

# DEBATE:

## Should All CTO Be Penetrated

Not Stenting, conservative Medical  
Therapy Is the Best Choice

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# SCOPE OF THE PROBLEM

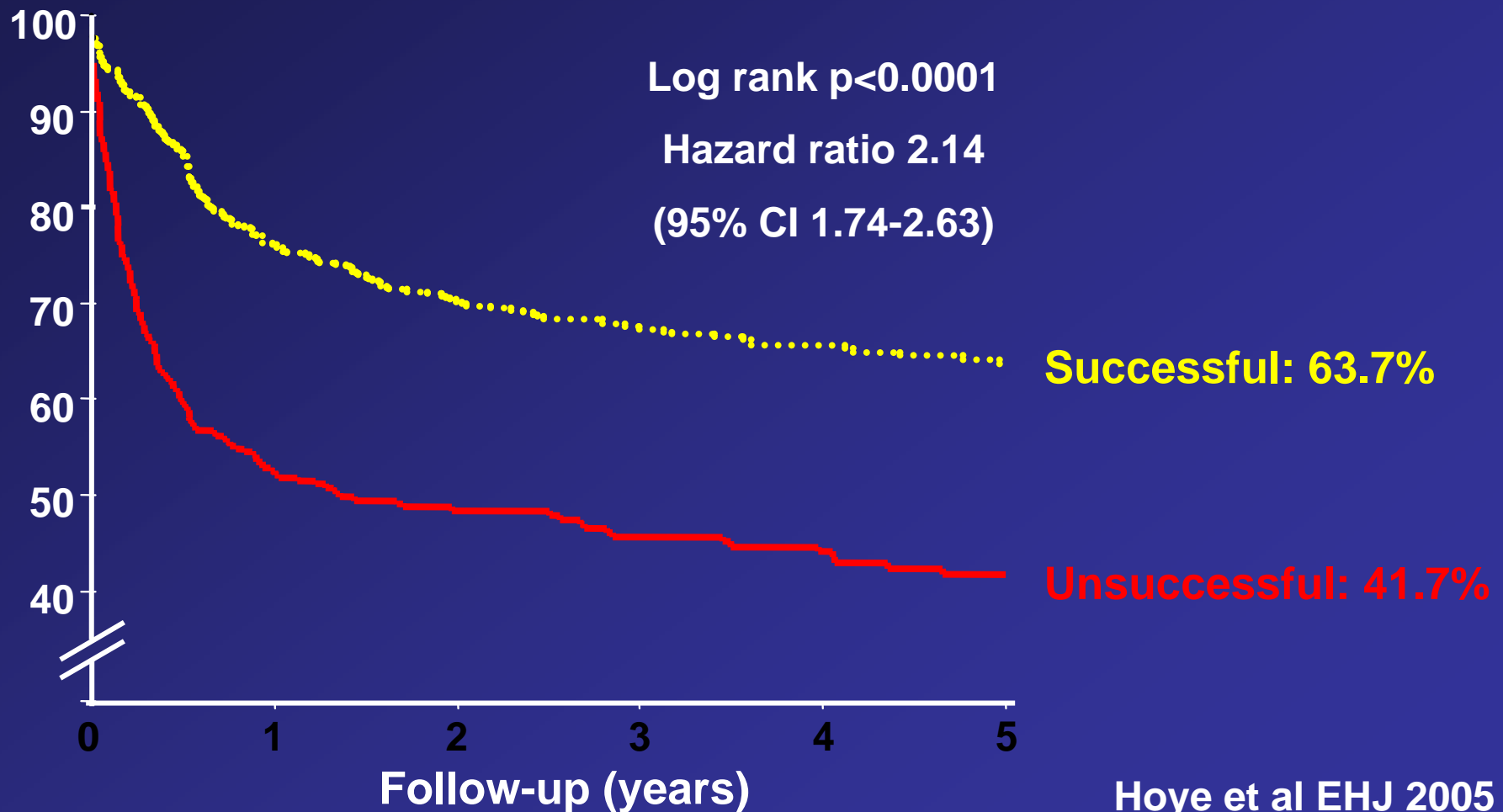


# Cumulative survival-free of MACE (death, AMI, or repeat reintervention (PCI or CABG)) at 5 years The Rotterdam Experience

