Revascularization Strategies
(SYNTAX, BARI 2D, and STICH)
Angioplasty Summit 2010
Seoul, Korea

David R. Holmes, MD
Mayo Clinic
Rochester, MN
Presenter Disclosure Information

David R. Holmes, Jr., M.D.

“Revascularization Strategies (SYNTAX, BARI 2D, and STICH) ”

The following relationships exist related to this presentation:

No relationships to disclose
Korean Alphabet

Consonants

\[\text{g,k,n,d,t,r,l,m,b,p,s,ng,j,ch,k,t,p,h}\]

\[\text{silent in initial position}\]

\[\text{kk tt pp ss jj}\]

Vowels

\[\text{ㅏ ㅑ ㅓ ㅕ ㅗ ㅛ ㅜ ㅠ ㅡ ㅣ}\]

\[\text{a ya eo yeo o yo u yu eu i}\]

\[\text{father saw home moon put meet}\]

\[\text{ae yae e ye wa wae oe wo we wi ui}\]

\[\text{hand set wet}\]

Pronunciations shown here are only rough approximations.
Surgical ventricular reconstruction has been developed for management of heart failure related to ventricular remodeling caused by coronary artery disease.

It has been suggested that surgical ventricular reconstruction may reduce rate of hospitalization and improve ventricular function better than CABG alone.

STICH Trial

• 1000 patients with EF ≤ 35%, amenable to CABG randomly assigned to either CABG plus surgical ventricular reconstruction vs CABG alone

• Primary end point:
  • Composite of death from any cause and hospitalization for cardiac causes

STICH Trial

Death from Any Cause or Hospitalization for Cardiac Causes

- CABG
- CABG + SVR

Probability

Years since randomization

No. at risk

- CABG + SVR: 501, 319, 275, 216, 111, 23

Death from Any Cause

- CABG
- CABG + SVR

P=0.90

P=0.98

Years since randomization

# STICH Trial

## Primary Outcome

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Pt (no.)</th>
<th>HR for event (95% CI)</th>
<th>P for interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥65 yr</td>
<td>391</td>
<td>1.06 (0.83-1.35)</td>
<td>0.48</td>
</tr>
<tr>
<td>&lt;65 yr</td>
<td>609</td>
<td>0.94 (0.76-1.17)</td>
<td></td>
</tr>
<tr>
<td><strong>NYHA heart failure class</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I or II</td>
<td>515</td>
<td>0.99 (0.78-1.25)</td>
<td>0.97</td>
</tr>
<tr>
<td>III or IV</td>
<td>485</td>
<td>0.99 (0.79-1.24)</td>
<td></td>
</tr>
<tr>
<td><strong>CCS angina class</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No angina or or ≤ class II</td>
<td>508</td>
<td>0.92 (0.73-1.16)</td>
<td>0.39</td>
</tr>
<tr>
<td>Class III or IV</td>
<td>492</td>
<td>1.06 (0.85-1.34)</td>
<td></td>
</tr>
<tr>
<td><strong>LVEF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤28%</td>
<td>534</td>
<td>1.07 (0.86-1.31)</td>
<td>0.33</td>
</tr>
<tr>
<td>&gt;28%</td>
<td>466</td>
<td>0.90 (0.70-1.17)</td>
<td></td>
</tr>
</tbody>
</table>

Jones RH et al:  
Conclusions: Adding surgical ventricular reconstruction to CABG reduced the left ventricular volume, as compared with CABG alone. However, this anatomical change was not associated with a greater improvement in symptoms or exercise tolerance or with a reduction in the rate of death or hospitalization for cardiac causes. (ClinicalTrials.gov number, NCT00023595.)
119 articles referenced by PubMed related to the COURAGE Trial
“The results of Hypothesis II of the STICH Trial will remain ‘true, true and unrelated’ and will go down as an expensive but clinically meaningless exercise in surgical research.”

Conte J, Johns Hopkins University
J Heart Lung Transplant, 29:491-495, 2010
The STICH Trial: Misguided Conclusions

“The STICH Trial conclusions show that statisticians can defy nature from a flawed database.”

“The real message of the STICH Trial is this: if one is pondering treatment of patients with poor ventricular function and mild aneurysmal dilatation, do NOT perform SVR surgery because if you do not send the patient to heaven (i.e. kill them) you will only prolong his or her and your own suffering with no clinical benefit.”

### Korean Alphabet

#### Consonants

<table>
<thead>
<tr>
<th>字母</th>
<th>音素</th>
</tr>
</thead>
<tbody>
<tr>
<td>가</td>
<td>g</td>
</tr>
<tr>
<td>나</td>
<td>n</td>
</tr>
<tr>
<td>다</td>
<td>d</td>
</tr>
<tr>
<td>라</td>
<td>l</td>
</tr>
<tr>
<td>마</td>
<td>m</td>
</tr>
<tr>
<td>바</td>
<td>b</td>
</tr>
<tr>
<td>사</td>
<td>s</td>
</tr>
<tr>
<td>아</td>
<td>a</td>
</tr>
<tr>
<td>자</td>
<td>j</td>
</tr>
<tr>
<td>하</td>
<td>h</td>
</tr>
<tr>
<td>Silent in initial position</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>字母</th>
<th>音素</th>
</tr>
</thead>
<tbody>
<tr>
<td>킬</td>
<td>k</td>
</tr>
<tr>
<td>ㅌ</td>
<td>t</td>
</tr>
<tr>
<td>ㅍ</td>
<td>p</td>
</tr>
<tr>
<td>OfMonth</td>
<td>j</td>
</tr>
</tbody>
</table>

#### Vowels

<table>
<thead>
<tr>
<th>字母</th>
<th>音素</th>
</tr>
</thead>
<tbody>
<tr>
<td>아</td>
<td>a</td>
</tr>
<tr>
<td>야</td>
<td>ya</td>
</tr>
<tr>
<td>에</td>
<td>e</td>
</tr>
<tr>
<td>이</td>
<td>i</td>
</tr>
<tr>
<td>오</td>
<td>o</td>
</tr>
<tr>
<td>우</td>
<td>u</td>
</tr>
<tr>
<td>알에</td>
<td>ae</td>
</tr>
<tr>
<td>아에</td>
<td>ya</td>
</tr>
<tr>
<td>와</td>
<td>wa</td>
</tr>
<tr>
<td>웨</td>
<td>we</td>
</tr>
<tr>
<td>와에</td>
<td>wae</td>
</tr>
<tr>
<td>와우</td>
<td>wo</td>
</tr>
<tr>
<td>웨에</td>
<td>we</td>
</tr>
<tr>
<td>웨우</td>
<td>wi</td>
</tr>
<tr>
<td>아에</td>
<td>ae</td>
</tr>
<tr>
<td>에에</td>
<td>e</td>
</tr>
<tr>
<td>예</td>
<td>ye</td>
</tr>
<tr>
<td>마</td>
<td>ma</td>
</tr>
<tr>
<td>마에</td>
<td>mae</td>
</tr>
</tbody>
</table>

*Pronunciations shown here are only rough approximations.*
BARI 2D Clinical Trial

Compare treatment strategies for patients with

- Type 2 diabetes mellitus
- Documented CAD suitable for elective revascularization (1 or more significant lesions)
- Documented ischemia
- No prior CABG or PCI within the last 12 months
Revascularization Decision
BARI 2D

