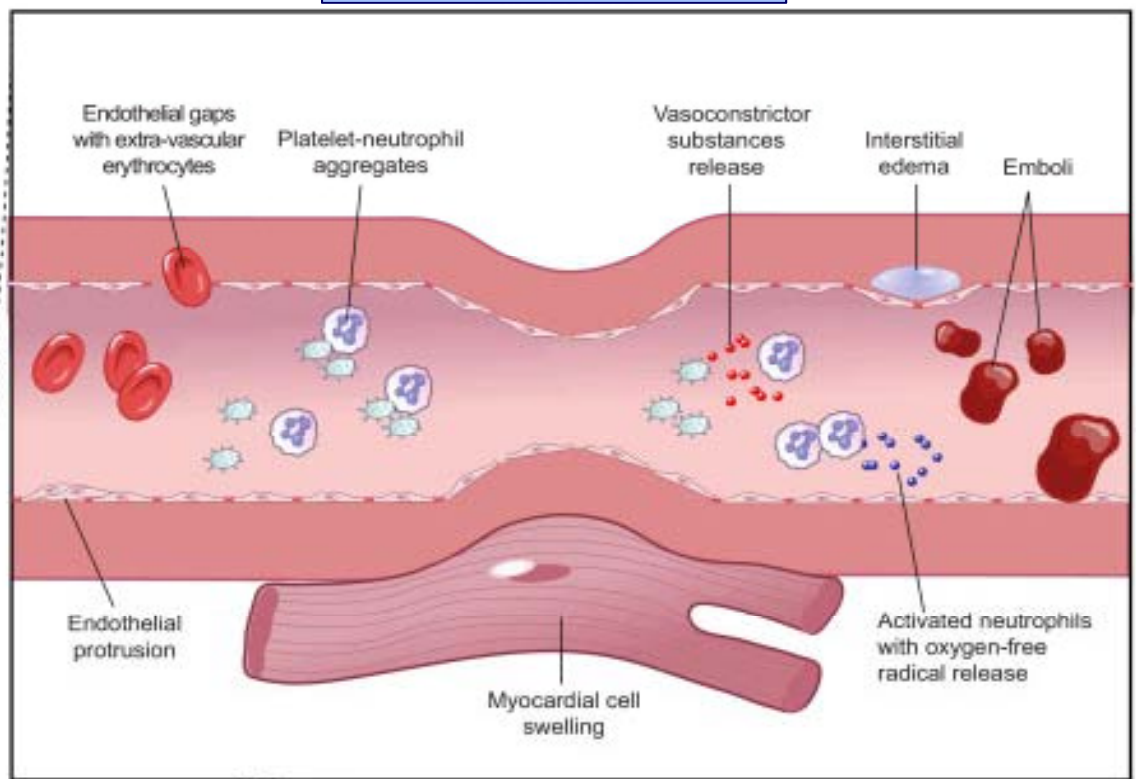
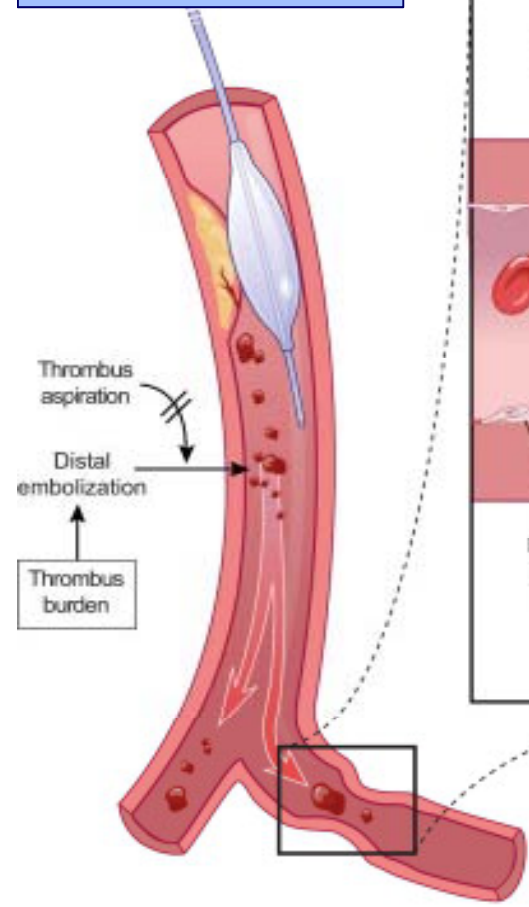


Correction of hyperglycemia  
Statins  
Nicorandil

Genetic variability  
Diabetes  
Acute hyperglycemia  
Hypercholesterolemia  
Lack of preconditioning

**Individual susceptibility**

**Distal Embolization**



Anti-neutrophil drugs  
ET-1r antagonists  
TXA2r antagonists  
Anti-platelet drugs