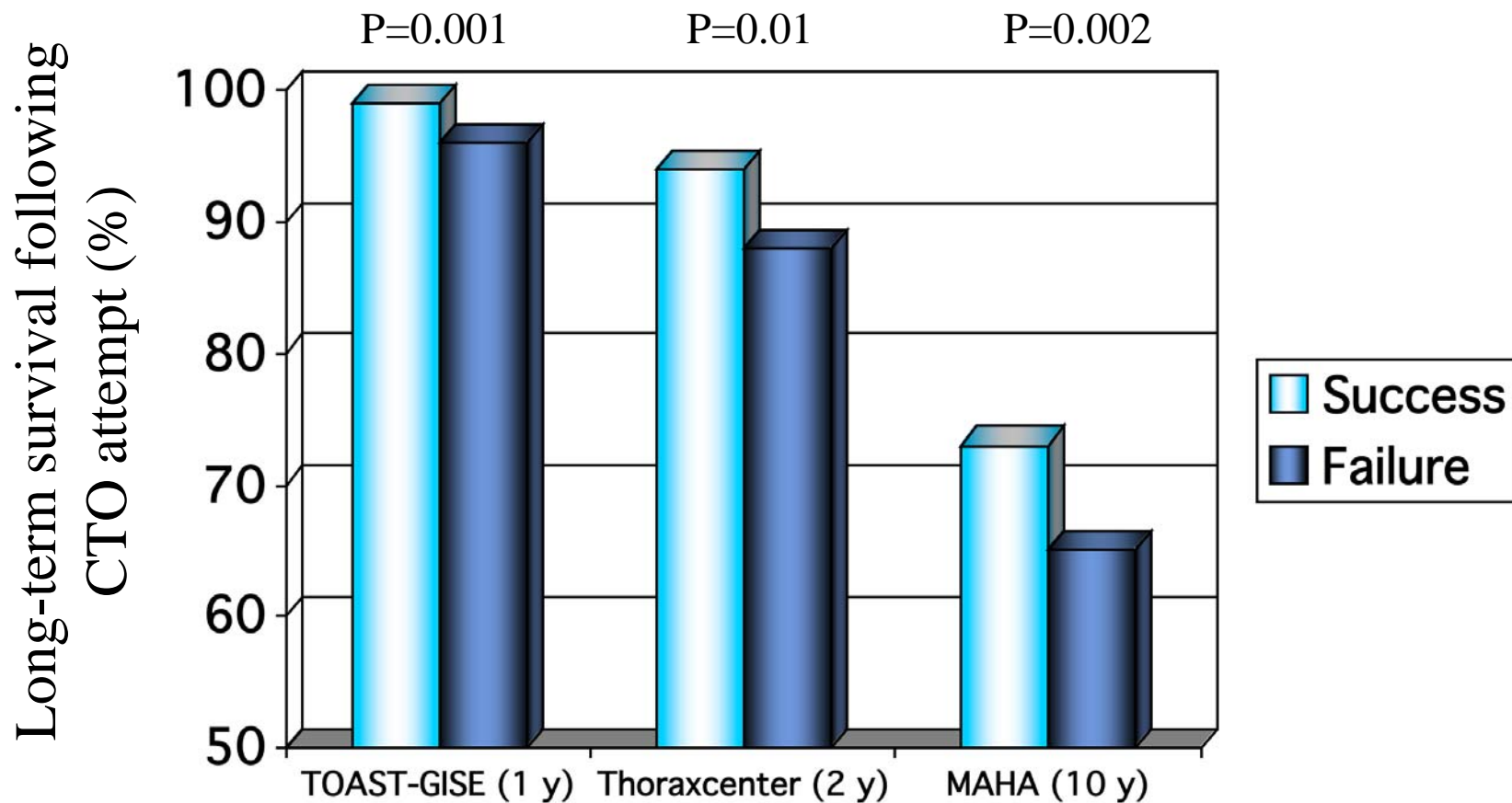
Stents were utilised in the majority (81%)

Consecutive series of 874 patients (885 CTOs)

Mean follow-up period was  $4.47 \pm 2.69$  years (median 4.10 years)



# SELECTION BIAS MAY UNDERMINE PROMISING LONG-TERM DATA FROM NON-RANDOMIZED STUDIES





## This is what Barry Rutherford Say or Write on CTO

- PCI to a CTO should be performed only in symptomatic patients with documented severe ischemia or angina
- Pre-procedural evaluation with delayed contrast-enhanced MRI may help in determining which patients may benefit from PCI of a CTO.
- The highest odds ratio for death after PCI to a CTO was found in those with poor left ventricular systolic function (ejection fraction  $<40\%$ ). History of heart failure and chronic renal insufficiency were associated with greater than doubling of the mortality rate.

# Improvement in Survival Following Successful Percutaneous Coronary Intervention of Coronary Chronic Total Occlusions: Variability by Target Vessel

Rutherford et al Am Coll Cardiol Intv, 2008; 1:295-302. 2008

## Conclusions:

- The data suggest that PCI for CTO of the LAD, **but not LCX or RCA**, is associated with improved long-term survival. This information may assist in selecting patients for attempted CTO PCI.
- We also identified increased risk in the LAD group, with a high cost (i.e., in-hospital mortality)
- Although some studies suggest that overall survival is improved by successful CTO PCI, the **benefit may be limited** to certain subgroups

End of the Debate !!!





## Certain Cases Should Never be Attempted.

- CTOs of vessel feeding only scar.
- CTOs where distal vessel is not visualized either antegrade or retrograde.
- When the chances of success are  $< 50\%$ , the risk of serious complication approaches that of success.
- In these cases medical therapy is the best choice



# When Not to Start

## Some Complications are More Frequent With CTOs

- Vessel perforation
- Destruction of collateral channels
- Destruction of septal perforators and/or side branches
- Renal failure
- Radiation Injury

Each of these complications can and have led to major morbidity and death.