Cardiologist a priori selected revascularization method based on clinical and angiographic factors

Percutaneous coronary intervention or
Coronary artery bypass graft surgery
2368 patients with mild to moderate CAD and Type 2 diabetes prior to randomization. Prospective. Randomized. Mean follow-up 5.3 years

- Primary Endpoint: Death (from any cause)
- Secondary Endpoint: Composite of Death, MI, or Stroke

BARI 2D Study Group, NEJM 2009
BARI 2D

1593 patients with MVD

CABG: 11% suitable for PCI

PCI: 49% suitable for CABG

• Selection of CABG rather than PCI
  • Based largely on greater extent, severity and complexity of CAD
  • More likely in patients >65 years
  • Less likely in patients with prior PCI
  • More likely in non U.S. centers
  • Less likely after introduction of DES

Conclusions: The majority of diabetic patients with multivessel disease were selected for PCI rather than CABG. Preference for CABG over PCI was largely based on angiographic features related to the extent, location, and nature of CAD, as well as geographic, demographic, and clinical factors. (Bypass Angioplasty Revascularization Investigation in Type 2 Diabetes [BARI 2D]; NCT00006035)
BARI 2D Trial: Primary Endpoint

- The 5-year death rate for the group receiving revascularization plus optimal medical therapy was 13.2% vs. 13.5% in the group receiving optimal medical therapy alone.

- The difference between the two treatment groups did not reach statistical significance.

Revasc. 13.2%  OMT 13.5%

p = 0.97

n = 155  n = 161

BARI 2D Study Group, NEJM 2009
Prompt Revascularization vs Medical Therapy

All-Cause Mortality

- 88.3% rev
- 87.8% med

P=0.97

Death/MI/Stroke

- 77.2% rev
- 75.9% med

P=0.70

Years since randomization

Survival (%)

Event free (%)

0 1 2 3 4 5

Prompt revascularization

Intensive medical

100 80 60 40 20 0

88.3% rev

87.8% med

0 1 2 3 4 5

0 1 2 3 4 5
The rates of MI, stroke and the combined secondary endpoint of death, MI, and stroke were similar between the group receiving revascularization plus optimal medical therapy vs. the group receiving optimal medical therapy alone.

The difference between the two treatment groups for the combined secondary endpoint of death, MI, and stroke did not reach statistical significance (p=0.70)
The 5-year death rate for the group receiving insulin sensitization therapy was 13.2% vs. 13.5% in the group receiving insulin provision therapy.

The difference between the two treatment groups did not reach statistical significance.
Insulin Sensitization vs Insulin Provision

**All-Cause Mortality**
- Survival (%)
- Years since randomization
- P=0.89
- 88.2% IS
- 87.9% IP

**Death/MI/Stroke**
- Event free (%)
- Years since randomization
- P=0.70
- 77.7% IS
- 75.4% IP
BARI 2D Primary Conclusion

**Overall similar mortality and CV events**
- Prompt revascularization vs delayed or no revascularization
- Insulin sensitization vs insulin provision

**Among high-risk patients selected for CABG**
- Prompt revascularization reduces major CV events compared with delayed or no revascularization (P=0.01)

**Among lower-risk patients selected for PCI**
- Prompt revascularization and delayed or no revascularization had similar rates for major CV events
Cumulative Rate of First Revascularization

Event rate (%)

Years since randomization

Prompt revascularization

Intensive medical
Conclusions

• Optimal medical therapy is required for diabetic patients with CAD

• Despite optimal medical therapy, 42% of diabetic patients will still undergo revascularization during 5 years FU

• Revascularization strategies chosen depend in large part on severity and extent of disease

• Clinical decision making still works
### Korean Alphabet

**Consonants**

<table>
<thead>
<tr>
<th>Consonants</th>
</tr>
</thead>
<tbody>
<tr>
<td>g, k, n, d, t, r, l, m, b, p, s, ng, j, ch, k, t, p, h</td>
</tr>
<tr>
<td>silent in initial position</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consonants</th>
</tr>
</thead>
<tbody>
<tr>
<td>kk, tt, pp, ss, jj</td>
</tr>
</tbody>
</table>

**Vowels**

<table>
<thead>
<tr>
<th>Vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>a, ya, eo, yeo, o, yo, u, yu, eu, i, father, saw, home, moon, put, meet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vowels</th>
</tr>
</thead>
<tbody>
<tr>
<td>ae, yae, e, ye, wa, wae, oe, wo, we, wi, ui, hand, set, wet</td>
</tr>
</tbody>
</table>

Pronunciations shown here are only rough approximations.
Patients with left main disease (n=705)

All randomized patients (n=1,800)

Patients with 3-vessel disease (n=1,095)

CABG (n=348)

TAXUS (n=357)

Withdrew consent (n=12)

Lost to follow-up (n=1)
Discontinued treatment (n=1)

12-month clinical follow-up CABG (n=336, 96.6%)

12-month clinical follow-up TAXUS (n=355, 99.4%)

SYNTAX Left Main Trial

Cumulative event rate (%)

All-Cause Death

P=0.88

Months since allocation

CABG (n=348)

PCI (n=357)

SYNTAX Left Main Trial

- **Myocardial Infarction**
  - P=0.97
  - Cumulative event rate (%): 4.3% (CABG) vs. 4.1% (PCI)

- **CVA**
  - P=0.009
  - Cumulative event rate (%): 2.7% (CABG) vs. 0.3% (PCI)

SYNTAX Left Main Trial


Months since allocation

Cumulative event rate (%)

Repeat Revascularization

CABG (n=348) PCI (n=357)

P=0.02

Death/
CVA/MI

P=0.29

9.1%

7.0%

6.7%

12.0%
SYNTAX Left Main Trial
1-Year MACCE

Mean baseline SYNTAX score
CABG 15.5±4.3
TAXUS 15.7±4.4
Δ-5.3 (-13.6, 3.0)
P=0.19

Mean baseline SYNTAX score
CABG 27.2±3.0
TAXUS 27.0±2.7
Δ-2.9 (-12.8, 7.0)
P=0.53

Mean baseline SYNTAX score
CABG 42.1±7.6
TAXUS 43.8±9.1
Δ12.4 (3.1, 21.7)
P=0.008

Cumulative event rate (%)

CABG (n=103)  TAXUS (n=118)

Months since allocation

0  6  12
13.0%  7.7%

CABG (n=92)  TAXUS (n=103)

Months since allocation

0  6  12
15.5%  12.6%

CABG (n=150)  TAXUS (n=135)

Months since allocation

0  6  12
25.3%  12.9%

“Patients with LM disease who had revascularization with PCI had comparable safety and efficacy outcomes to CABG at 1 year.”

**MACCE to 2 Years**  
**Left Main Population**

- Similar LM MACCE rates through 2 years between PCI and CABG
- PCI of LM is safe and feasible
Whether SYNTAX score should be used as a stand-alone tool or whether its performance may be improved by the parallel use of clinical scores focusing on co-morbidities, such as EuroSCORE, is a matter of debate.

