"You Did It, You Fixed It"
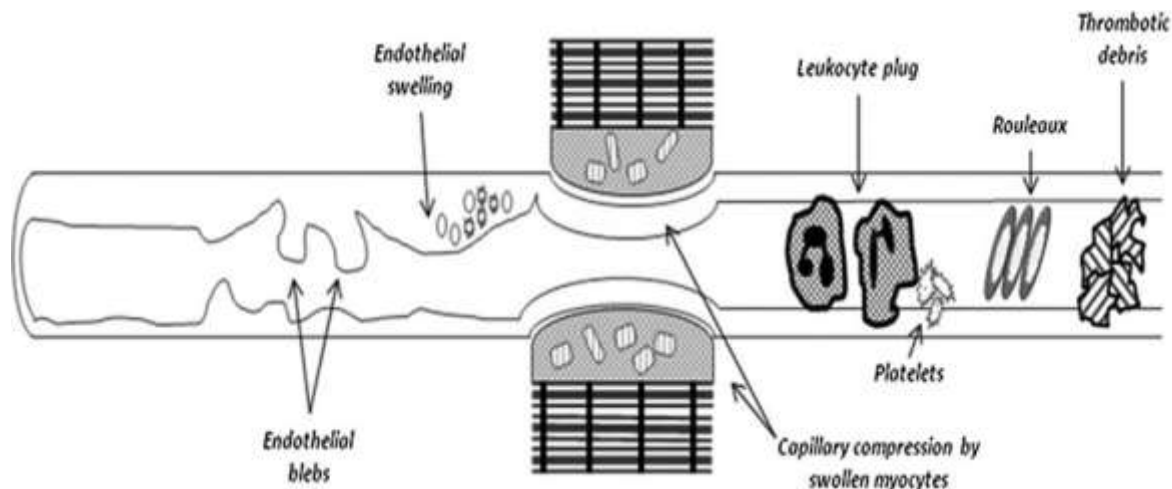
How to Deal with Thrombus and No Reflow

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Mechanisms of No Reflow

1. Mechanical obstruction of **distal embolization** and /or **atherosclerotic debris**

2. Vascular auto-regulation. Severe micro-vascular dystunction due to alpha-adrenergic macro-and micro-vascular **constriction and vasospasm**

3. Extrinsic coagulation pathway. Endothelial cell dysfunction/vasoconstriction induces exposure of TF leading to **thrombosis**

4. Leukocyte adherence, platelet thrombi and free radicals. **Oxygen free radical-medicated endothelial injury**. Capillary plugging by red cells and activated neutrophils
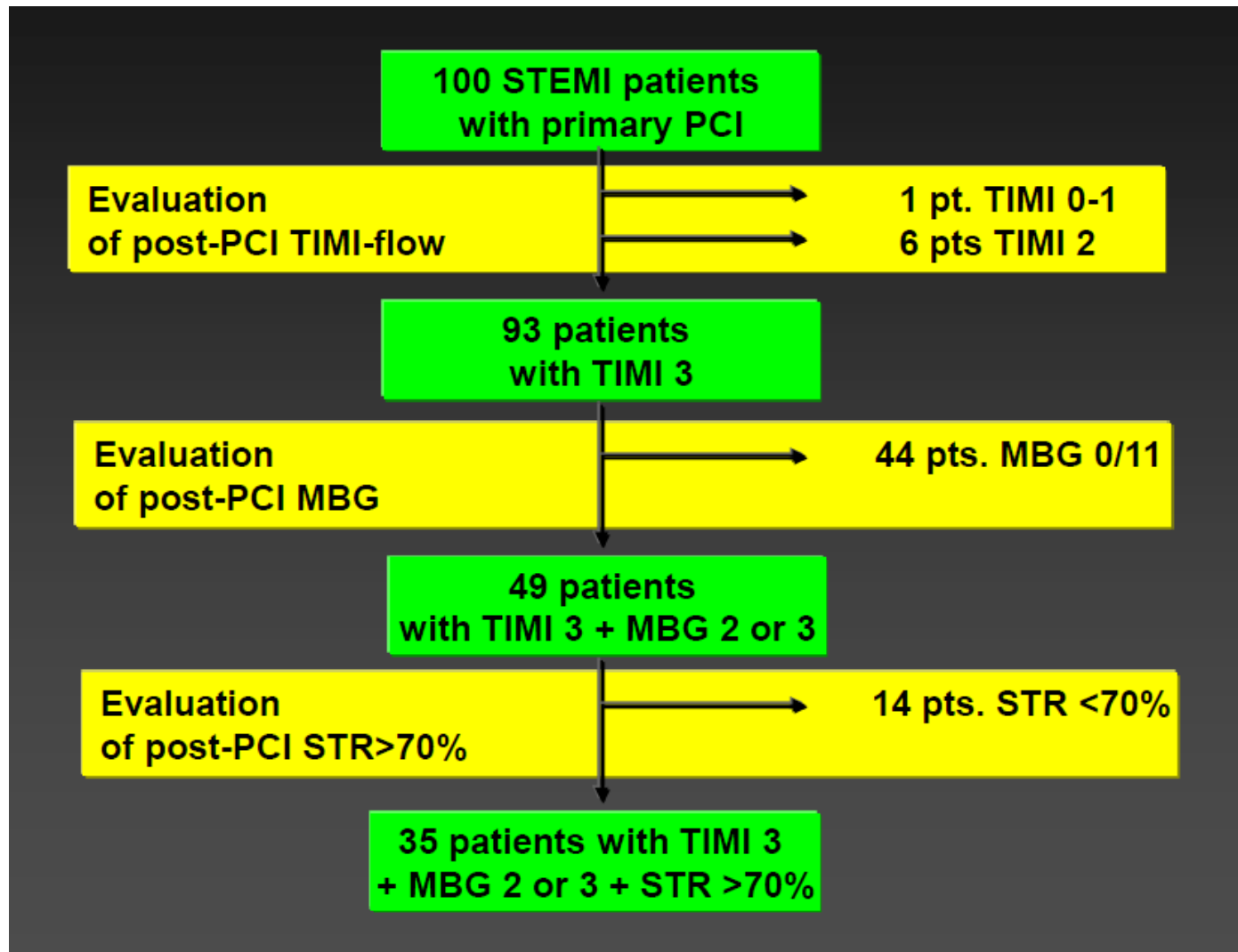
Clinical and Procedural Settings Frequently Associated with No Reflow