Medical Therapy is a better choice

I strongly recommend  
Medical Therapy to  
Control the Horse



Courtesy Prof Nicolaus Reifart

# Late Outcomes of Chronic Total Occlusion Intervention

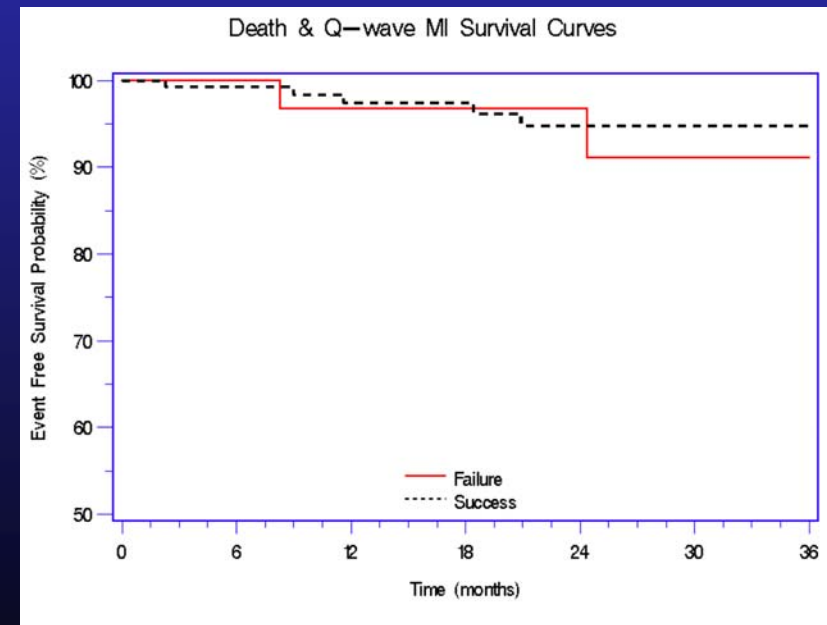
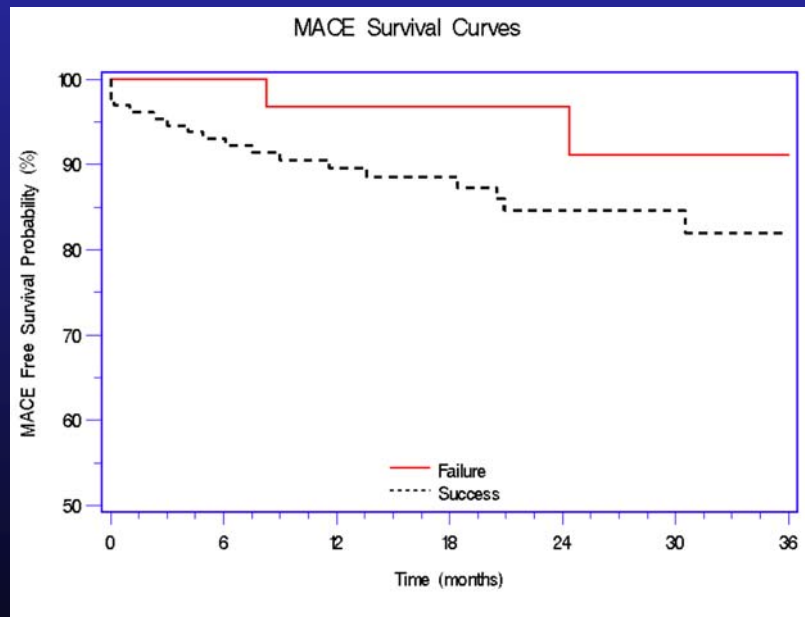
Reference	Number	Duration	Flow	Benefit	
Bell <sup>9</sup>	1992	354	≤ 1day	“no antegrade flow”	No
Ivanhoe <sup>8</sup>	1992	480	> 10days	TIMI 0 or 1	Yes
Naguchi <sup>11</sup>	2000	226	> 3 months	“no antegrade flow”	Yes
Suero <sup>4</sup>	2001	2007	> 7days	TIMI 0 or 1	Yes
Olivari <sup>5</sup>	2003	419	> 30 days	TIMI 0 or 1	Yes
Hoye <sup>12</sup>	2005	874	> 1 month	“no antegrade flow”	Yes
Aziz <sup>13</sup>	2007	543	> 3 months	TIMI 0 or 1	Yes
Prazad <sup>10</sup>	2007	1262	< 3 months	Not stated	No
Hochman <sup>19</sup>	2006	2166	> 7d and < 1m	TIMI 0 or 1,2 ,3	No

# CHRONIC TOTAL OCCLUSIONS SUCCESSFUL VERSUS FAILURE RECANALIZATION DOES IT MAKE A DIFFERENCE?

194 consecutive patients with CTO for PCI 144 successful 50 failure

with in hospital complications

without in hospital complications



# Limiting Factors

## Consider Medical Therapy

- Contrast dose
- Radiation exposure
- Complications
- Operator, staff and patient fatigue
- Operator knowledge and experience

# Radiation skin injuries in patients have been reported with the spread of IR.

**50 minutes of flouro time = 1 Gy**

- Early Transient Erythema 2 Gy 2~24 hr
- Permanent Epilation 7 Gy ~ 3 wk
- Dermal Necrosis (Delayed) 12 Gy > 52 wk
- Ischemic Dermal Necrosis 18 Gy > 10 wk


## **Delayed Dermal Necrosis**

Estimated skin dose = 20 Gy



*JACC2004 : 44 : 2261*

# Patient issues

- 
- CTO- pre-requisites –
- i. Symptoms
  - ii. Evidence of reversible ischaemia
  - iii. Useful collaterals
  - iv. You know what you are doing (wires)



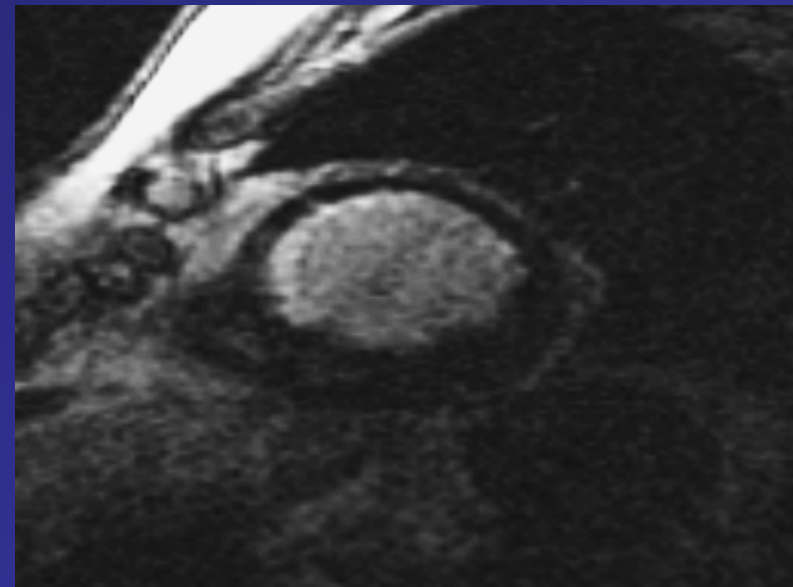
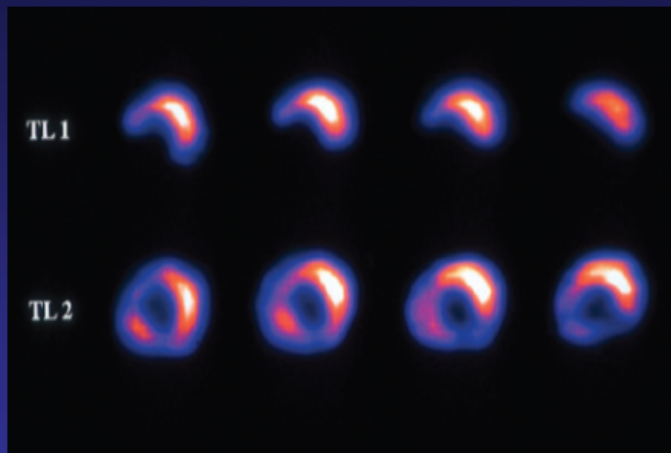
## Non invasive testing – the choice is yours