The Global Risk Score
EuroScore and SYNTAX Score
255 Patients with LMCA PCI

SYNTAX score

<table>
<thead>
<tr>
<th>SYNTAX score</th>
<th>&lt;19</th>
<th>19-27</th>
<th>&gt;27</th>
</tr>
</thead>
<tbody>
<tr>
<td>EuroSCORE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>L</td>
<td>L</td>
<td>I</td>
</tr>
<tr>
<td>3-6</td>
<td>L</td>
<td>L</td>
<td>I</td>
</tr>
<tr>
<td>&gt;6</td>
<td>I</td>
<td>I</td>
<td>H</td>
</tr>
</tbody>
</table>

2-Year Survival

SYNTAX Score

Cardiac death-free survival (%)

Days

Days

Global Risk Score

Conclusions: We found a significant improvement in the prediction of cardiac mortality with the inclusion of EuroSCORE in a SYNTAX score-based model. The degree of reclassification between treatment threshold categories indicates that clinical and angiographic information are both important for assessing individual risk of patients undergoing left main PCI.
All-Cause Death to 2 Years

Cumulative event rate (%)

Before 1 year
3.5% vs 4.4%
P=0.37

After 1 year
1.5% vs 1.9%
P=0.53

CABG (n=897)  
TAXUS (n=903)
Repeat Revascularization to 2 Years

Cumulative event rate (%)

- **CABG (n=897)**
- **TAXUS (n=903)**

Before 1 year
- 5.9% vs 13.5%
- P < 0.001

After 1 year
- 3.7% vs 5.6%
- P = 0.06

Months since allocation

- **P=0.06**
- **P<0.001**

17.4% 8.6%
MACCE to 2 Years by SYNTAX Score Tercile

Low Scores (0-22)

Cumulative event rate (%)

- CABG (n=275)
- TAXUS (n=299)

Mean baseline SYNTAX score

<table>
<thead>
<tr>
<th>Procedure</th>
<th>SYNTAX score</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td>16.6±4.0</td>
<td>0.63</td>
</tr>
<tr>
<td>TAXUS</td>
<td>16.7±4.1</td>
<td></td>
</tr>
</tbody>
</table>

19.4% 17.4%

Months since allocation
MACCE to 2 Years by SYNTAX Score Tercile
Intermediate Scores (23-32)

Cumulative event rate (%)

Months since allocation

CABG (n=300)  TAXUS (n=310)

Mean baseline SYNTAX score
CABG 27.4±2.8
TAXUS 27.3±2.8

P=0.06

22.8%
16.4%
MACCE to 2 Years by SYNTAX Score Tercile

High Scores (≥33)

Cumulative event rate (%)

Months since allocation

Mean baseline SYNTAX score

<table>
<thead>
<tr>
<th>Group</th>
<th>SYNTAX score (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CABG</td>
<td>41.5 ± 7.1</td>
</tr>
<tr>
<td>TAXUS</td>
<td>41.7 ± 7.8</td>
</tr>
</tbody>
</table>

P < 0.001

CABG (n=315)  TAXUS (n=290)

28.2%  15.4%
2-Year Outcomes in 3VD and LM Subgroups

**3 vessel disease**  
- CABG: 8.2, 11.1, 17.4, 14.4, 23.8  
- TAXUS: 7.5, 10.2, 10.4, 17.3, 19.3, 22.9

**Left main disease**  
- CABG: 10.2, 17.3, 19.3  
- TAXUS: 10.4, 17.3, 22.9

- **Death/CVA/MI**:  
  - 3VD: P=0.11, P<0.001  
  - LM: P=0.48, P=0.01, P=0.27

- **Revasc**:  
  - 3VD: P=0.11  
  - LM: P<0.001, P<0.001

- **MACCE**:  
  - 3VD: P=0.11, P<0.001  
  - LM: P=0.48, P=0.01, P=0.27

**n=1095**  
**n=705**
Summary I

• In the SYNTAX randomized patients, 2-year MACCE rates were significantly higher for PCI than CABG, mainly driven by higher repeat revascularization in the PCI arm.

Significant increase of MI compared to CABG at 2 years driven by higher PCI MI rate between years 1 and 2

Significantly higher CVA rate in CABG compared to PCI with the majority of CVAs occurring in the first year

Composite safety (death/CVA/MI) remains similar between arms at 2 years

• MACCE rates at 2 years not significantly different for patients with a low (0-22) or intermediate (23-32) baseline SYNTAX score; for patients with high SYNTAX scores (≥33), MACCE continued to be increased at 2 years in patients treated with PCI.
Summary II

• In the predefined subgroups of patients with either 3VD or LM disease

Safety outcomes (death/CVA/MI) in the 3VD group were similar for PCI and CABG, but the 2-year revascularization and MACCE rates favored CABG.

In the LM group, safety outcomes and MACCE rates were similar for PCI and CABG, but the 2-year revascularization rate was lower in the CABG group.

• The 2-year SYNTAX results suggest that CABG remains the standard of care for patients with complex disease (high SYNTAX scores); however, PCI may be an acceptable alternative revascularization method to CABG when treating patients with less complex (low or intermediate SYNTAX score) disease.
Korean Alphabet

Consonants

ɡ, k, n, d, t, r, l, m, b, p, s, n, g, j, ch, k, t, p, h

silent in initial position

 kk tt pp ss jj

Vowels

ㅏ ㅑ ㅓ ㅕ ㅗ ㅘ ㅜ ㅠ ㅡ ㅣ

a ya eo yeo o yo u yu eu i

father saw home moon put meet

ㅐ ㅒ ㅔ ㅖ ㅚ ㅕ ㅟ ㅢ

ae yae e ye wa wae oe wo we wi ui

hand set wet

Pronunciations shown here are only rough approximations.
Revascularization

- Improve Symptoms
  - Improve rhythm control
  - Decreasing need for optimal medical therapy
- Angina
- CHF
- Decrease infarction
- Salvage myocardium
- Improve Survival

Survival

Symptoms
“In your case, Dave, there’s a choice—elective surgery, outpatient medical therapy, or whatever’s in the box that our lovely Carol is holding.”
<table>
<thead>
<tr>
<th>Blood is better than drugs for ischemic myocardium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rahimtoola</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The more disease present, the more blood helps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeons can be vicious</td>
</tr>
<tr>
<td>Modified</td>
</tr>
<tr>
<td>Revascularization Strategies</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>• Patient demographics</td>
</tr>
<tr>
<td>• Lesion specifics</td>
</tr>
<tr>
<td>• Specific revascularization</td>
</tr>
<tr>
<td>• Timing of the specific revascularization</td>
</tr>
<tr>
<td>• What are the metrics for comparing these issues?</td>
</tr>
<tr>
<td>• At what time do we compare the metrics?</td>
</tr>
</tbody>
</table>
SCENARIOS

50-year-old
Mild, stable angina
Proximal RCA
stenosis
Normal LV function

50-year-old
Unstable angina
EF 42%
Severe complex 3VD

50-year-old
CHF
EF 23%
LAD 30%
Prox RCA 50%
Circ 60%
## Revascularization Goals

<table>
<thead>
<tr>
<th>Goals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prolong survival</td>
</tr>
<tr>
<td>Reduce infarction</td>
</tr>
<tr>
<td>Reduce CHF</td>
</tr>
<tr>
<td>Alleviate symptoms</td>
</tr>
<tr>
<td>Reduce ischemia</td>
</tr>
<tr>
<td>Reduce repeat hospitalization</td>
</tr>
<tr>
<td>Reduce medical costs</td>
</tr>
</tbody>
</table>
Revascularization Goals