**Reperfusion-related Injury**

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

Reduction of coronary time  
Reduction of O<sub>2</sub> consumption

**Ischemia-related Injury**

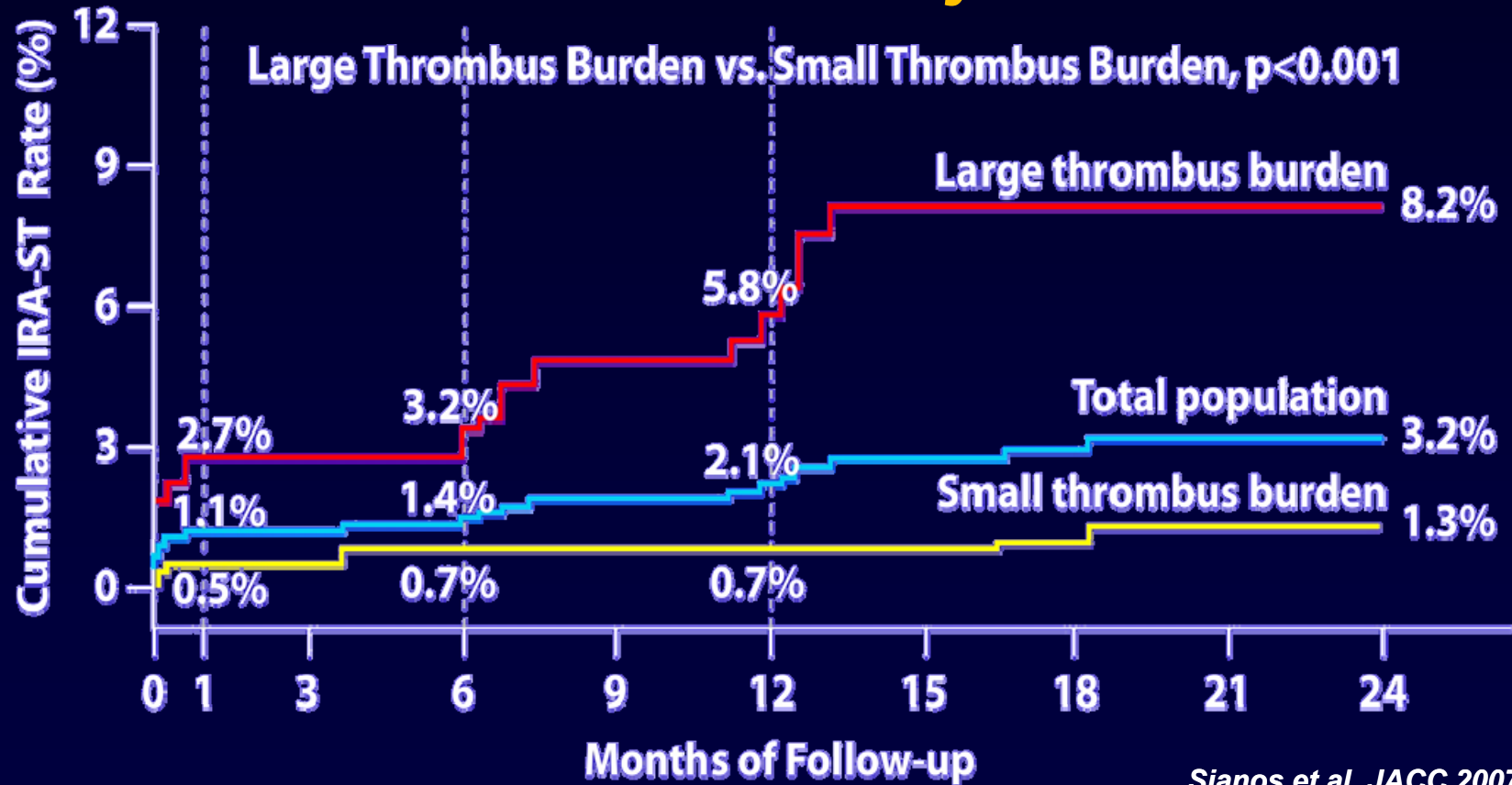
Ischemia duration  
ischemia extent

Niccoli G et al.  
*J Am Coll Cardiol* 2009;54:281-92

# Angiographic Stent Thrombosis After Routine Use of DES in STEMI: *The Importance of Thrombus Burden*

812 pts, Apr 2002-Dec 2004, STEMI  $\leq 12$  hrs; F/U  $18.2 \pm 7.8$  months  
Large Thrombus Burden (LTB)  $\geq 2$  vessel diameters

## Cumulative Infarct-Related Artery Stent Thrombosis

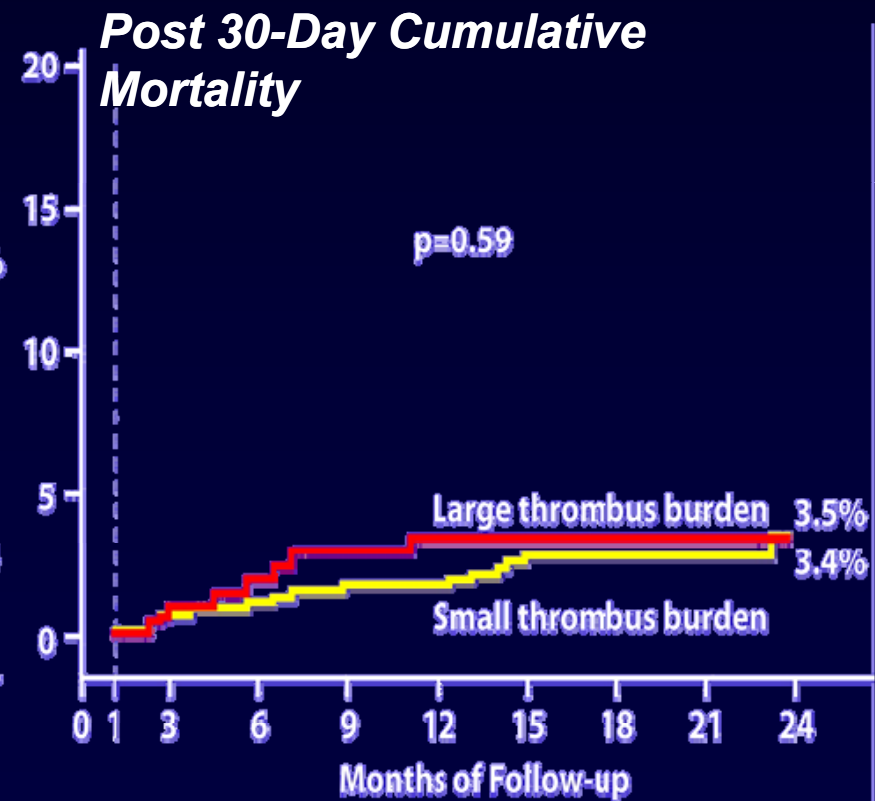
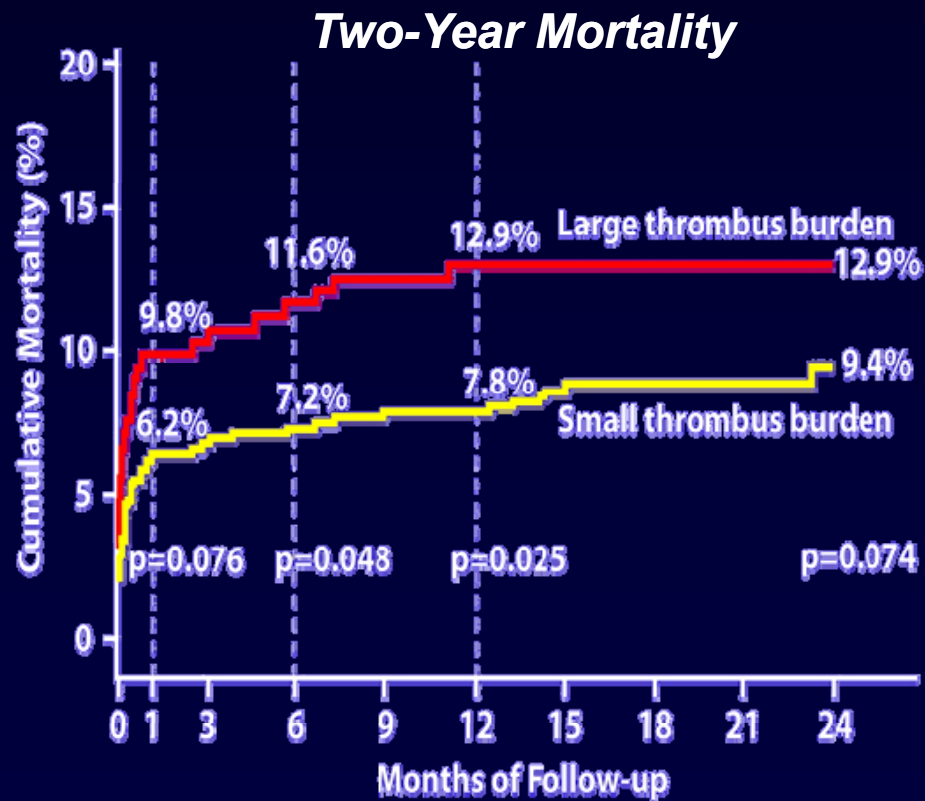