Myocardial perfusion scanning

MRI – gadolinium

Stress echo cardiography

### SPECT with $^{201}\text{Tl}$



# Occluded Artery Trial: 1° Hypothesis and Design

1° Hypothesis: Late PCI to open occluded IRA will ↓ death/reinfarction/class IV CHF by 25% compared to MED alone

- 2166 Acute MI pts (2000-2005)
- TIMI 0 or 1 flow
- 3-28 days post MI

+

- High Risk**
- EF < 50%
  - Proximal occlusion affecting ≥ 25% LV
- TOSCA 2

## Exclude:

- 3V/LM disease
- Clinically unstable due to ischemia, hemodynamics

PCI with Stent of IRA

Medical RX

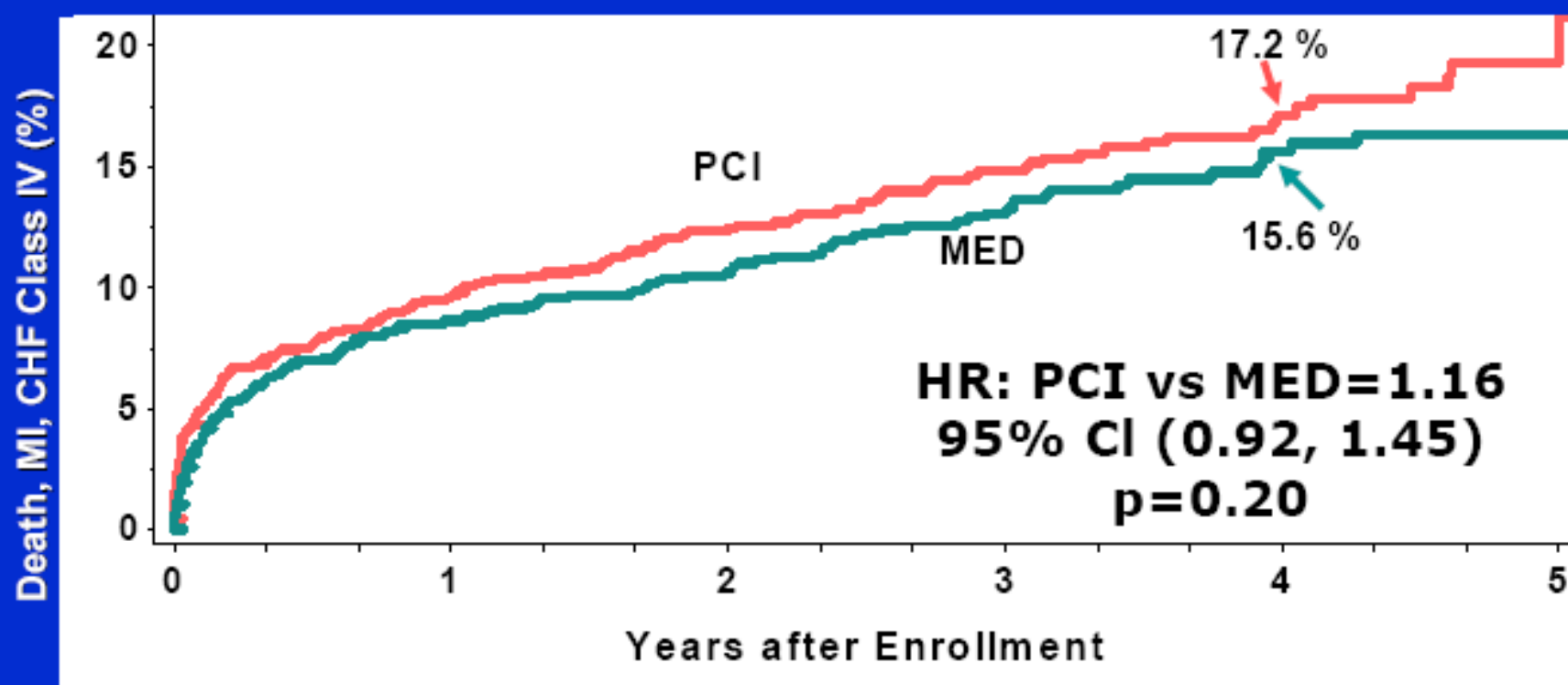
- 87% successful PCI
- 83% open IRA at 1 yr (TOSCA)

- 8% crossover to PCI (total)
- 25% open IRA at 1 yr (TOSCA)