- What is the comparator?
- How long do we compare against what we are comparing with?
Revascularization Goals

- Adjunctive therapy
- Specific anatomic subset
- Specific revascularization strategy and performance
- Specific patient demographics
Murder

Parking Ticket
Conclusions: The SXscore is a useful tool to predict cardiac mortality and MACE in patients undergoing percutaneous revascularization of the left main coronary artery.
SYNTAX and Unprotected LMCA

Cardiac mortality (%)

Days

SXscore ≤18
SXscore >18-27
SXscore >27

MACE (%)

Days

No. at risk

I tertile
68
49
38

II tertile
71
52
46

III tertile
66
64
46

No. at risk

I tertile
72
65
39

II tertile
72
54
46

III tertile
70
55
46

SYNTAX and Unprotected LMCA
Cardiac Death

Node 1 (n=255)
SYNTAX score
P<0.001

<34
Node 2 (n=195)

>34
Node 3 (n=60)

SYNTAX and Unprotected LMCA MACE

Node 1 (n=255)
SYNTAX score P<0.001
≤37
Node 2 (n=218)
>37
Node 3 (n=42)

SYNTAX Score and UPLMCA
Unadjusted 2-Year Mortality

Number at risk

<table>
<thead>
<tr>
<th></th>
<th>PCI</th>
<th>CABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>186</td>
<td>204</td>
</tr>
<tr>
<td>6</td>
<td>148</td>
<td>186</td>
</tr>
<tr>
<td>12</td>
<td>124</td>
<td>153</td>
</tr>
<tr>
<td>18</td>
<td>87</td>
<td>129</td>
</tr>
<tr>
<td>24</td>
<td>49</td>
<td>145</td>
</tr>
<tr>
<td>30</td>
<td>39</td>
<td>123</td>
</tr>
<tr>
<td>36</td>
<td>31</td>
<td>104</td>
</tr>
<tr>
<td>42</td>
<td>22</td>
<td>96</td>
</tr>
</tbody>
</table>

Cumulative incidence (%)

- SYNTAX Score ≤34
  - PCI: 4.5%, 5.1%, 8.1%
  - CABG: 6.2%
  - P = 0.461

- SYNTAX Score >34
  - PCI: 15.0%
  - CABG: 6.8%, 8.5%
  - P < 0.001

Capodanno D et al: J Am Coll Cardiol Intv 2:731, 2009
SYNTAX Score and UPLMCA
Unadjusted and Adjusted 2-Year RR of Death with PCI or CABG

<table>
<thead>
<tr>
<th>SYNTAX score</th>
<th>Favors PCI</th>
<th>Favors CABG</th>
<th>HR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td></td>
<td>1.30 (0.65-2.58)</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Adjusted</td>
<td></td>
<td>0.81 (0.33-1.99)</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>&gt;34</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted</td>
<td></td>
<td>4.24 (2.19-8.23)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Adjusted</td>
<td></td>
<td>2.54 (1.09-5.92)</td>
<td>0.031</td>
<td></td>
</tr>
</tbody>
</table>

Capodanno D et al: J Am Coll Cardiol Intv 2:731, 2009
SYNTAX Score and UPLMCA

Capodanno D et al: J Am Coll Cardiol Intv 2:731, 2009
Subject: SYNTAX Score and UPLMCA, Capodanno

Background: BU3

Banner/brdr: 0-40-159/BU41

Side title: YW105

• /colhdgs: YW105

Text: WT/BK

Highlight: YO114

Subdue: BU31

Footnotes: BU41

COLOR REFERENCE ONLY
Match: Mayo2bu-2002 (CP1111378)
Conclusions: We found a significant improvement in the prediction of cardiac mortality with the inclusion of EuroSCORE in a SYNTAX score-based model. The degree of reclassification between treatment threshold categories indicates that clinical and angiographic information are both important for assessing individual risk of patients undergoing left main PCI.

In patients with unprotected left main coronary artery disease (CAD), prediction of individual outcomes can assist physicians, patients and their families to achieve a better comprehension of attendant risks and provide an objective basis to select the most appropriate treatment options. EuroSCORE is a prognostic scoring system developed for patients undergoing cardiac surgery, including those with left main CAD, which has gained wide popularity over time as its performance has been validated in several local populations within and outside Europe. Since most of its variables are derived from the clinical status of the patient, it is not surprising that EuroSCORE can also reasonably stratify into risk categories, although lacking in precision, a population undergoing percutaneous coronary intervention (PCI). Other clinical risk scores have been specifically proposed over the last decade to predict adverse cardiovascular outcome following PCI. However, one common concern of using clinical risk scores in the setting of PCI is that they do not incorporate any or a comprehensive information regarding the anatomy and extent of CAD.

SYNTAX score is an emerging tool developed to characterize the coronary vasculature in more detail with respect to the number of lesions and their complexity, functional impact, and location. The performance of SYNTAX score in aiding treatment decision making of patients with complex CAD is encouraging and its potential for predicting long-term outcomes of PCI patients has also been suggested. Whether SYNTAX score should be used as a stand-alone tool or whether its performance may be improved by the parallel use of clinical scores that determine the procedural risk, such as EuroSCORE, is currently unsolved.

To shed more light on the value of a so-called Global Risk Classification (GRC) resulting from merging the angiographic and clinical information contained in the
The Global Risk Score

<table>
<thead>
<tr>
<th>SYNTAX score</th>
<th>&lt;19</th>
<th>19-27</th>
<th>&gt;27</th>
</tr>
</thead>
<tbody>
<tr>
<td>EuroSCORE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>L</td>
<td>L</td>
<td>I</td>
</tr>
<tr>
<td>3-6</td>
<td>L</td>
<td>L</td>
<td>I</td>
</tr>
<tr>
<td>&gt;6</td>
<td>I</td>
<td>I</td>
<td>H</td>
</tr>
</tbody>
</table>

Subject: Euro Score & SYNTAX, Capodanno

Background: BU3
Banner/brdr: 0-40-159/BU41

Side title: YW105
• /colhdgs: YW105

Text: WT/BK
Highlight: YO114
Subdue: BU31
Footnotes: BU41

Plot/brdr: open/BU41

COLOR REFERENCE ONLY
Match: Mayo2bu-2002 (CP1111378)
## STICH Trial
### Baseline Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>CABG alone (n=499)</th>
<th>CABG with surgical ventricular reconstruction (n=501)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (yr)</td>
<td>Median: 62</td>
<td>Median: 62</td>
</tr>
<tr>
<td></td>
<td>Interquartile range: 54-69</td>
<td>Interquartile range: 55-69</td>
</tr>
<tr>
<td>Female sex, no. (%)</td>
<td>78 (16)</td>
<td>69 (14)</td>
</tr>
<tr>
<td><strong>Medical history</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI, no. (%)</td>
<td>435 (87)</td>
<td>437 (87)</td>
</tr>
<tr>
<td>Diabetes, no. (%)</td>
<td>173 (35)</td>
<td>171 (34)</td>
</tr>
<tr>
<td>Chronic renal insufficiency</td>
<td>42 (8)</td>
<td>43 (9)</td>
</tr>
<tr>
<td>Stroke, no. (%)</td>
<td>28 (6)</td>
<td>28 (6)</td>
</tr>
<tr>
<td><strong>Angina class</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>203 (41)</td>
<td>205 (41)</td>
</tr>
<tr>
<td>IV</td>
<td>45 (9)</td>
<td>39 (8)</td>
</tr>
<tr>
<td><strong>NY Heart Assoc HF class</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>210 (42)</td>
<td>218 (44)</td>
</tr>
<tr>
<td>IV</td>
<td>31 (6)</td>
<td>26 (5)</td>
</tr>
</tbody>
</table>