- **Thrombus related**

  – **ACS, esp STEMI**

- **Non-thrombus related (debris embolization)**

  – **Rotational atherectomy**

  – **SVG intervention**

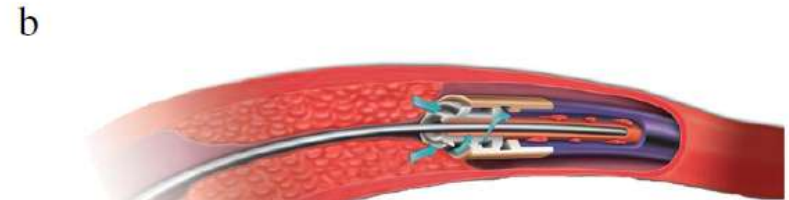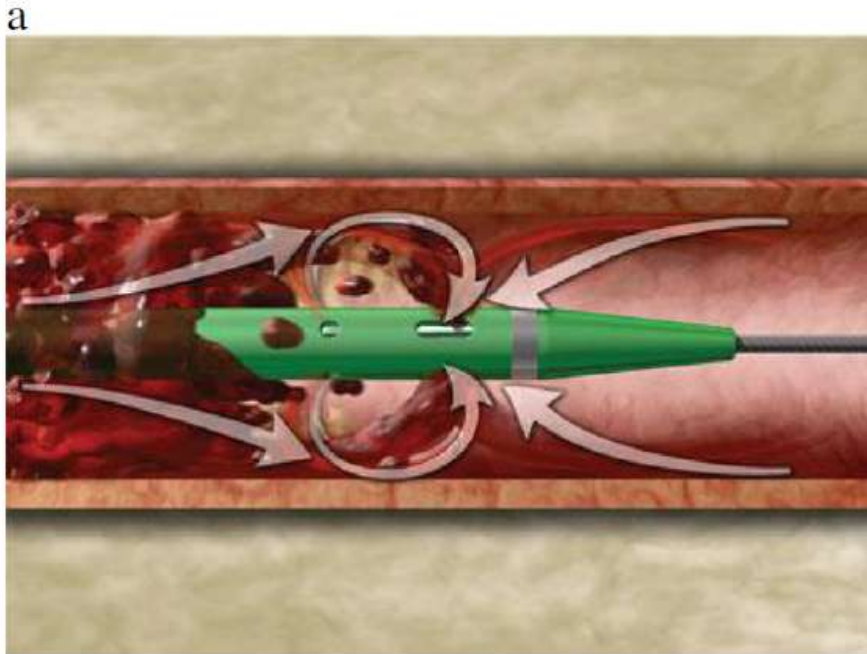# Epicardial flow does NOT tell you the whole story
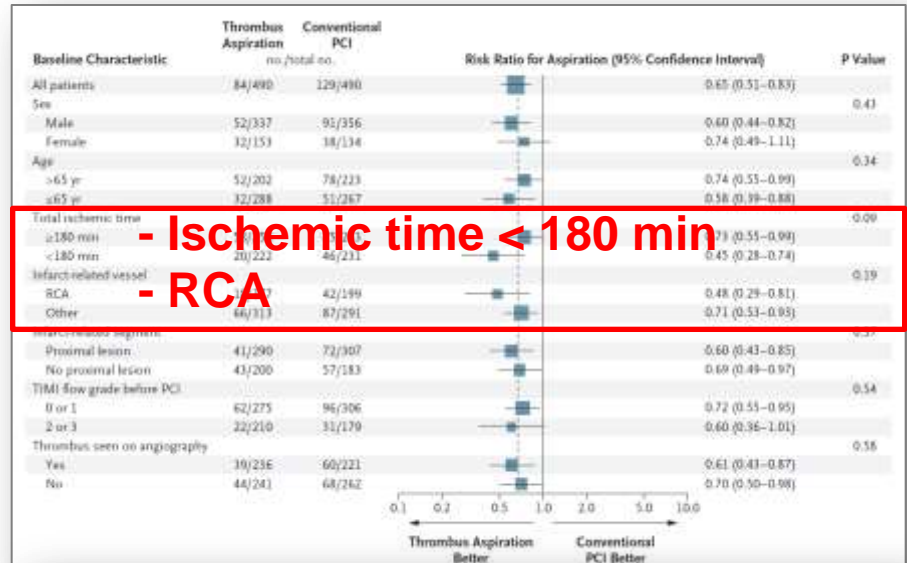

Niccoli et al. JACC 2009;54:281-291

Manual Aspiration Catheters

Mechanical Thrombectomy Devices

TAPAS

- Ischemic time < 180 min
- RCA
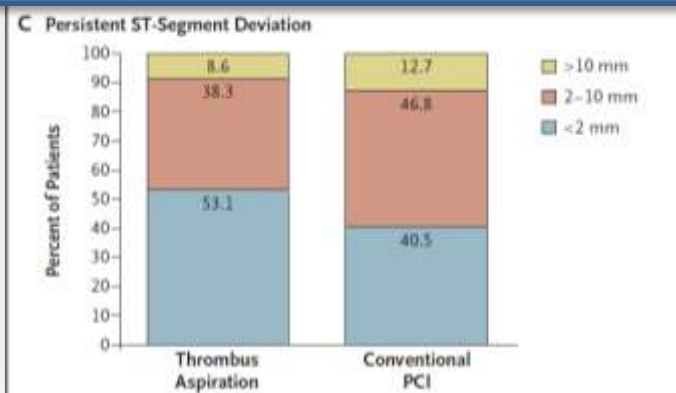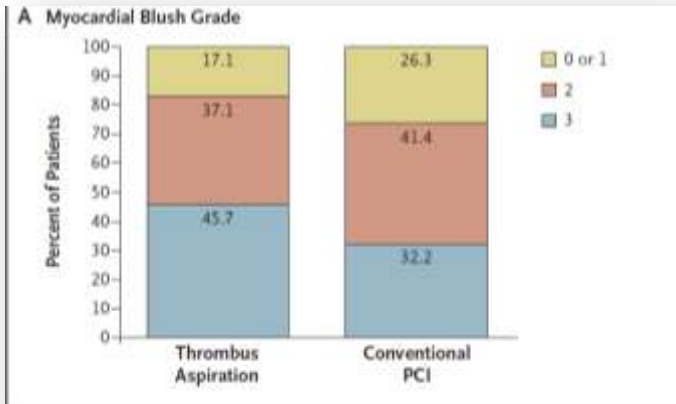
Angiographic distal embolization increased!!!

Svilaas T et al. N Engl J Med 2008; 358;6
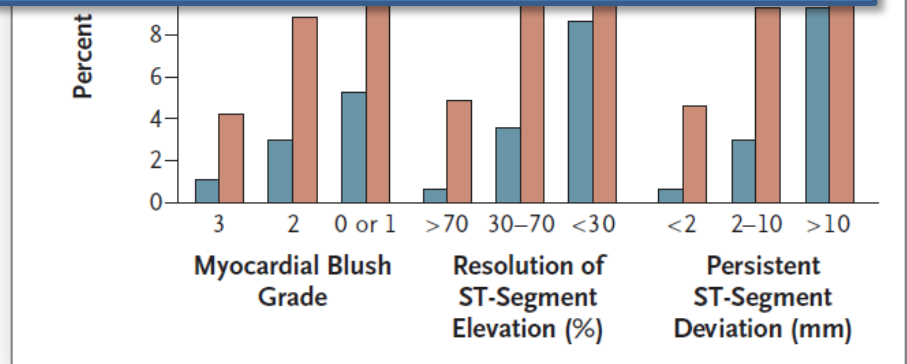
TAPAS