Hochman JS et al. NEJM 12/06

# OAT: 1° Composite Endpoint

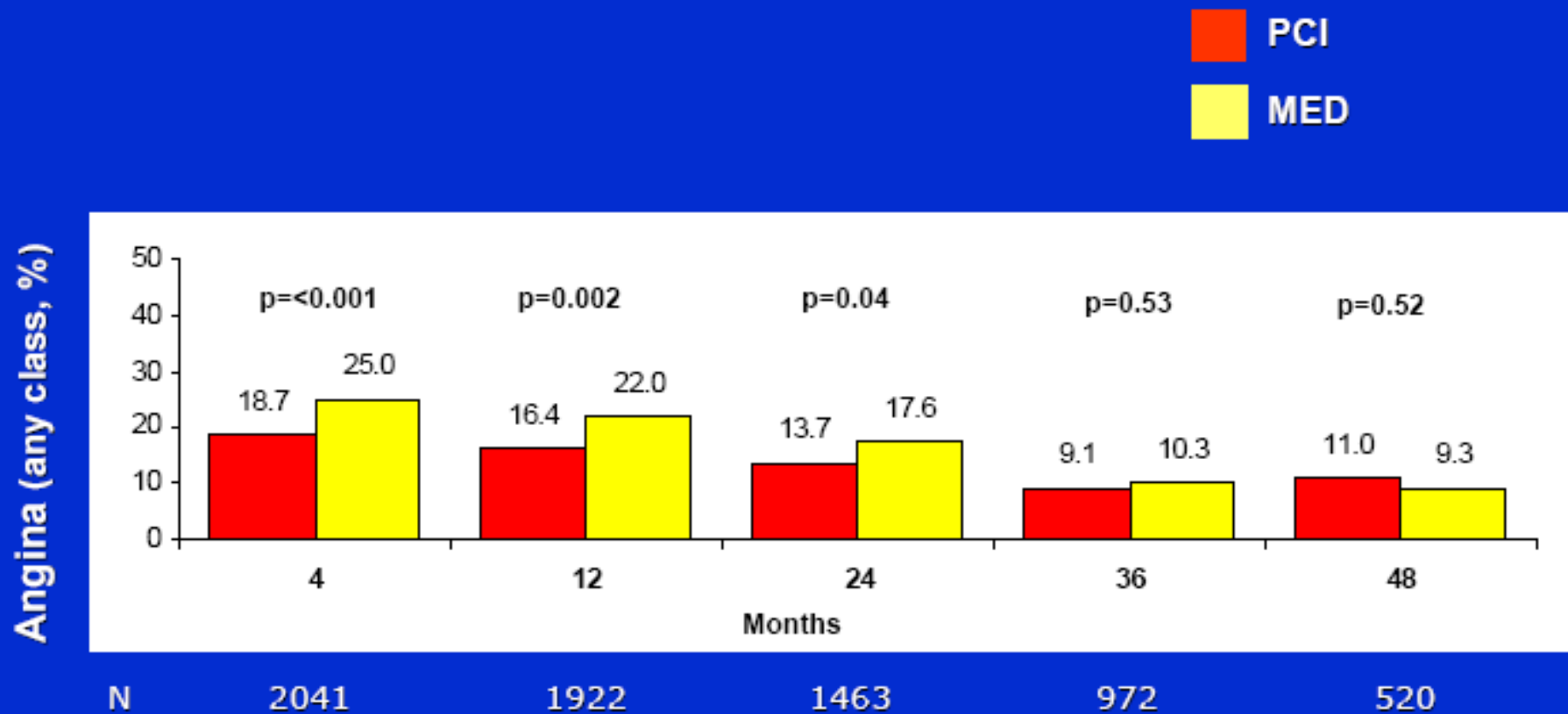
## Death, Nonfatal MI, Class IV CHF



### Number at Risk

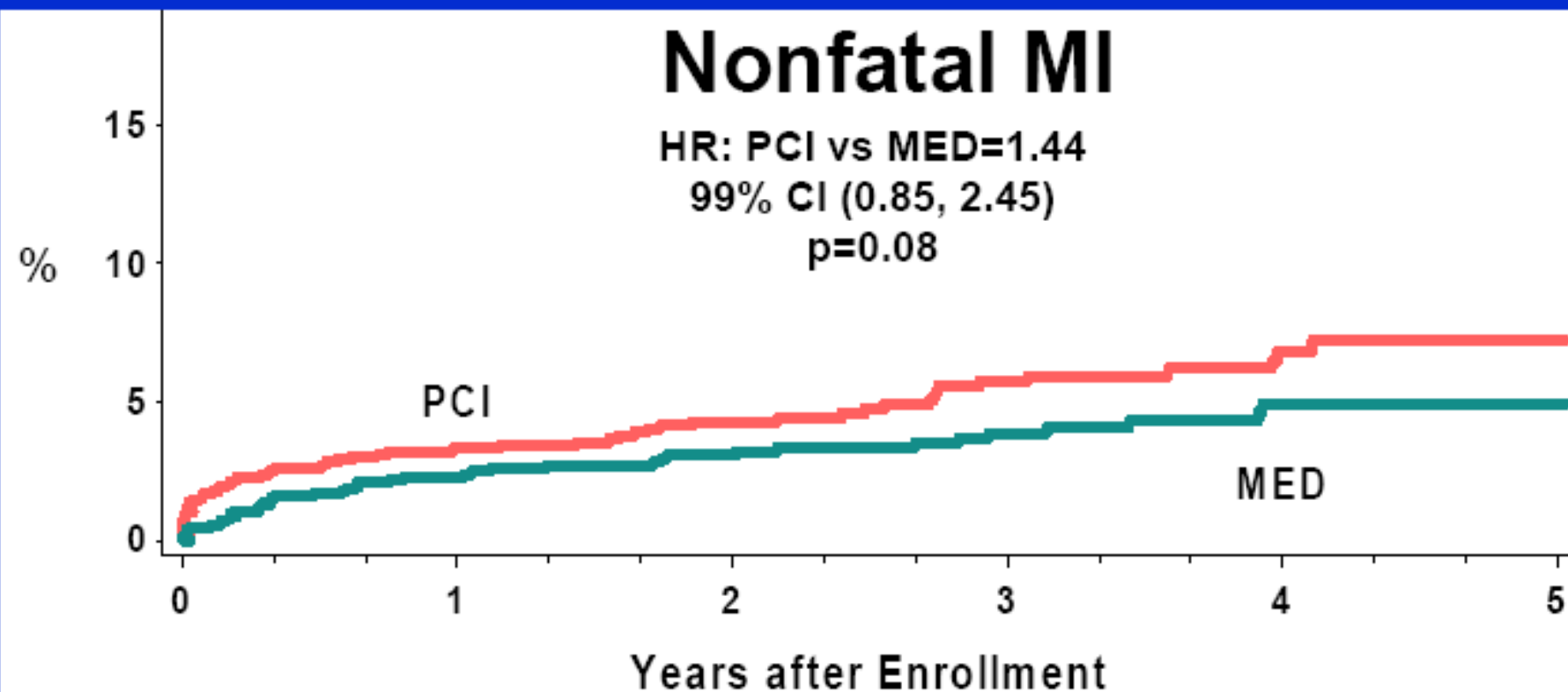
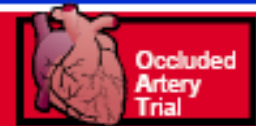
PCI:	1082	895	719	482	265	85
MED:	1084	909	714	474	268	78