Sianos et al. JACC 2007;50:573

# Angiographic Stent Thrombosis After Routine Use of DES in STEMI: *The Importance of Thrombus Burden*

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## Impact of Thrombus Burden on Mortality



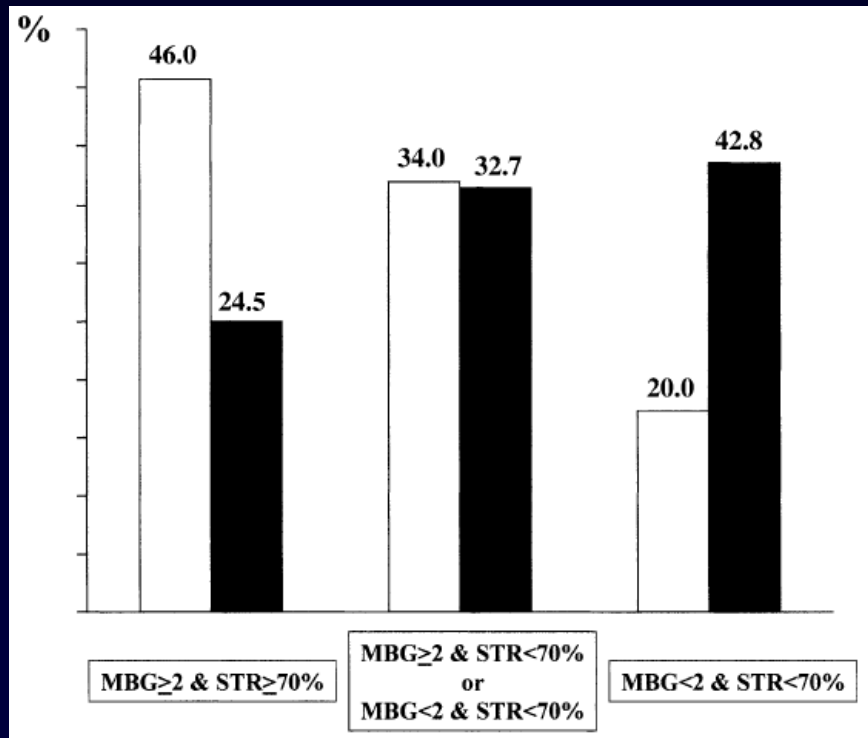
# Large Thrombus Burden

1. Thrombus greatest linear dimension more than 3 times the RD
2. Cut-off 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. Reference lumen diameter of the IRA  $> 4.0$  mm.

*Yip HK, et al. Chest 2002;122:1322–32.*

# REMEDIA

- Randomized, 100 consecutive STEMI, Italy
- Primary end points : post-procedural MBG  $\geq 2$  , STR  $\geq 70\%$ .



	Thrombus-Aspiration (n = 48)	Standard PCI (n = 48)
Death		
In the cath lab	1 (2.0%)	2 (4.1%)
After PCI	2 (4.0%)	1 (2.1%)
Reinfarction	2 (4.0%)	2 (4.1%)
Stroke	1 (2.0%)	1 (2.1%)
Target lesion revascularization	1 (2.0%)	1 (2.1%)
Any major adverse event	5 (10.0%)	5 (10.2%)

*Burzotta et al. JACC Vol. 46, No. 2, 2005*

# DEAR-AMI

- Pronto extraction catheter
- Italy, 160 consecutive STEMI
- 1ry end point: 70% ST-segment resolution, post-PPCI MBG-3.