All cause mortality

Cardiac death

Svilaas T et al. N Engl J Med 2008; 358;6
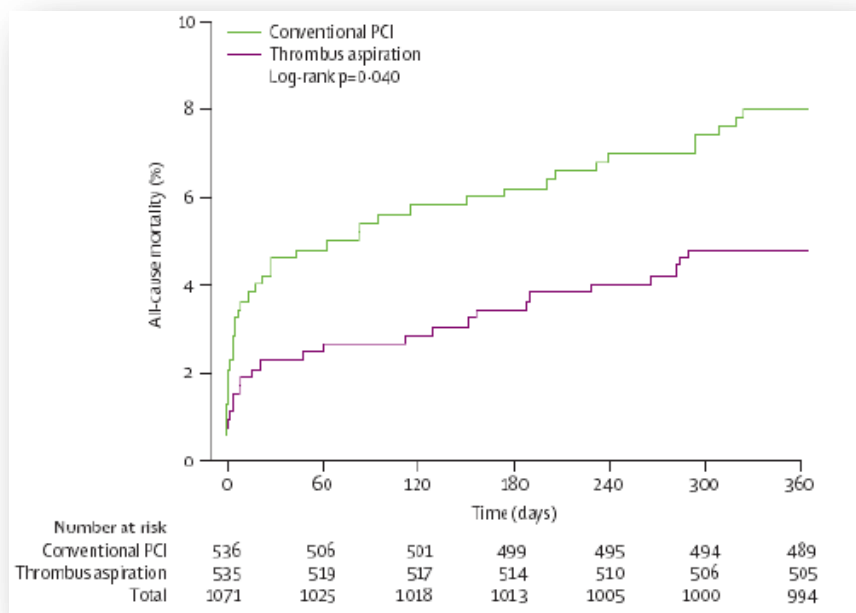
Meta-analysis of Manual Aspiration versus Conventional Primary PCI in STEMI

Kumbhani et al. JACC Vol. 62, No. 16, 2013
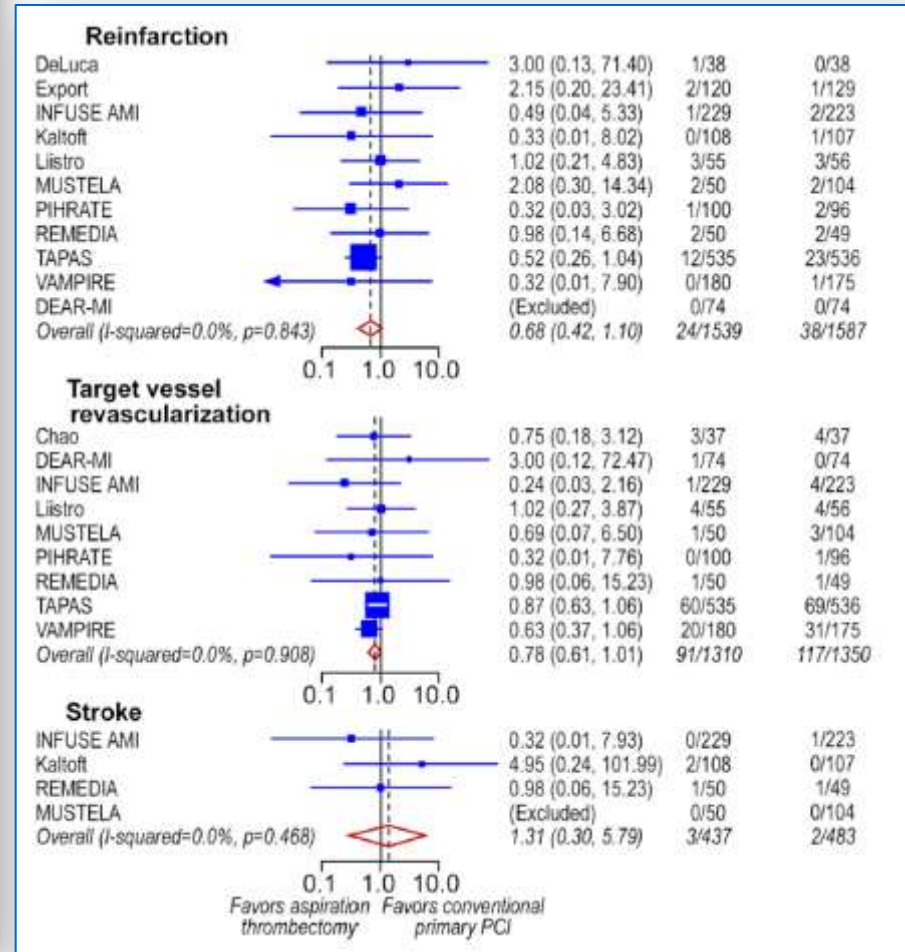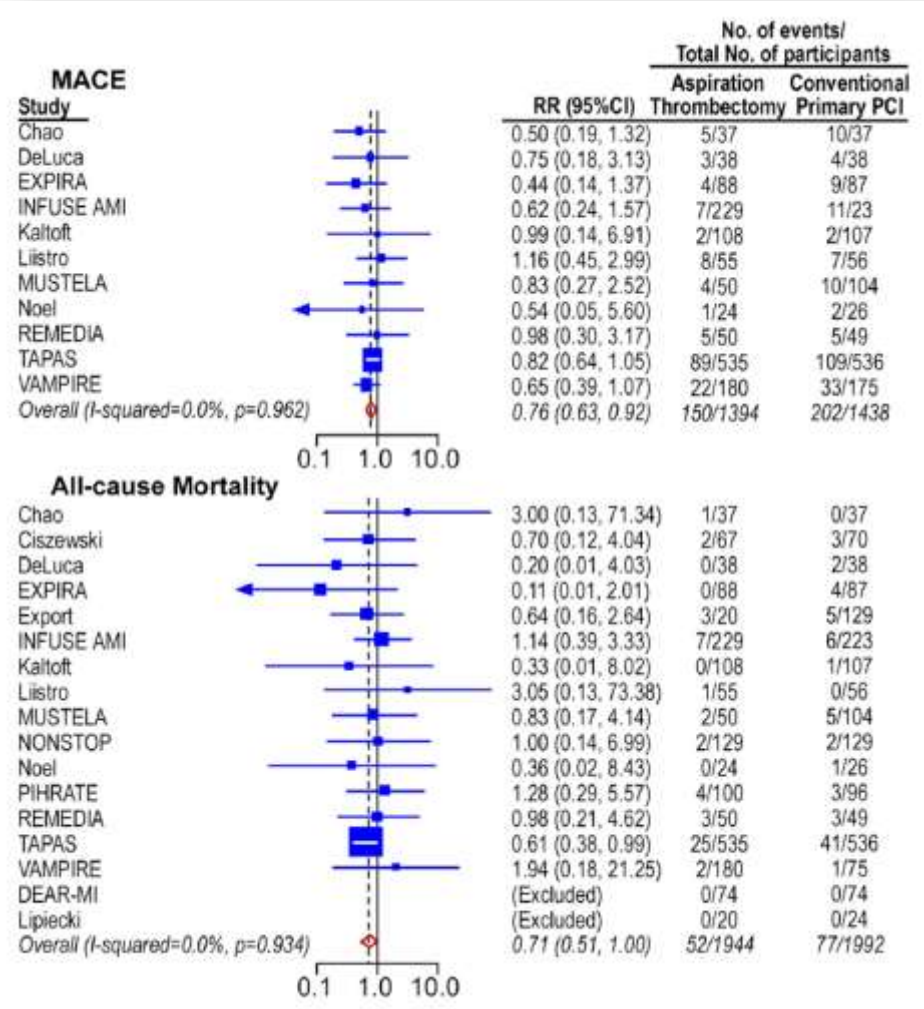
Meta-analysis of Mechanical Thrombectomy versus Conventional Primary PCI in STEMI