# OAT Secondary Outcomes: Angina (CCS Class >0)



Hochman JS et al.  
NEJM 12/06

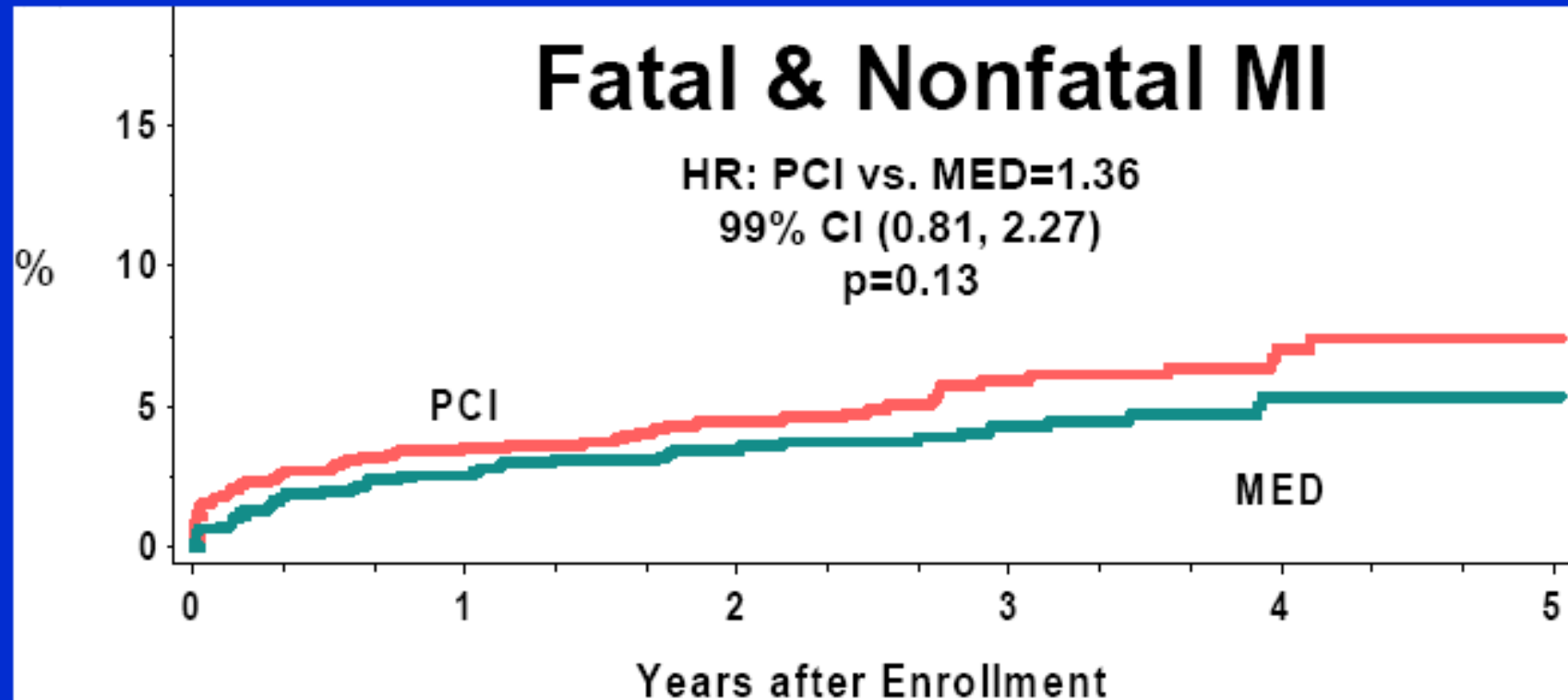
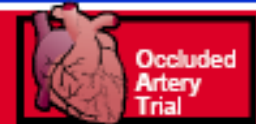
# OAT Components of 1<sup>o</sup> Endpoint: Nonfatal MI