	Thrombus Removal	No Thrombus Removal	p Value
Patients, n	74	74	
ST-segment score pre-PPCI (mm)	13.75 ± 10.37	12.60 ± 8.9	0.470
ST-segment score post-PPCI (mm)	3.98 ± 5.17	4.88 ± 5.3	0.297
ST-segment resolution score			
Complete (>70%)	50 (68%)	37 (50%)	0.043
Partial (30–70%)	21 (28%)	26 (35%)	0.639
None (<30%)	3 (4%)	11 (15%)	0.046
Maximum ST-segment elevation pre-PPCI (mm)	4.6 ± 2.71	4.52 ± 2.52	0.852
Maximum ST-segment elevation post-PPCI (mm)	1.45 ± 1.69	1.68 ± 1.72	0.413
Maximum ST-segment resolution			
Complete (>70%)	50 (68%)	37 (50%)	0.041
Partial (30–70%)	21 (28%)	27 (36%)	0.388
None (<30%)	3 (4%)	10 (13%)	0.096
<b>MBG-3</b>	<b>88%</b>	<b>44%</b>	<b>0.0001</b>

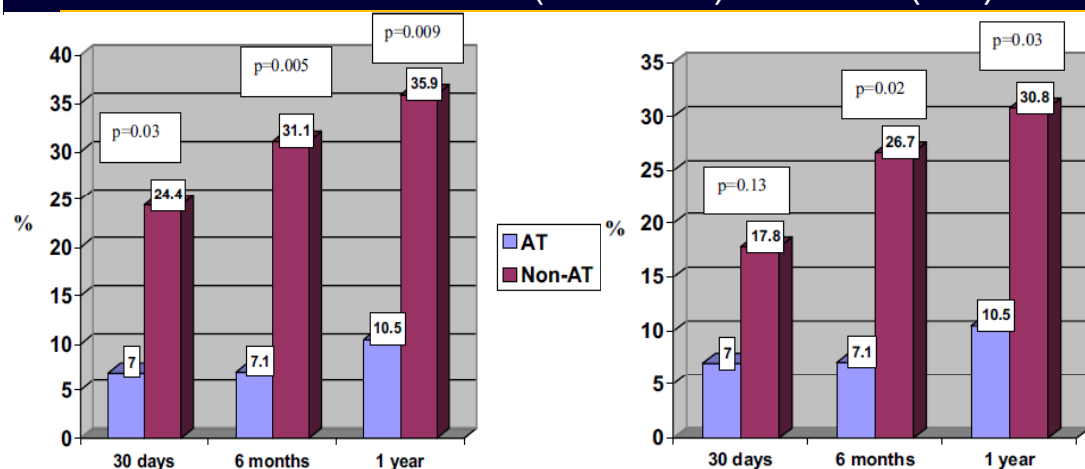
*Silva-Orrego et al. JACC Vol. 48, No. 8, 2006*

# Adjunct Thrombus Aspiration for STEMI With High-Risk Angiographic Characteristics

Washington Hospital Center

## Angiographic and procedural outcomes

Variable	Thrombus Aspiration		p Value
	Yes (n 80)	No (n 78)	
TIMI 3 flow after PCI (entire group)	73 (91%)	53 (68%)	0.001
TIMI 3 flow after PCI (baseline TIMI 0 flow)	43 (90%)	26 (57%)	0.001
TIMI 3 flow after PCI (baseline visible thrombus only)	30 (94%)	27 (84%)	0.43
Visible thrombus after procedure	6 (8%)	15 (19%)	0.03
Abrupt closure	0 (0%)	1 (1%)	0.50
No reflow or slow flow (TIMI 0–1)	0 (0%)	6 (8%)	0.01



## Decreased Death/MI

Javaid A. et al, Am J Cardiol 2008;101:452– 456



# PIHRATE Trial

*Poland, Italy, Hungary*

	<b>TD</b> <b>N = 75</b>	<b>TB</b> <b>N = 25</b>	<b>BS</b> <b>N=96</b>	<b>p-value</b>
<b>TIMI-3 Flow</b>	<b>91%</b>	<b>78%</b>	<b>82%</b>	<b>0.08</b>
<b>MBG 3</b>	<b>81%</b>	<b>53%</b>	<b>59%</b>	<b>0.03</b>
<b>TIMI-3 + MBG 3</b>	<b>78%</b>	<b>53%</b>	<b>56%</b>	<b>0.01</b>
<b>STR &gt; 70% + MBG 3</b>	<b>41%</b>	<b>29%</b>	<b>24%</b>	<b>0.01</b>
<b>Need for NP/Adenosine</b>	<b>8.9%</b>	<b>37%</b>	<b>22.6%</b>	<b>0.003</b>