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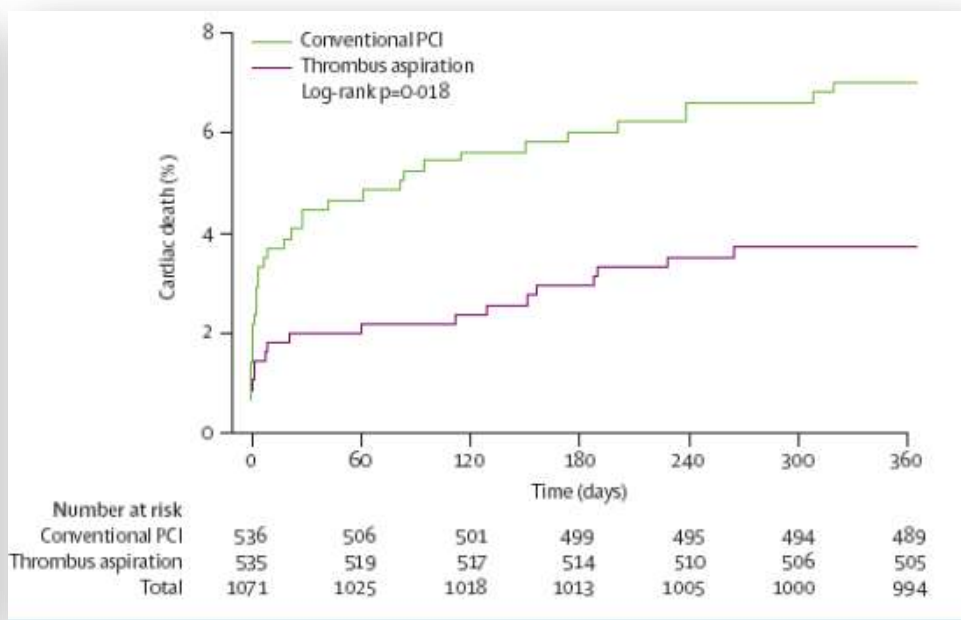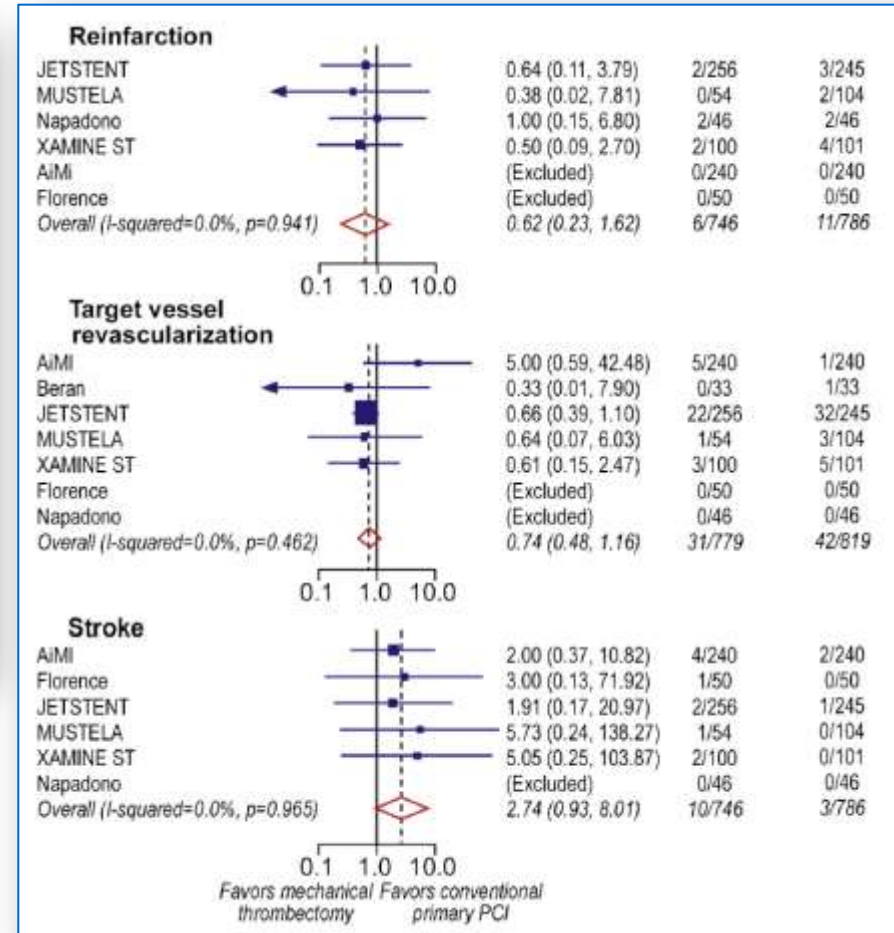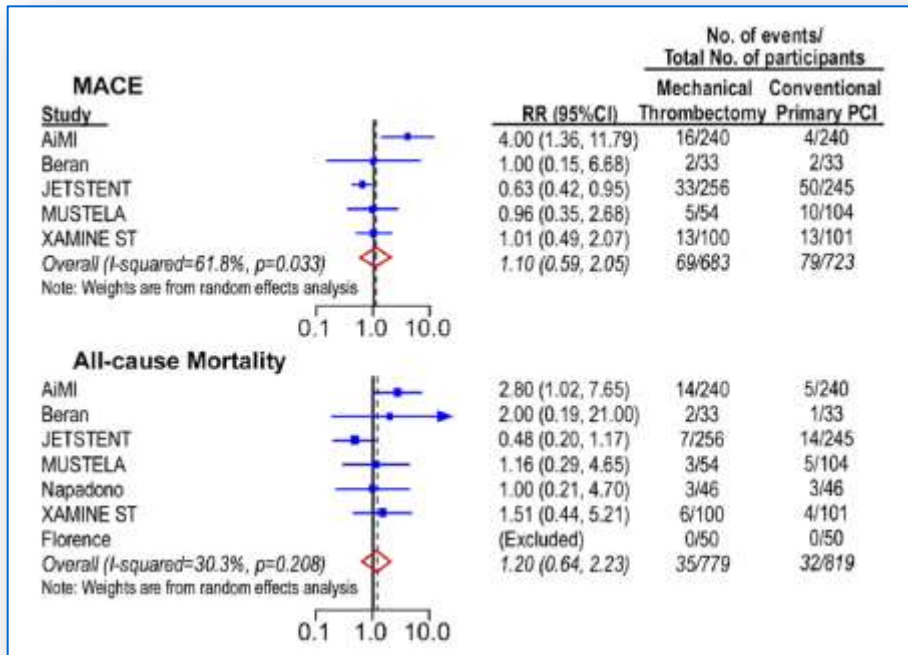# TASTE: 30-day All Cause Mortality
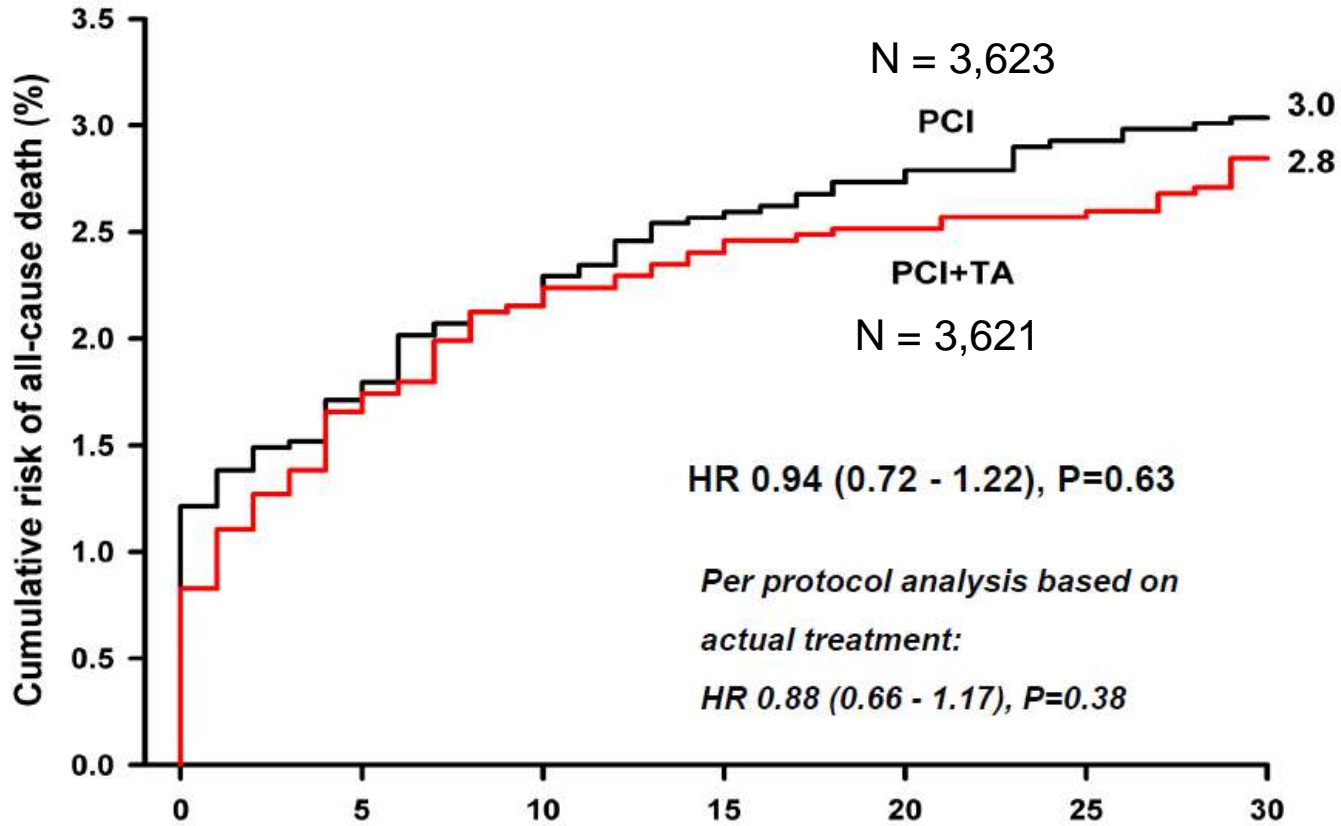
Froebert et al. NEJM 2013; 369: 1587-1597