# STICH Trial
## Baseline Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>CABG alone (n=499)</th>
<th>CABG with surgical ventricular reconstruction (n=501)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coronary anatomy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>No. of vessels with stenosis of ≥50%, no. (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>36 (7)</td>
<td>51 (10)</td>
</tr>
<tr>
<td>2</td>
<td>144 (29)</td>
<td>131 (26)</td>
</tr>
<tr>
<td>3</td>
<td>319 (64)</td>
<td>319 (64)</td>
</tr>
<tr>
<td><strong>Stenosis of left main coronary artery, no. (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-74%</td>
<td>72 (14)</td>
<td>61 (12)</td>
</tr>
<tr>
<td>≥75%</td>
<td>31 (6)</td>
<td>33 (7)</td>
</tr>
<tr>
<td>≥75% stenosis of proximal LAD coronary artery, no. (%)</td>
<td>388 (78)</td>
<td>369 (74)</td>
</tr>
</tbody>
</table>

STICH Trial
NYHA Heart Failure Class

Subject: STICH Trial

Background: BU3
Banner/brdr: 0-40-159/BU41
Side title: YW105
• /colhdgs: YW105
Text: WT/BK
Highlight: YO114
Subdue: BU31
Footnotes: BU41
Plot/brdr: open/BU41
x, y only

COLOR REFERENCE ONLY
Match: Mayo2bu-2002 (CP1111378)
Conclusions: The majority of diabetic patients with multivessel disease were selected for PCI rather than CABG. Preference for CABG over PCI was largely based on angiographic features related to the extent, location, and nature of CAD, as well as geographic, demographic, and clinical factors. (Bypass Angioplasty Revascularization Investigation in Type 2 Diabetes [BARI 2D]; NCT00006035)

Jeopardized myocardium (in quartiles) (%)

US (n=714) vs Non-US (n=594) CABG-intended patients (%)
Selection of CABG Rather than PCI

- Non-US vs US
- Rand after DES available
- Male sex
- Age ≥65 years
- Prior PCI
- Triple vessel disease
- LAD ≥70% stenosis
- Prox LAD ≥50% stenosis
- Total occlusion
- Class C lesions ≥2

Subject: BARI 2D Kim

Background: BU3
Banner/brdr: 0-40-159/BU41
Side title: YW105
• /colhdgs: YW105
Text: WT/BK
Highlight: YO114
Subdue: BU31
Footnotes: BU41

Plot/brdr: open/BU41
x, y only

PPT shooting instructions
PPT File to Server
(3 images)

Artist: mls
Start Date: 4-12-10

COLOR REFERENCE ONLY
Match: Mayo2bu-2002 (CP1111378)
Stable Angina Should be Approached with PCI

14th Annual 2009 Cardiology at Cancun
February 2009

David R. Holmes, MD
Mayo Clinic
Rochester, MN
Presenter Disclosure Information

David R. Holmes, Jr., M.D.

“Stable Angina Should be Approached with PCI”

The following relationships exist related to this presentation:

No relationships to disclose
How Do We Choose

Issues

Physician

Patient, Family

Societal, Health Plan
“Nobody else has complained about flies in the soup.”
Expectations

• Economic stimulus package will work
• The bathing suit will cover as well as it used to
• The sun will shine in Cancun while we are there
• I will not get a headache from the Tequila
<table>
<thead>
<tr>
<th>Want to live forever</th>
</tr>
</thead>
<tbody>
<tr>
<td>Want good health and thinness without sweat or carrot sticks</td>
</tr>
<tr>
<td>Want to avoid a heart attack or death</td>
</tr>
<tr>
<td>Most of all, want to avoid a stroke</td>
</tr>
<tr>
<td>Want to go to heaven</td>
</tr>
<tr>
<td>Certainly want to avoid surgery</td>
</tr>
<tr>
<td>Would be nice if it improved their skills at shopping, bargain hunting, golf or fishing</td>
</tr>
</tbody>
</table>
Willpower lasts about 30 days and is soluble in alcohol
<table>
<thead>
<tr>
<th></th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAD</td>
<td>70</td>
<td>0</td>
</tr>
<tr>
<td>RCA</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Circ</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

Coated Stent

High dose statin
Increasingly Common
Psychologic Distress and CAD

- 381 patients (311 men, 70 women) referred for cardiac rehabilitation
- Assessment of psychologic distress using self report inventory (SCL – 90 – R)
- Distressed defined as SCL – 90 – R scores >90% for outpatient adults

Cumulative Risk of Early Cardiovascular Rehospitalization

Psychologic distress adversely affects the prognosis of CAD patients

We Can Help You... Avoid a Stroke In Just 10 Minutes

- Stroke is America's third leading killer.
- Stroke is the #1 cause of nursing home admissions.

Unfortunately, half of all stroke victims have no warning signs before a stroke occurs! Don't delay; sign up for a painless screening today!

Life Line Screening is America's Leading provider of quality health screenings. Since 1993, we have provided quick, painless and affordable vascular screenings to more than 2.5 million people.

Our mobile units are coming to neighborhoods across the country - SO CALL NOW!

We provide these non-invasive, completely painless screenings using Doppler ultrasound technology.

1. Stroke Screening/ Carotid Artery
   Visualizes the buildup of fatty plaque in the carotid arteries which leads to stroke.

2. Abdominal Aortic Aneurysm (AAA) Screening
   Visualizes the existence of an aneurysm (enlargement) in the abdominal aorta that could lead to a ruptured aortic artery.

3. Peripheral Arterial Disease Screening
   Screens for peripheral arterial disease (plaque buildup) in the lower extremities which is linked to coronary artery disease.

4. Osteoporosis Screening
   Screens for abnormal bone mass density in men and women. Osteoporosis is painless and silent in its early stages.
The key to surviving a heart attack is promptly recognizing the warning signals and getting immediate medical attention.

**Patient Expectations**

- **Montana Heart Center**
  - Do Not Delay Seeking Treatment. It Could Save Your Life.
  - The Quicker You Seek Treatment Following Symptoms, The Better The Outcome!

**Treating A Heart Attack - Dealing With A Heart Attack: Heart Disease**

If you have a heart attack and reach the hospital in time, chances are very good that you will walk out of the hospital within a week or even sooner. (provided by the Faculty of the Harvard Medical School)

**Fast Action Saves Lives**

Calling 9-1-1 is the fastest way to get lifesaving treatment. If you or someone you are with has any symptoms of a heart attack, call 9-1-1 immediately.
Patient Expectations

If I or my spouse recognizes heart symptoms on time and gets me to the cardiologist and the cardiologist says it is my heart and that he/she can treat it, then that treatment will save my life.
PCI
What do we know?