**TD = Thrombectomy + Direct Stenting**

**TB = Thrombectomy + Balloon Angioplasty**

**BS = Balloon Angioplasty + Stenting**

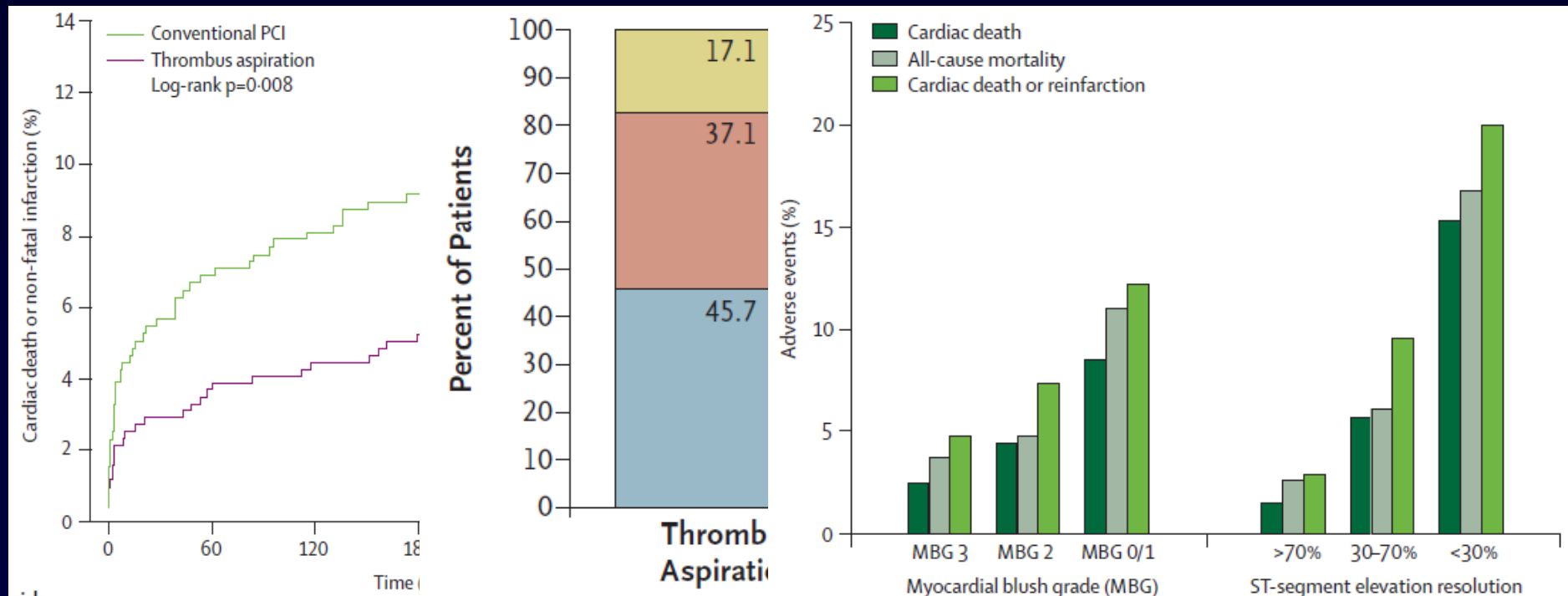
*W. Miclecki et al. AJC 2008;102:63i*



# Thrombus Aspiration During Primary Percutaneous Intervention in AMI Study (TAPAS)

*Lancet 2008; 371: 1915–20, N Engl J Med 2008;358:557-67.*

- 1071 STEMI pts, randomized study
- AT with Export Catheter (533 pts) vs. Standard PPCI (536 pts)
- Primary Endpoint: Myocardial Blush Grade (MBG)
- MBG 0/1 for TA = 17%, for Control = 26.3%,  $p < 0.001$












# EXPIRA trial

- 175 STEMI, Italy and UK, Export catheter
- To evaluate Clinical Outcome & the impact on myocardial perfusion and infarct size by contrast-enhanced MRI
- Better early micro-vascular obstruction sign

	Standard PCI	PCI with AT	P value
Post-stent MBG $\geq 2$	59.8%	88.6%	<0.0001
90-min STR	39.1%	63.6%	0.001
9-month Cardiac death	4.6%	0%	0.02
<b>2-year cardiac death</b>	6.8%	0%	0.0001
<b>2-year Reinfarction</b>	1.1%	0%	0.999
<b>2-year TVR</b>	5.7%	4.5%	0.651
<b>2-year MACE</b>	13.6%	4.5%	0.050

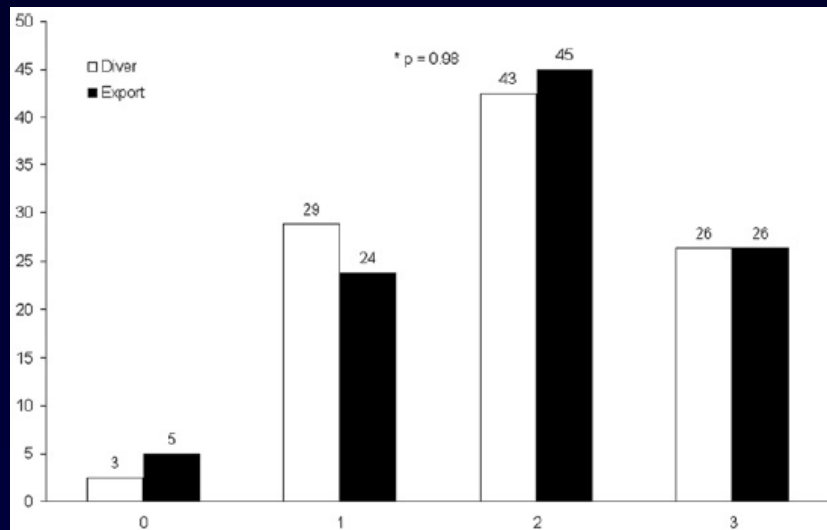
*Sardella et al., JACC Vol. 53, No. 4, 2009  
AHA 2009 presentation*

# Aspiration Thrombectomy Catheters

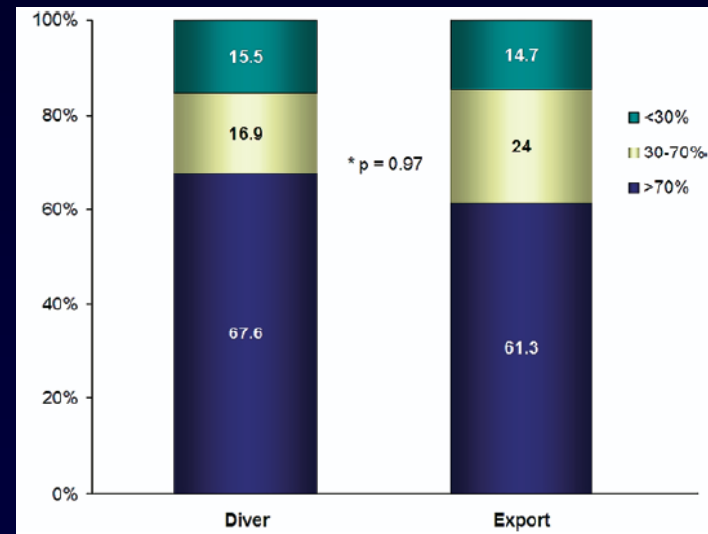
Export XT	Export 6F	Export 7F	Pronto V3	Diver (side holes)	Quick Cat	Fetch	Xtract 6F	Xtract 7F
								
Soft, beveled short tip	Bevel cut	Bevel cut	Rounded "bull-nose" tip with slot cut to prox tip	Bevel cut with long tip and 3 side holes	Bevel cut with long tip	Convex cut	Flat cut	Flat cut
0.041	0.041	0.050	0.047	0.033	0.041	0.044	0.045	0.064
Distal Lumen (inches)								