TASTE: Re-infarction

TASTE Limitations
-Selection bias???
- Conducted as a registry
- No event adjudication
-No data verification
-No centralized core lab
-Short term follow-up

Froebert et al. NEJM 2013; 369: 1587-1597
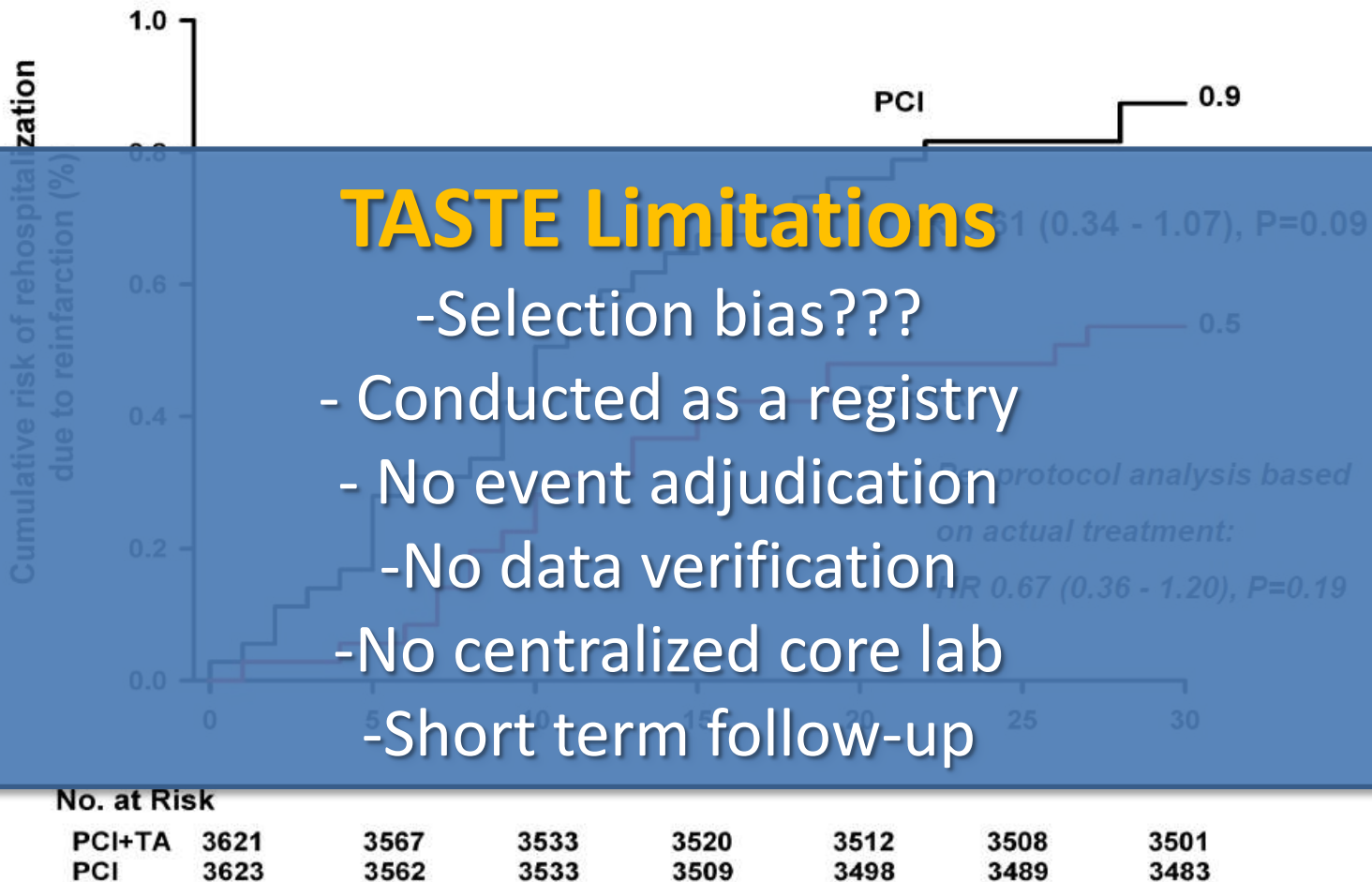
An Attempt to keep the clot from going down stream …