### No. at Risk

PCI: 1082	926	744	500	277	87
MED: 1084	944	745	497	283	82

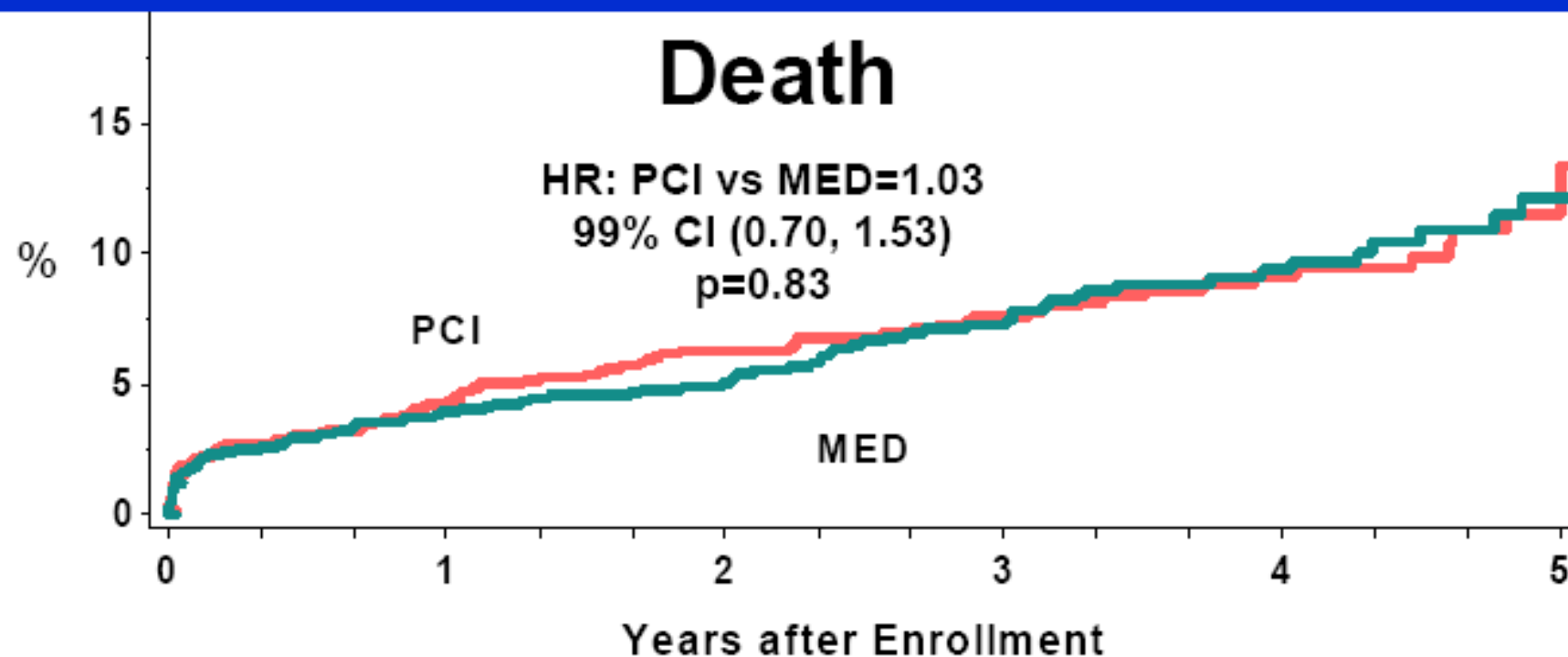
# OAT Components of 1° Endpoint: Fatal & Nonfatal MI



\*6 of 59 adjudicated MI's procedure related

No. at Risk						
PCI:	1082	926	744	500	277	87
MED:	1084	944	745	497	283	82

# OAT Components of 1° Endpoint: Death (All Cause)



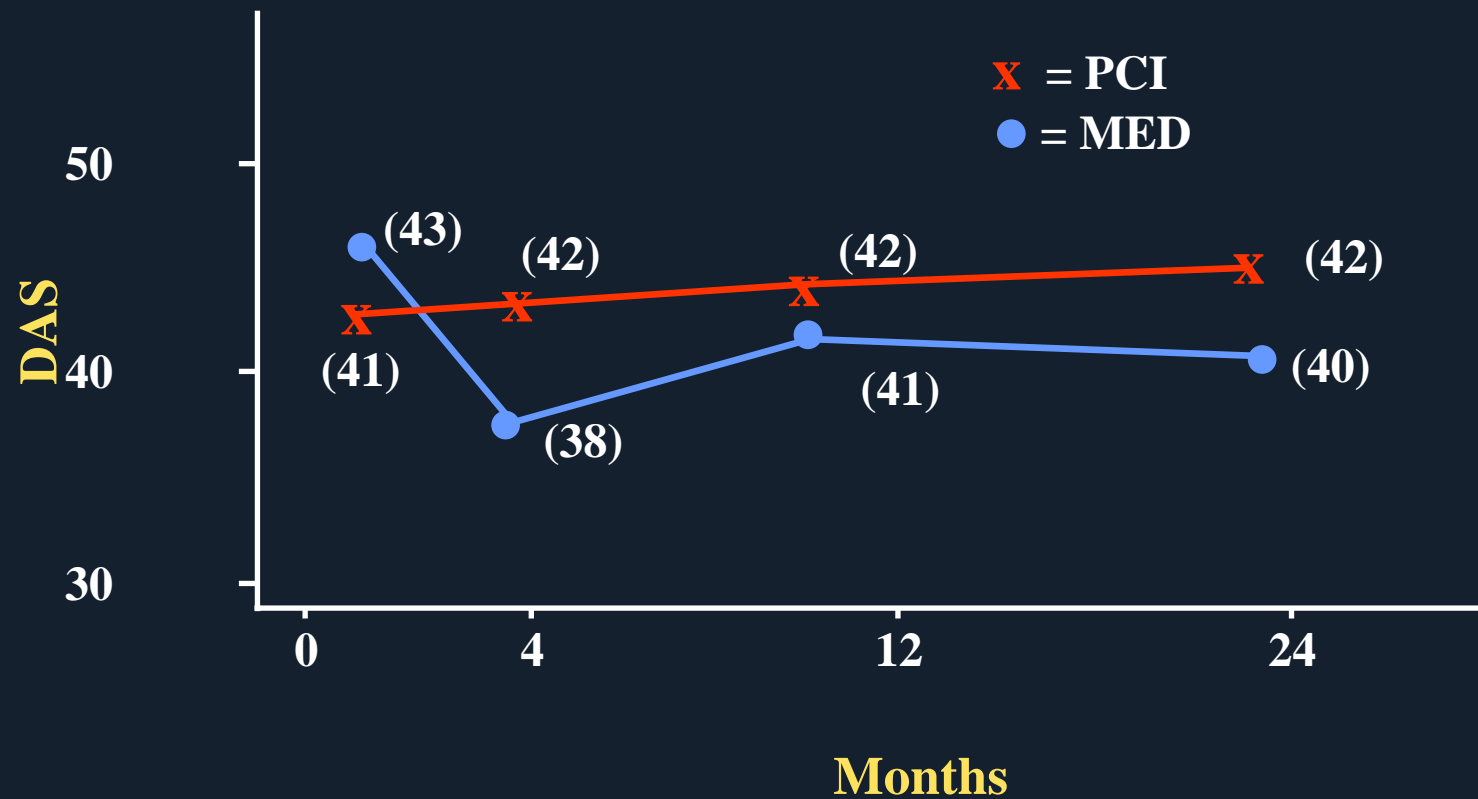
No. at Risk						
PCI:	1082	959	777	528	296	95
MED:	1084	965	770	517	298	84