# Aspiration Device Lumen Size

- Prospective cohort study, 160 patients undergoing PPCI
- Comparison a large-internal-lumen catheter (Diver, Invatec, Roncadelle, Italy). vs. a medium-sized catheter (Export, Medtronic, Minneapolis, Minnesota, USA)
- Outcomes were compared with a matched population in TAPAS



Myocardial blush



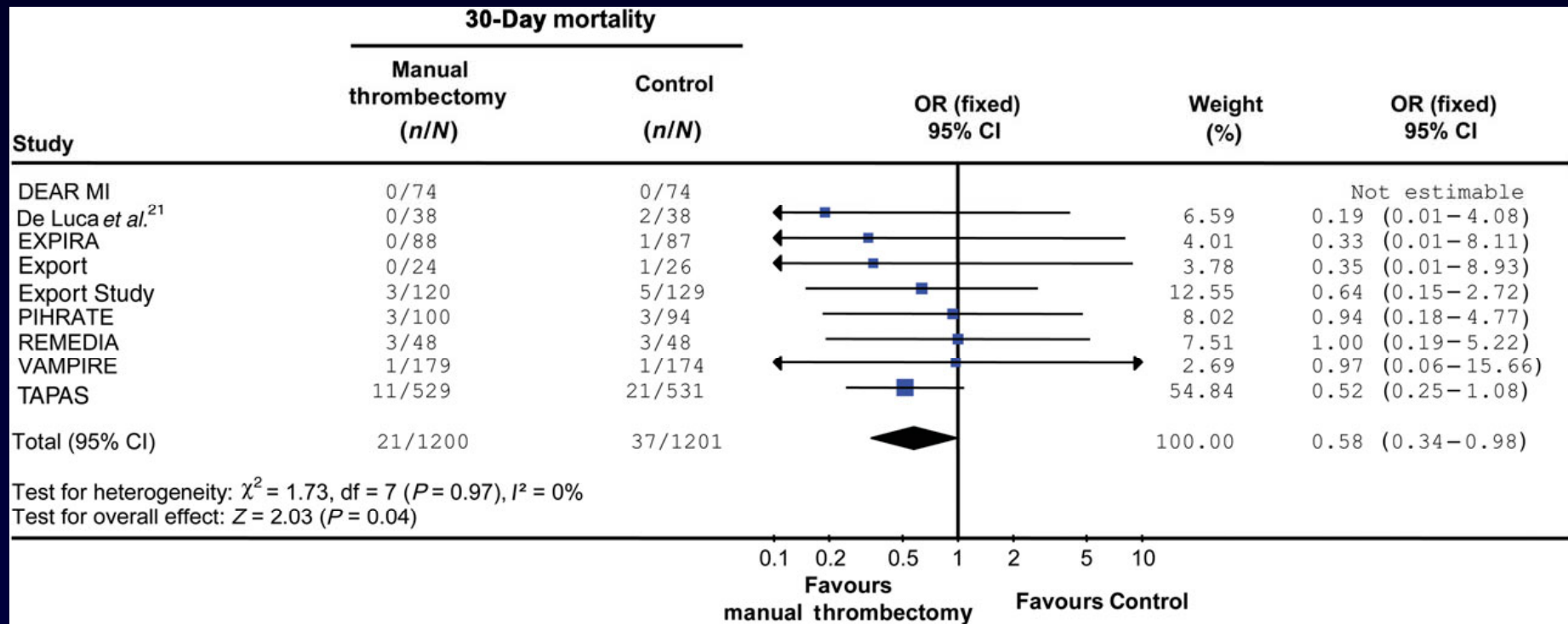
ST-seg resolution

**A larger internal lumen diameter did not result in retrieval of larger thrombotic particles, nor in improved angiographic or ECG outcomes.**

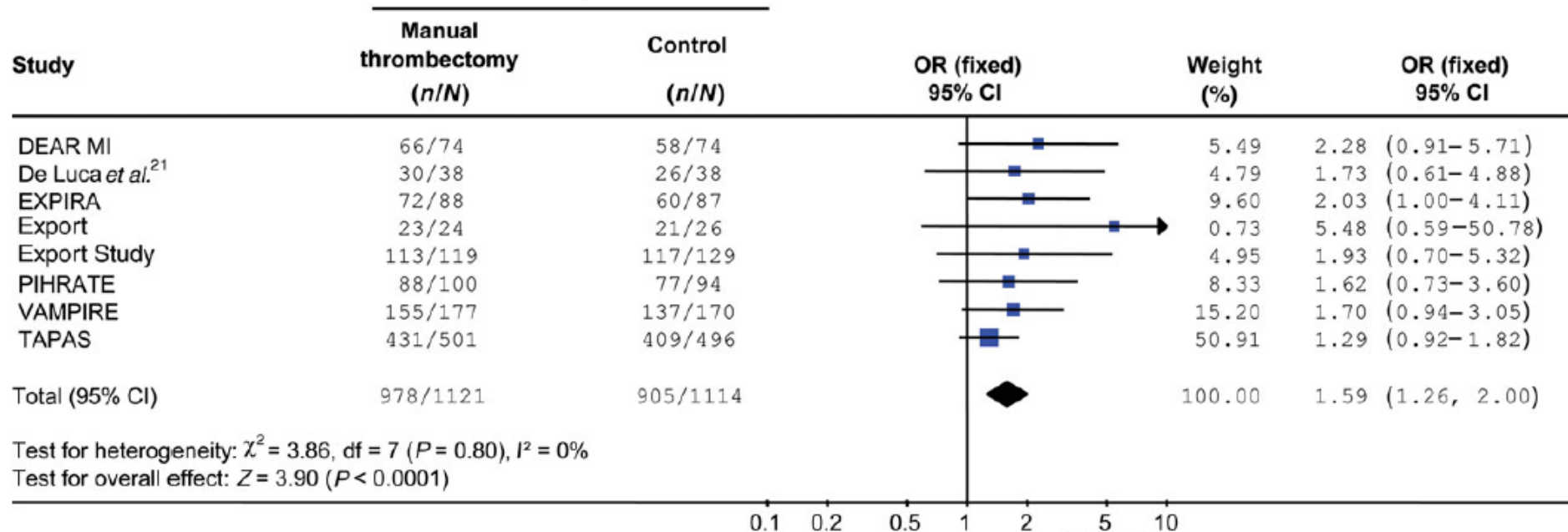
# Meta-analysis (1)