- **Distal embolic protection** in native artery Primary PCI in STEMI **DOES NOT** work

- **Mechanical thrombectomy** failed to show any meaningful benefits

- **Manual aspiration**, in a "meta-analysis fashion", appears to show benefits in improving TIMI flow, MPBS, STS resolution, reduction in infarct size and MACE

- **Unanswered questions**: how to aspirate, how many passes, routine versus selective (clot burden driven?) – more data is needed

Limitations of Manual Aspiration

- **10% of the time, they can not pass the lesions**

- **30% of the time, no thrombus retrieved**

- **They can not remove all the thrombus**

- **They can cause distal embolization**

- **There was a trend for increase stroke in meta-analysis**

Beyond clot removal attempt

- **GP IIbIIIa inhibitor**

  – **IC, IV, intra-lesional**

- **Vasodilator (after manual aspiration)**

- **Direct stenting (vs pre-dilatation)**

- **Mesh covered stent**

- **Deferred stenting**

- **Others: chronic statin Rx, P2Y12 inhibitors**

INFUSE-AMI Trial

452 pts with anterior STEMI
Anticipated Sx to PCI <5 hrs, TIMI 0-2 flow in prox or mid LAD
Primary PCI with bivalirudin anticoagulation

Pre-loaded with aspirin and clopidogrel 600 mg or prasugrel 60 mg

R 1:1

Stratified by symptoms to angio <3 vs ≥3 hrs, and prox vs mid LAD occlusion

Manual aspiration

No aspiration

R 1:1

R 1:1

IC Abcx

No Abcx

IC Abcx

No Abcx

Primary endpoint: Infarct size at 30 days (cMRI)
2° endpoints: TIMI flow, blush, ST-resolution, MACE (30d, 1 yr)

Stone et al. JAMA 2012

INFUSE-AMI: Infarct Size at 30 days

Effect of IC abciximab via Clearway Rx

Stone GW et al. JAMA 2012: 307
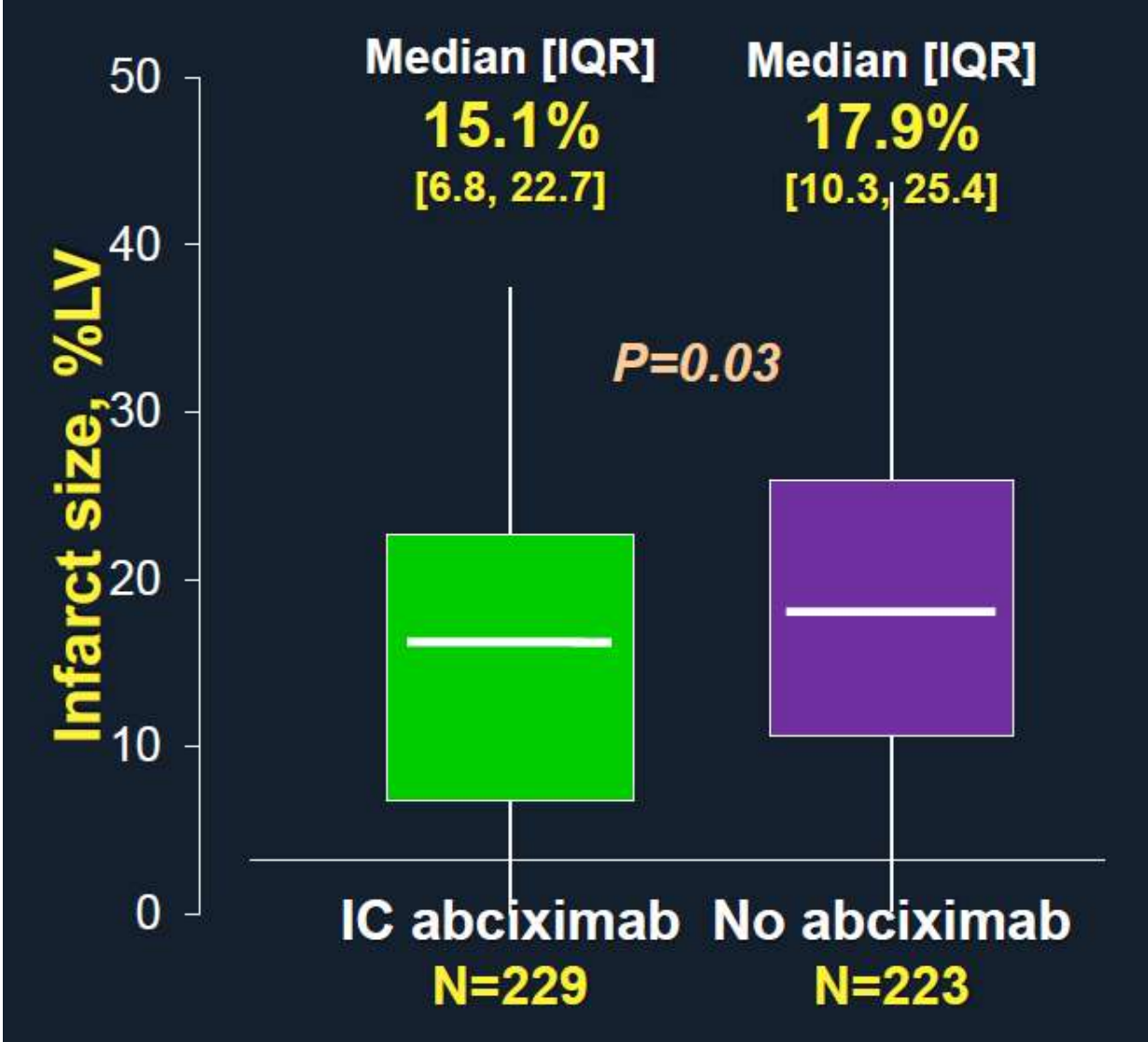
AIDA STEMI:
Combined Clinical Endpoint