• Treatment of choice for acute STEMI; documented to decrease death and recurrent MI

• Improves outcome in selected patients with ACS

• Reduces ischemia and symptoms in selected patient subsets
PCI
What do we know?

• It is not perfect
• It treats only the treated area
• It has the potential for ST or restenosis which while uncommon still occurs
• It does not do much to reduce weight, stop smoking, exercise, control BP, decrease BS or improve lipids
Aphorism

Blood is better than drugs for the ischemic myocardium
A burglar broke into a house one night. He shined his flashlight around, looking for valuables; and when he picked up a CD player to place in his sack, a strange, disembodied voice echoed from the dark saying, "Jesus is watching you."
He nearly jumped out of his skin, clicked his flashlight off, and froze.

When he heard nothing more after a bit, he shook his head, promised himself a vacation after the next big score, then clicked the light on and began searching for more valuables.

Just as he pulled the stereo out so he could disconnect the wires, clear as a bell he heard,

Jesus is watching you
Freaked out, he shined his light around frantically, looking for the source of the voice.

Finally, in the corner of the room, his flashlight beam came to rest on a parrot.

“Did you say that?” he hissed at the parrot.

“Yes”, the parrot confessed, then squawked, “I’m just trying to warn you”.
The burglar relaxed, “Warn me, huh? Who in the world are you?”

“Moses”, replied the bird.

“Moses?” the burglar laughed. What kind of people would name a bird Moses?”
“The kind of people that would name a Rottweiler Jesus”.

[Image of a black dog with a chain collar]
COURAGE Trial

• Multicenter randomized clinical trial
• Screened 35,539 patients
• 2,287 patients randomized
  • Objective evidence of myocardial ischemia
  • Stable angina
• Randomization
  • PCI + optimal medical therapy vs
  • Optimal medical therapy

Boden WE, NEJM 2007; 356:1503-16
Survival Free of Death from Any Cause and MI

Medical therapy
PCI

HR 1.05
95% CI 0.87-1.27
P=0.62

No. at risk

<table>
<thead>
<tr>
<th>Years</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical therapy</td>
<td>1,138</td>
<td>1,017</td>
<td>959</td>
<td>834</td>
<td>638</td>
<td>408</td>
<td>192</td>
<td>30</td>
</tr>
<tr>
<td>PCI</td>
<td>1,149</td>
<td>1,013</td>
<td>952</td>
<td>833</td>
<td>637</td>
<td>417</td>
<td>200</td>
<td>35</td>
</tr>
</tbody>
</table>

As an initial management strategy in patients with stable coronary artery disease, PCI did not reduce the risk of death, myocardial infarction, or other major cardiovascular events when added to optimal medical therapy.

Boden WE, NEJM 2007; 356:1503-16
<table>
<thead>
<tr>
<th>Outcome</th>
<th>No. of Events</th>
<th>PCI Group</th>
<th>Med-Rx Group</th>
<th>HR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revasc (PCI or CABG)</td>
<td></td>
<td>228</td>
<td>348</td>
<td>0.60</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Boden WE, NEJM 2007; 356:1503-16
Paul Harvey
The Rest of the Story
Outcomes - Details

Table 3. Primary and Secondary Outcomes.*

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of Events</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
<th>Cumulative Rate at 4.6 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death and nonfatal myocardial infarction</td>
<td>211</td>
<td>1.05 (0.87–1.27)</td>
<td>0.62</td>
<td>19.0</td>
</tr>
<tr>
<td>Death</td>
<td>68</td>
<td>74</td>
<td></td>
<td>18.5</td>
</tr>
<tr>
<td>Periprocedural myocardial infarction</td>
<td>35</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous myocardial infarction</td>
<td>108</td>
<td>119</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death, myocardial infarction, and stroke</td>
<td>222</td>
<td>213</td>
<td></td>
<td>9.5</td>
</tr>
</tbody>
</table>

Large preponderence of procedural MIs – death and spontaneous MI actually less after PCI

30 % of OMT patients “crossed over” because of failure of OMT alone
Chronic Stable Angina

• PCI is very effective in reducing or abolishing angina and improving functional status

• In patients treated medically, crossover to PCI is frequent

• PCI is not more effective than aggressive medical therapy in reducing MI and death in stable mildly symptomatic patients

• Should we really have been surprised
Quality of Life
COURAGE Trial

• 2,287 patients with stable CAD to PCI + OMT or OMT alone

• QOL assessed using Seattle Angina Questionnaire and RAND – 36 item health survey

Quality of Life
Freedom from Angina

Angina free (%) vs Months

PCI + OMT vs OMT

P-values:
- BL: P=0.35
- 1 month: P<0.001
- 3 months: P<0.001
- 6 months: P<0.001
- 12 months: P=0.005
- 24 months: P=0.010
- 36 months: P=0.30

Quality of Life

*P<0.01


PCI + OMT
OMT

Mean score

Months from baseline

50 60 70 80 90 100

0 6 12 18 24 30 36
Angina Frequency

![Graph showing the mean score of Angina Frequency over months from baseline. The graph compares PCI + OMT and OMT groups.](image)

*P<0.01

Quality of Life
COURAGE Trial

• Improvement in angina frequency depended on severity at baseline

• Largest clinical improvement with PCI seen in patients with most severe angina at baseline. No improvement in patients with mildest angina.

**Cardiac ischemia**

What is cardiac ischemia? How serious is it?
From Ruth in Virginia

**Answer:** Cardiac ischemia occurs when blood flow to the heart muscle (myocardium) is obstructed by a partial or complete blockage of a coronary artery. A sudden, severe blockage may lead to a heart attack (myocardial infarction). Cardiac ischemia may also cause a serious abnormal heart rhythm (arrhythmia), which can cause fainting or even sudden death.

In some people, especially those with diabetes, cardiac ischemia may cause no signs or symptoms. A doctor may make a diagnosis of cardiac ischemia based on: Medical History, Physical examination, Electrocardiogram, Stress Test, X-rays of coronary arteries (coronary angiogram)

Treatment is directed at improving blood flow to the heart muscle.
Hypothesis: Reduction in Ischemia will be greater for patients randomized to PCI+OMT than for those randomized to OMT

Serial Rest/Stress Myocardial Perfusion SPECT (MPS)
To compare patient management strategy for ischemia reduction

- Pre-Rx = Off Meds
- 6-18m = On Meds

Documented Pre-Rx Ischemia

PCI+OMT (n=159)
Repeat MPS* at 6-18 m

OMT (n=155)
Repeat MPS* at 6-18 m

Mean = 374±50 days

*Timing chosen to occur beyond window of in-stent restenosis & delayed to allow effects of medical Rx to be observed

Inducible Ischemia

PCI + Optimal Medical Therapy (n=159)

33.3% with ≥5% ischemia reduction (P=0.0004)

Mean = 2.7% (95% CI = -1.7% to -3.8%)

Optimal Medical Therapy (n=155)

18.9% with ≥5% ischemia reduction

Mean = 0.5% (95% CI = -1.6% to 0.6%)

Indicate ≥5% reduction in myocardial ischemia

No significant reduction in ischemia

Residual Ischemia and Outcome


Cumulative event-free survival

Follow-up (years)