European Heart Journal (2008) 29, 3002–3010

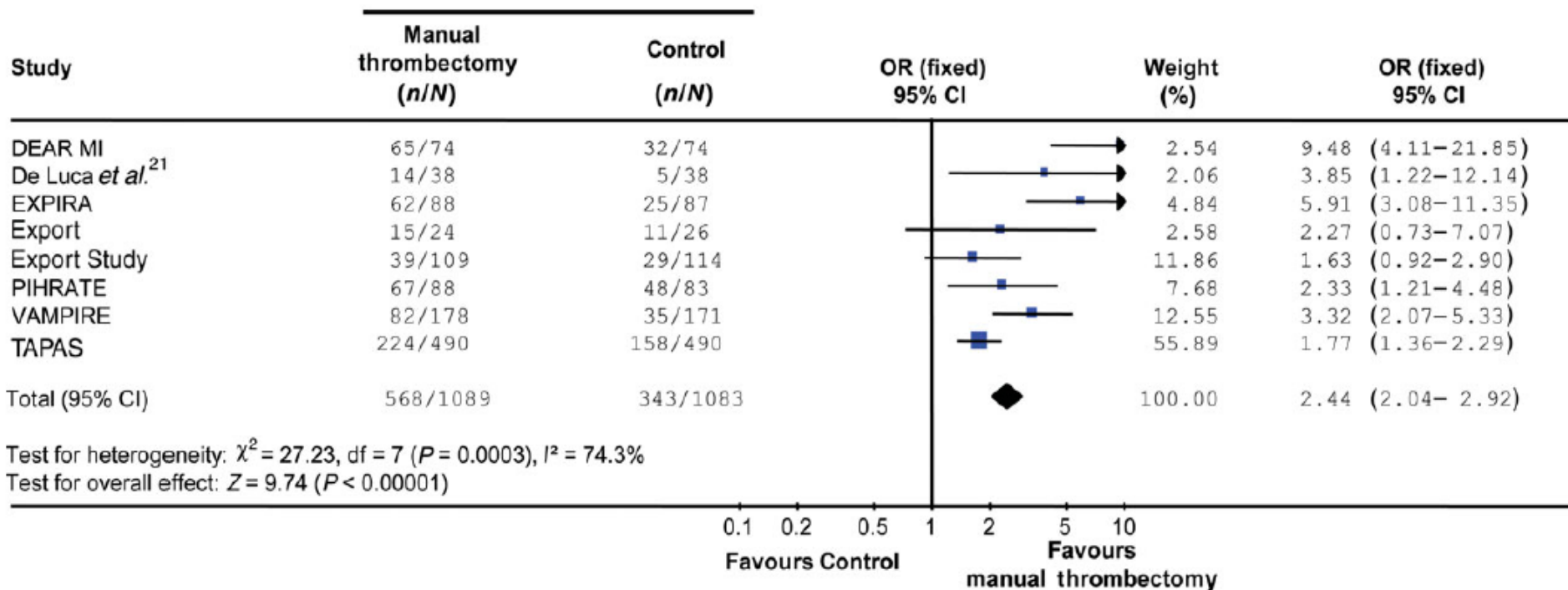
9 randomized trials included



**TIMI 3 post**



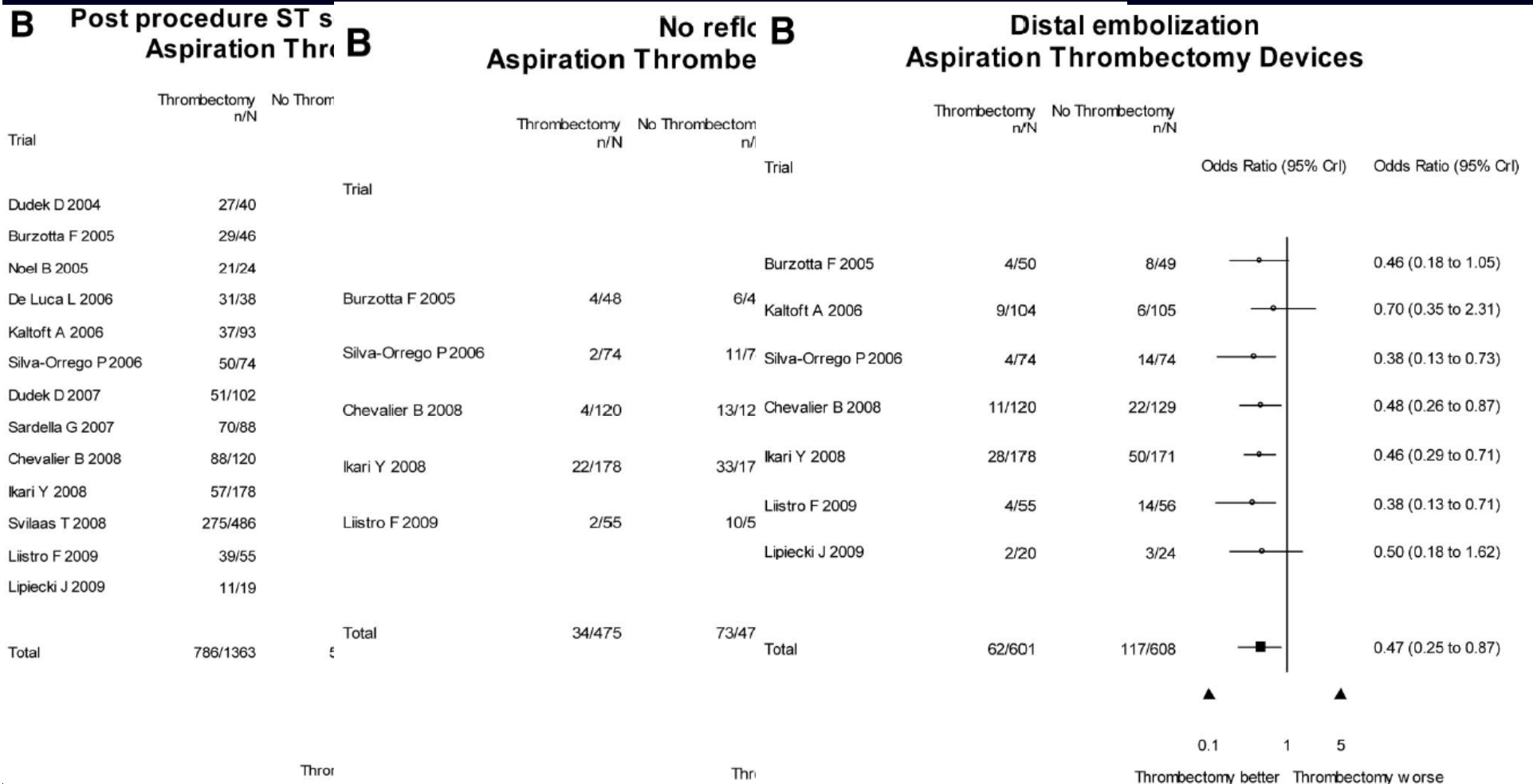
**MBG 3**



# Meta-analysis

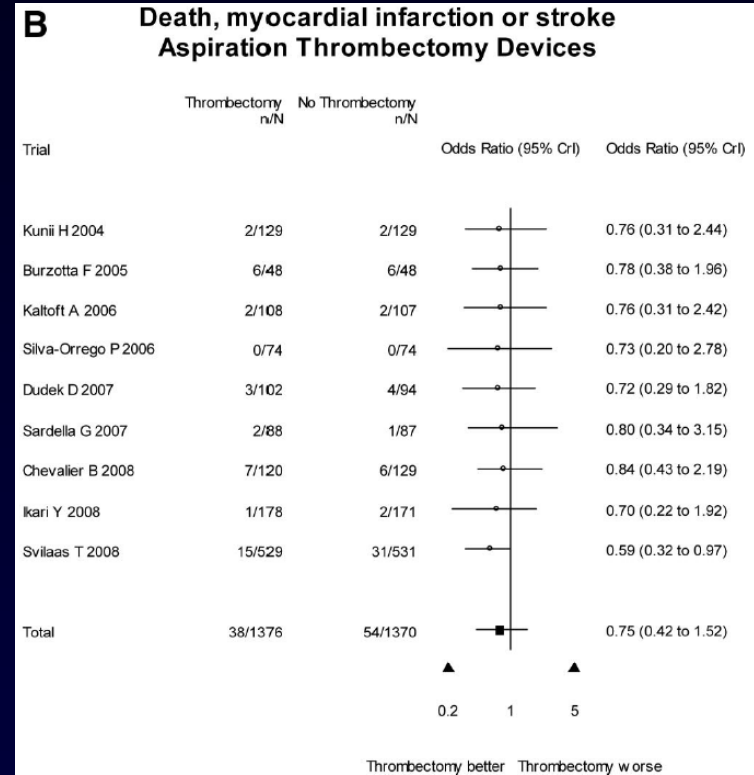
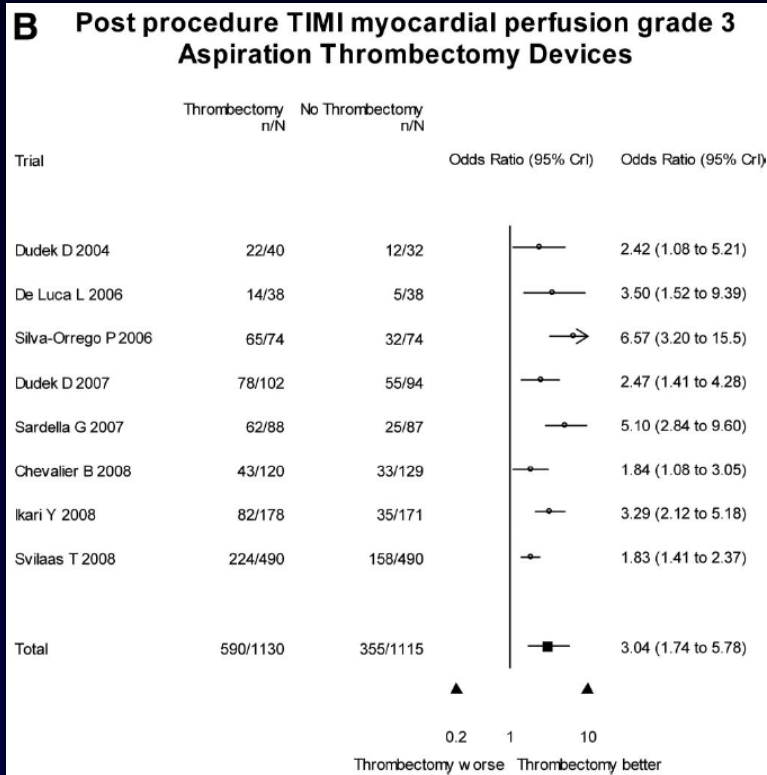
*Circ Cardiovasc Interv.* 2010;3:6-16

21 randomized trials included





# Meta-analysis



- Adjunctive thrombectomy improves early markers of reperfusion but does not substantially effect 30-day clinical event, such as, post-MI mortality, reinfarction, and stroke.

(*Circ Cardiovasc Interv.* 2010;3:6-16.)



# Conclusion

- Adjunctive Manual thrombus aspiration, if not anatomically contraindicated, should be considered in the setting of PPCI, particularly in patients with a large thrombus burden.
- We need a very large randomized trial with adequate power.