Thiele et al. Lancet 2012; 379: 923-931
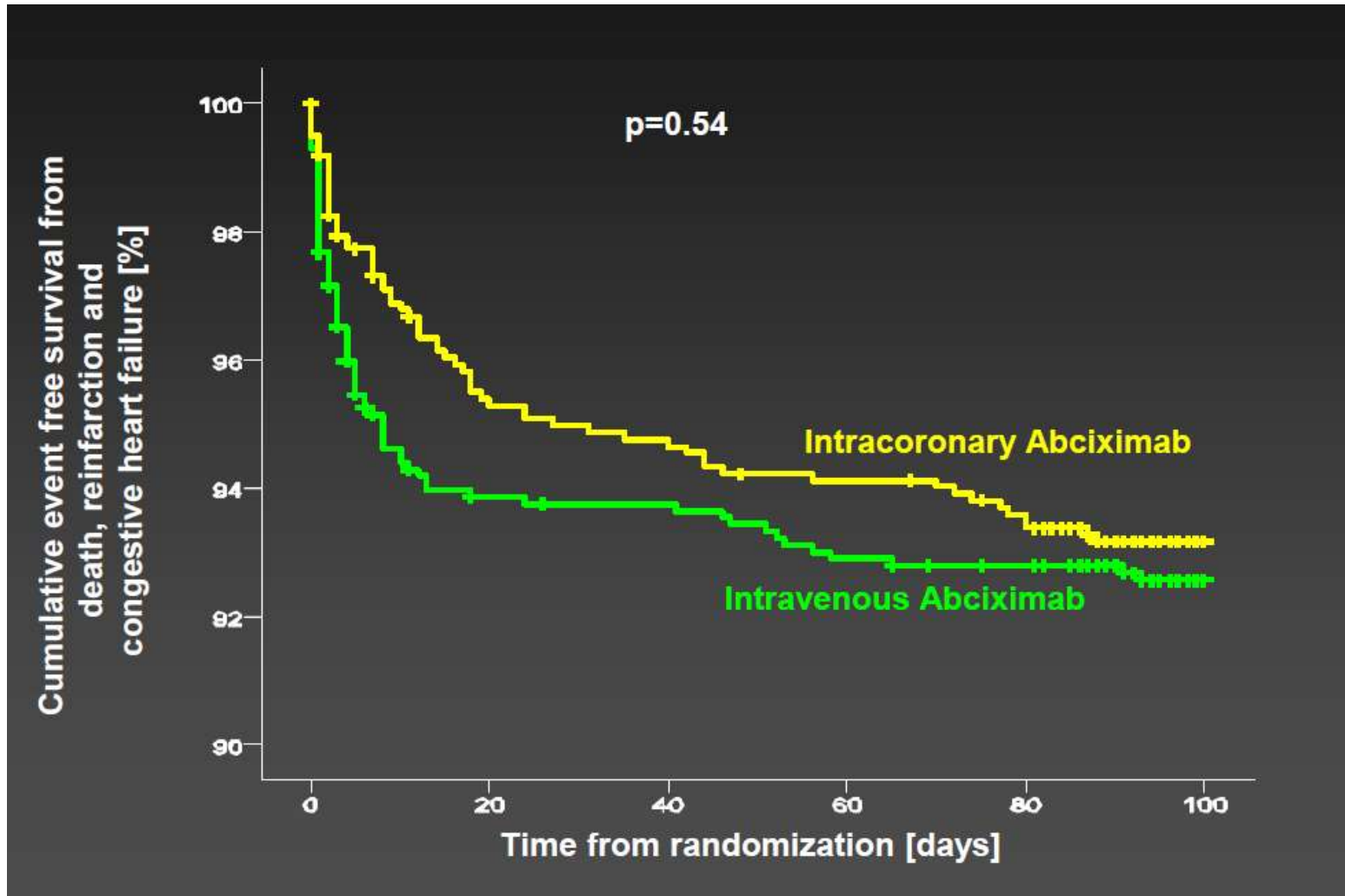
AIDA STEMI: CMR sub study
Reperfusion Injury
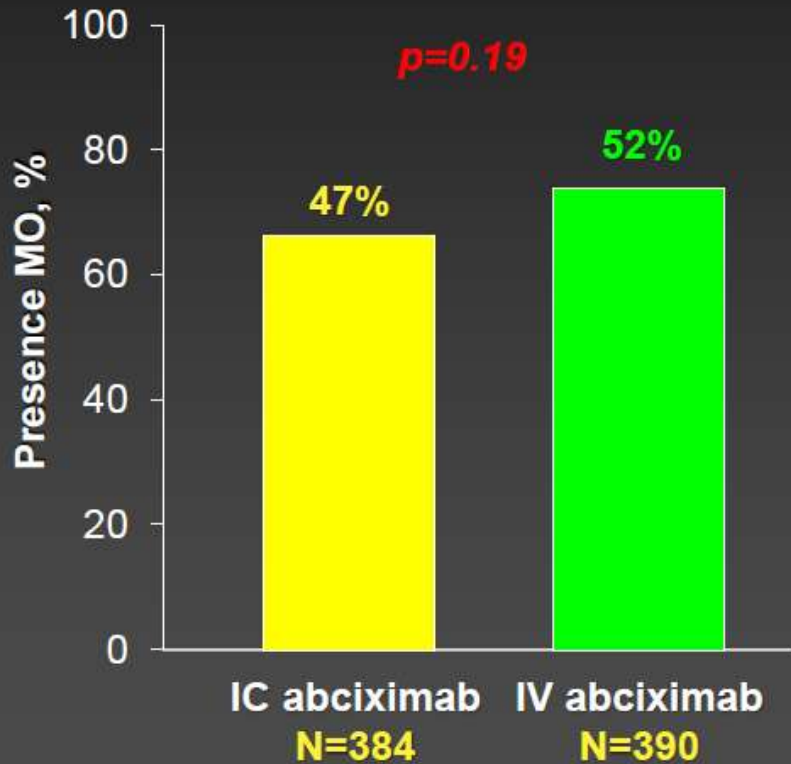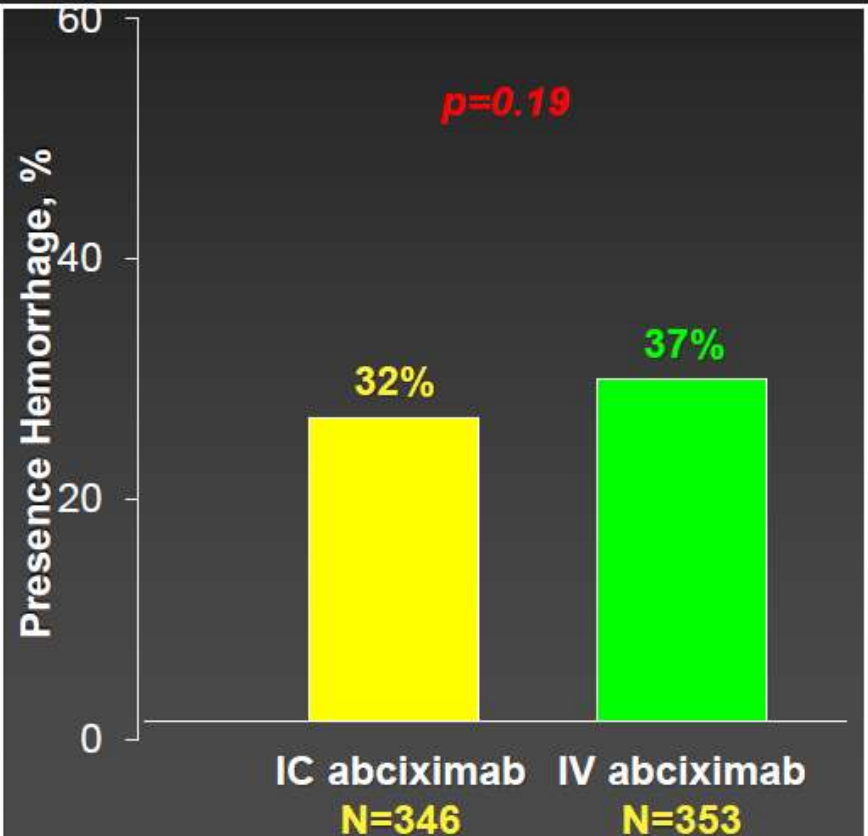
Eitel et al. JACC 2013;61: 1447-1454