- 0% (n=23)
- 1-4.9% (n=141)
- 5-9.9% (n=88)
- ≥10% (n=62)

Unadjusted P=0.001
Risk-adjusted P=0.09

Hazard ratio (x-fold)

1-4.9%
5-9.9%
≥10%

Risk-adjusted P=0.09
Unadjusted P=0.001

Unadjusted
Risk-adjusted

MAYO CLINIC
Rates of Death or MI by Residual Ischemia

COURAGE Trial

- 0% (n=22)
  - P=0.063

- 1%-4.9% (n=160)
  - P=0.023

- 5%-9.9% (n=94)
  - P=0.002

- ≥10% (n=61)
COURAGE
Nuclear Substudy

• Adding PCI to OMT results in greater reduction in ischemia compared with OMT alone

• Reduction of ischemia is associated with decreased death/MI

• Severity of residual ischemia is associated with outcome

Meta Analysis
PCI in Stable Angina

- 17 randomized trials
- 7,513 patients with symptoms/signs of ischemia but no ACS
- 3,675 assigned to PCI
- 3,838 assigned to medical therapy
- Primary endpoint: all cause death

Odds Ratios for Cardiac Death in Individual Trials Comparing the PCI-Based Strategy with Medical Treatment Strategy

<table>
<thead>
<tr>
<th>Trial</th>
<th>Year of publication</th>
<th>Cardiac deaths/total</th>
<th>Odds ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sievers et al</td>
<td>1993</td>
<td>0/44</td>
<td>0.74 (0.51 to 1.06)</td>
</tr>
<tr>
<td>Dakik et al</td>
<td>1998</td>
<td>1/21</td>
<td></td>
</tr>
<tr>
<td>AVERT</td>
<td>1999</td>
<td>1/177</td>
<td></td>
</tr>
<tr>
<td>MASS</td>
<td>1999</td>
<td>4/72</td>
<td></td>
</tr>
<tr>
<td>Bech et al</td>
<td>2001</td>
<td>1/90</td>
<td></td>
</tr>
<tr>
<td>ALKK</td>
<td>2003</td>
<td>4/149</td>
<td></td>
</tr>
<tr>
<td>RITA-2</td>
<td>2003</td>
<td>20/504</td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>2004</td>
<td>32/153</td>
<td></td>
</tr>
<tr>
<td>Hambrecht et al</td>
<td>2004</td>
<td>0/50</td>
<td></td>
</tr>
<tr>
<td>INSPIRE</td>
<td>2006</td>
<td>2/104</td>
<td></td>
</tr>
<tr>
<td>MASS II</td>
<td>2006</td>
<td>24/205</td>
<td></td>
</tr>
<tr>
<td>SWISSI II</td>
<td>2007</td>
<td>3/96</td>
<td></td>
</tr>
<tr>
<td>COURAGE</td>
<td>2007</td>
<td>23/1149</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>115/2814</td>
<td>0.74 (0.57 to 0.96)</td>
</tr>
</tbody>
</table>

Random effects model
Fixed effects model
P heterogeneity = 0.161; I^2 = 29%

### Odds Ratios for Nonfatal Myocardial Infarction in Individual Trials Comparing the PCI-Based Strategy with Medical Treatment Strategy

<table>
<thead>
<tr>
<th>Trial</th>
<th>Year of publication</th>
<th>PCI MI total</th>
<th>Medical MI total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sievers et al</td>
<td>1993</td>
<td>2/44</td>
<td>0/44</td>
</tr>
<tr>
<td>ACME-1</td>
<td>1997</td>
<td>14/115</td>
<td>8/112</td>
</tr>
<tr>
<td>ACME-2</td>
<td>1997</td>
<td>6/51</td>
<td>6/50</td>
</tr>
<tr>
<td>ACIP</td>
<td>1997</td>
<td>7/192</td>
<td>18/366</td>
</tr>
<tr>
<td>Dakik et al</td>
<td>1998</td>
<td>2/21</td>
<td>0/23</td>
</tr>
<tr>
<td>AVERT</td>
<td>1999</td>
<td>5/177</td>
<td>4/164</td>
</tr>
<tr>
<td>MASS</td>
<td>1999</td>
<td>5/72</td>
<td>3/72</td>
</tr>
<tr>
<td>Bech et al</td>
<td>2001</td>
<td>3/90</td>
<td>0/91</td>
</tr>
<tr>
<td>ALKK</td>
<td>2003</td>
<td>10/149</td>
<td>12/151</td>
</tr>
<tr>
<td>RITA-2</td>
<td>2003</td>
<td>32/504</td>
<td>23/514</td>
</tr>
<tr>
<td>TIME</td>
<td>2004</td>
<td>18/153</td>
<td>18/148</td>
</tr>
<tr>
<td>Hambrecht et al</td>
<td>2004</td>
<td>1/50</td>
<td>0/51</td>
</tr>
<tr>
<td>DANAMI</td>
<td>2006</td>
<td>32/503</td>
<td>59/505</td>
</tr>
<tr>
<td>INSPIRE</td>
<td>2006</td>
<td>5/104</td>
<td>7/101</td>
</tr>
<tr>
<td>MASS II</td>
<td>2006</td>
<td>23/205</td>
<td>31/203</td>
</tr>
<tr>
<td>SWISSI II</td>
<td>2007</td>
<td>11/96</td>
<td>40/105</td>
</tr>
<tr>
<td>COURAGE</td>
<td>2007</td>
<td>143/1,149</td>
<td>128/1,138</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>319/3,675</td>
<td>357/3,838</td>
</tr>
</tbody>
</table>

**Random effects model**

- Odds ratio (95% CI): 0.90 (0.66-1.23)

**Fixed effects model**

- Odds ratio (95% CI): 0.91 (0.77-1.06)

- $P_{heterogeneity} = 0.263$; $I^2 = 17\%$

---

# Odds Ratios for Mortality for PCI vs Medical Treatment

<table>
<thead>
<tr>
<th>Recent MI (&lt;4 weeks)</th>
<th>Trials (no.)</th>
<th>Patients (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>4</td>
<td>1,557</td>
</tr>
<tr>
<td>No</td>
<td>13</td>
<td>5,956</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Angiography required before randomization</th>
<th>Trials (no.)</th>
<th>Patients (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>14</td>
<td>5,999</td>
</tr>
<tr>
<td>No</td>
<td>3</td>
<td>1,514</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CABG as a treatment option in PCI group</th>
<th>Trials (no.)</th>
<th>Patients (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>4</td>
<td>2,072</td>
</tr>
<tr>
<td>No</td>
<td>13</td>
<td>5,441</td>
</tr>
</tbody>
</table>

*Schomig A et al: J Am Coll Cardiol 52:894, 2008*
These findings suggest that a PCI-based invasive strategy may improve long-term survival compared with a medical treatment-only strategy in patients with stable coronary artery disease.