# OAT: Quality of Life

- **N = 951**
- **History of Angina – 22.6%**
- **NY Heart Association Class I – 87%**
- **Med Group PCI**
  - **In-hospital 14%**
  - **2-year 25%**

# OAT: Quality of Life



Mark NEJM 2009;360:774

# OAT: Symptom Status

## Patients with Angina (%)

	PCI	MED
Baseline	26	27
4 months	10	17
12 months	10	13
24 months	8	12

## Patients with Dyspnea

Baseline	47	48
4 months	32	40
12 months	31	40
24 months	29	36

# OAT: Quality of Life

## Costs

	<b>PCI</b>	<b>MED</b>
<b>Hospital</b>	\$22,800	\$12,700
<b>Year 1</b>	\$3400	\$5300
<b>Year 2</b>	\$1500	\$2700

Mark NEJM 2009;360:774

# **OAT Economic and Quality of Life: Substudy Conclusions**



- **PCI associated with clinically significant benefit in physical functioning at 4 mos, but not sustained at 1 yr or beyond**
- **No significant effects on psychological well being (prespecified 1° QOL endpoints)**
- **Secondary QOL endpoints showed modest symptom benefits for PCI that attenuated over time**
- **In US pts, a strategy of routine PCI was substantially more expensive than optimal medical therapy alone out to 2 yrs and the small symptom benefits provided were insufficient to make PCI an economically attractive strategy in OAT eligible pts**

# Clinical Considerations for CTO Treatment

## Single Vessel

- Responsible for symptoms
- >60% likelihood of success

## Multi-Vessel: Think twice with

- DM
- Proximal LAD
- Multiple CTOs with >1 low likelihood of success

# Appropriate Criteria by Non-invasive Imaging

## Low-Risk

### Symptoms Med. Rx

Class III or IV Max Rx

U A A A A

Class I or II Max Rx

U U A A A

Asymptomatic Max Rx

I I U U U

Class III or IV No/min Rx

I U A A A

Class I or II No/min Rx

I I U U U

Asymptomatic No/min Rx

I I U U U

### Coronary Anatomy

CTO

1.2 vz.  
disease with  
prox. LAD

1 vz. disease  
with prox.  
LAD

2 vz. disease  
with prox.  
LAD

3 vz. disease  
with Left  
Main

A = indicates appropriate CTO (chronic total occlusion)

I = inappropriate med. medical prox LAD, proximal left anterior descending artery Rx treatment

U = uncertain and vz. vessel



# Appropriate Criteria by Non-invasive Imaging

## Intermediate-Risk

### Symptoms Med. Rx

Class III or IV Max Rx

A A A A A

Class I or II Max Rx

U A A A A

Asymptomatic Max Rx

U U U U A

Class III or IV No/min Rx

U U A A A

Class I or II No/min Rx

U U U A A

Asymptomatic No/min Rx

I I U A A

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# Appropriate Criteria by Non-invasive Imaging

## High-Risk

### Symptoms Med. Rx

Class III or IV Max Rx

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Class I or II Max Rx

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# PCI Guidelines for CTO

**ACC/AHA :**

**FC I-III Angina**

**Class III**

- **Small area of viability**
- **No ischemia**
- **Low likelihood of success**

European Guidelines IIa C

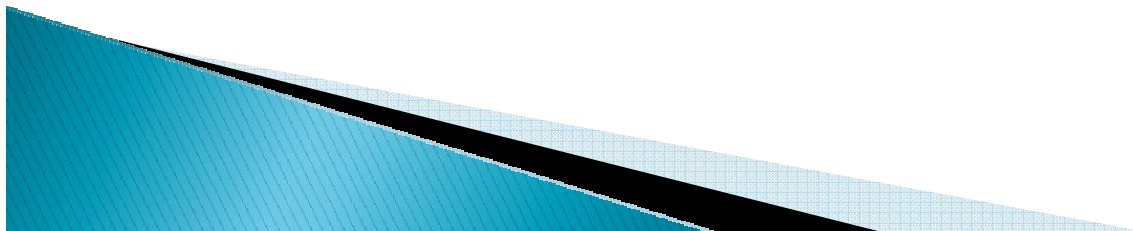
# 1. NOT ALL CTOS ARE BORN EQUAL



# Is There a Time not to Try ?

*Maybe...*

- 1) Long Tortuous Gap +
- 2) Severe Calcification +
- 3) Poor Distal Vessel  
Visualization +
- 4) No prospect for Retrograde



## 2. BOTH PCI AND MAXIMAL MEDICAL RX ARE PIVOTAL





# Japanese Master After Day of CTO's

Dr.  
Osamu  
Katoh:

The  
Tiger  
Wood  
of  
CTO's

Are you sure you want to do this?