REOPEN-AMI Study
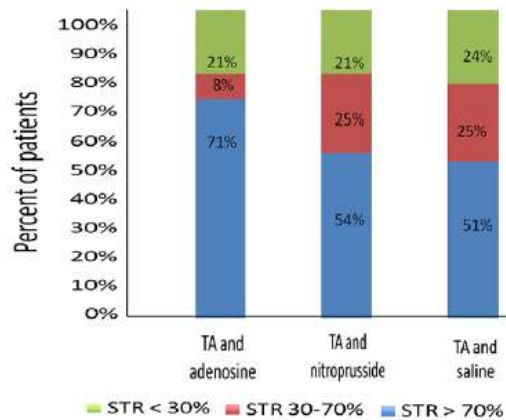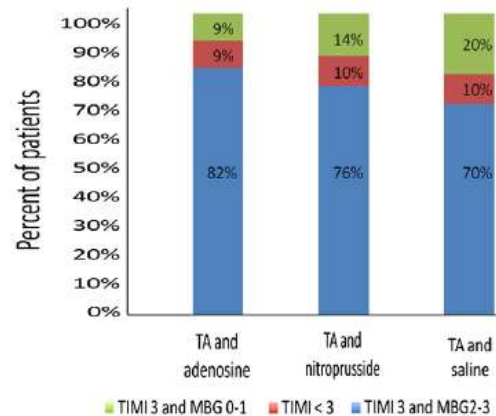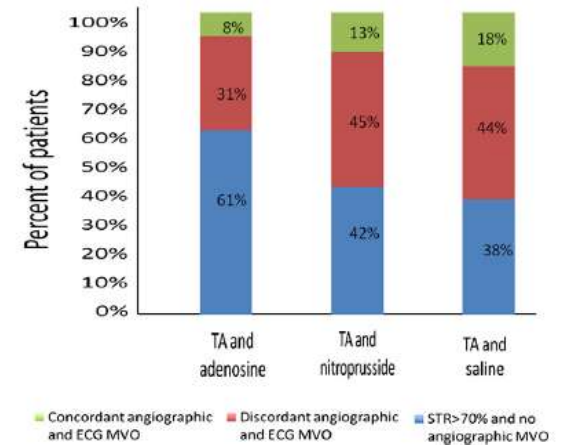
Conclusions In STEMI patients treated by PCI and TA, the additional intracoronary administration of adenosine, but not that of nitroprusside, results in a significant improvement of MVO, as assessed by STR.

Niccoli G et al. J Am Coll Cardiol Intv 2013;6:580–9

Mesh Covered Stent

Death or MI Time-to-Event curve

— MGuard
— BMS/DES

5

HR: 0.62 [95% CI: 0.20, 1.89]
P= 0.04

1

0

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |

Months

Number at risk:
MGuard	217	212	207	205	125
BMS/DES	216	209	208	206	123

However, restenosis (TLR, TVR) is approaching that of BMS, rather than DES

NEW RESULTS

Stone GW et al. J Am Coll Cardiol. 2012;60:1975-1984

A Randomized Trial of Deferred Stenting versus Immediate Stenting to Prevent No-or Slow Reflow in Acute ST-Elevation Myocardial Infarction (DEFER-STEMI)

Abstract

Objectives: To assess whether deferred stenting might reduce no-reflow and salvage myocardium in primary percutaneous coronary intervention (PCI) for ST-elevation myocardial infarction (STEMI).

Background: No-reflow is associated with adverse outcomes in STEMI.

Methods: A prospective single center randomized controlled proof-of-concept trial in reperfused STEMI patients with ≥ 1 risk factors for no-reflow. Randomization was to deferred stenting with an intention-to-stent 4-16 hours later or conventional treatment with immediate stenting. The primary outcome was the incidence of no/slow-reflow (TIMI ≤ 2). Cardiac magnetic resonance imaging (MRI) was performed 2 days and 6 months post-MI. Myocardial salvage was the final infarct size indexed to the initial area-at-risk.

Results: Of 411 STEMI patients (11 March 2012 - 21 November 2012), 101 patients (mean age 60 years, 69% male) were randomized (n=52 deferred group, n=49 immediate stenting). The median (IQR) time to the second procedure in the deferred group was 9 (6, 12) hours. Fewer patients in the deferred stenting group had no/slow-reflow [14 (29%) vs. 3 (6%); p=0.006], no-reflow [7 (14%) vs. 1 (2%); p=0.052] and intra-procedural thrombotic events [16 (33%) vs. 5 (10%); p=0.010]. TIMI coronary flow grades at the end of PCI were higher in the deferred stenting group (p=0.018). Recurrent STEMI occurred in 2 patients in the deferred group before the second procedure. Myocardial salvage index at 6 months was greater in the deferred group [68 (54, 82%) vs. 56 (31, 72%); p=0.031].

Conclusion: In high risk STEMI patients, deferred stenting in primary PCI reduced no-reflow and increased myocardial salvage.

Conclusions

- No reflow carries high mortality rate, both short- and long-term

- Clot burden is one main cause of no-reflow in the setting of STEMI primary PCI

- Prevention, rather than treatment (after it already happened) is the KEY!

- Manual aspiration of thrombus, probably helps, in situation with large clot burden, but not in a routine fashion

- GP IIbIIIa inhibitors, IV or IC is probably useful