PCI and Medical Therapy
Low Risk Coronary Artery Disease

- Multicenter randomized trial
- Stable low risk CAD: 1 or 2 vessel CAD with stable angina
- Randomization to initial medical therapy alone or PCI plus medical therapy
- Medical therapy “recommended to the patient’s physician”

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
# Baseline Clinical and Angiographic Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Initial MT only group n=192</th>
<th>PCI + MT group n=192</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yr)</strong></td>
<td>64.2±7.6</td>
<td>64.5±7.2</td>
<td>0.755</td>
</tr>
<tr>
<td><strong>Male, no. (%)</strong></td>
<td>144 (75.4)</td>
<td>141 (75.0)</td>
<td>0.930</td>
</tr>
<tr>
<td><strong>Clinical</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Initial angina grade, no. (%)</strong></td>
<td></td>
<td></td>
<td>0.396</td>
</tr>
<tr>
<td>0</td>
<td>24 (12.9)</td>
<td>21 (11.7)</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>69 (37.1)</td>
<td>64 (35.8)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>74 (39.8)</td>
<td>68 (38.0)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>16 (8.6)</td>
<td>19 (10.6)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>3 (1.6)</td>
<td>6 (3.3)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0 (0.0)</td>
<td>1 (0.6)</td>
<td></td>
</tr>
<tr>
<td><strong>Diabetes, no. (%)</strong></td>
<td>76 (39.8)</td>
<td>76 (40.4)</td>
<td>0.900</td>
</tr>
<tr>
<td><strong>MI, no. (%)</strong></td>
<td>28 (15.1)</td>
<td>25 (14.0)</td>
<td>0.768</td>
</tr>
<tr>
<td><strong>Previous PCI, no. (%)</strong></td>
<td>54 (29.0)</td>
<td>44 (24.6)</td>
<td>0.337</td>
</tr>
<tr>
<td><strong>CABG, no. (%)</strong></td>
<td>3 (1.6)</td>
<td>5 (2.8)</td>
<td>0.441</td>
</tr>
<tr>
<td><strong>Cerebrovasc disease, no. (%)</strong></td>
<td>10 (5.4)</td>
<td>13 (7.3)</td>
<td>0.459</td>
</tr>
</tbody>
</table>

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
# Baseline Clinical and Angiographic Characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Initial MT only group n=192</th>
<th>PCI + MT group n=192</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stress test, no. (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total patients</td>
<td>149 (80.1)</td>
<td>146 (81.6)</td>
<td>0.724</td>
</tr>
<tr>
<td>Treadmill test</td>
<td>76 (40.9)</td>
<td>68 (38.0)</td>
<td>0.575</td>
</tr>
<tr>
<td>Duration of treadmill test, min, no. (%)</td>
<td>7.0±3.5</td>
<td>6.4±2.7</td>
<td>0.255</td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>55 (29.6)</td>
<td>63 (35.2)</td>
<td>0.251</td>
</tr>
<tr>
<td>Echocardiography</td>
<td>13 (7.0)</td>
<td>13 (7.3)</td>
<td>0.919</td>
</tr>
<tr>
<td><strong>Angiographic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vessels with disease, no. (%)</td>
<td></td>
<td></td>
<td>0.998</td>
</tr>
<tr>
<td>1</td>
<td>129 (67.5)</td>
<td>127 (67.6)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>62 (32.5)</td>
<td>61 (32.5)</td>
<td></td>
</tr>
<tr>
<td>Ejection fraction</td>
<td>65.8±9.6</td>
<td>64.0±9.7</td>
<td>0.171</td>
</tr>
<tr>
<td>Cardiac index</td>
<td>3.1±0.8</td>
<td>3.1±0.8</td>
<td>0.742</td>
</tr>
</tbody>
</table>

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
Stable Coronary Artery Disease

- **Mortality:**
  - 271 deaths in PCI
  - 335 with medical therapy
  - 20% reduction (95% CI 0.64, 0.99)

- **Non fatal infarction:**
  - 319 in PCI group
  - 357 with medical therapy
  - 10% reduction (95% CI 0.66, 1.33)

Death

PCI + medical therapy

Initial medical therapy only

Death
HR 0.865; 95% CI 0.278-2.604
P=0.794

Years

0.6
0.7
0.8
0.9
1.0

0 1 2 3 4 5

Initial medical 188 188 180 133 19
PCI + medical 186 186 178 131 17

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
Death and ACS

Death + ACS
HR 0.474; 95% CI 0.243-0.881
P=0.019

PCI + medical therapy
Initial medical therapy only

Initial medical
184  178  167  116  18
PCI + medical
183  179  171  124  16

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
Death, ACS, CVA

Death + ACS + CVA
HR 0.541; 95% CI 0.287-0.983
P=0.045

Years

Initial medical
PCI + medical

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
Death, ACS, CVA, Hospitalization

PCI + medical therapy

Initial medical therapy only

Death + ACS + CVA + hospitalization
HR 0.664; 95% CI 0.446-0.981
P=0.040

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
In stable low risk CAD, PCI and medical therapy may improve long-term prognosis more effectively than medical therapy alone.

Nishigaki K et al: J Am Coll Cardiol Intv 1:469, 2008
The Bottom Line

- PCI is very good for the treatment of ischemia and for improving functional class and reducing angina.
- In patients with significant ischemia, PCI improves the hard endpoints of cardiac death, nonfatal MI and need for symptom driven revascularization.
It has long been recognized that the problems with alcohol relate not to the use of a bad thing but to the abuse of a good thing.

Abraham Lincoln
1861
### Who to Stent

- Significant stenosis
- Significant ischemia
- Informed consent
- Amenable to PCI
PCI is reasonable for recurrent stenosis after PCI with large area of viable myocardium or high risk criteria on non-invasive testing (IIA, level of evidence C)
### Who to Not Stent

- Patients who do not need revascularization
- People who do not need revascularization
- Lesions which cannot be treated
- Lesions which should not be treated
- Patients in whom another approach is better
## Courage Trial Substudy

<table>
<thead>
<tr>
<th></th>
<th>PCI + OMT</th>
<th>OMT</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate-severe pre treatment</td>
<td>78%</td>
<td>52%</td>
<td>.007</td>
</tr>
<tr>
<td>Ischemia → Improved</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Shaw, AHA 2007
Overall Survival

Medical therapy

PCI

HR 0.87
95% CI 0.65-1.16
P=0.38

No. at risk

Years

0.7 0.8 0.9 1.0
0 1 2 3 4 5 6 7

1,138 1,029 917 717 468 302 38
1,149 1,094 929 733 488 312 44

Asymptomatic Ischemia on CCS I/II AP

• Reasonable in patients with >50% stenosis of LMCA, who are candidates for revascularization but are not eligible for CABG (IIA, level of evidence B)
BARI 2D Primary and Principal Secondary Endpoints

- All-cause mortality
- Major cardiovascular events
- Composite of death/MI/stroke
- Average follow-up 5.3 years
Cardiologist a priori selected revascularization method based on clinical and angiographic factors

Percutaneous coronary intervention

or

Coronary artery bypass graft surgery
The BARI 2D Study Group
Rates of Survival and Freedom from Major CV Events

Survival, Revascularization vs Medical Therapy

- **Survival (%)**
  - Years since randomization
  - Revasc: 88.3
  - Medical Rx: 87.8
  - **P=0.97**

- **No. at risk**
  - 2,368 2,296 2,247 2,197 1,892 1,196

Freedom from Major CV Events, Revascularization vs Medical Therapy

- **Event-free survival (%)**
  - Years since randomization
  - Revasc: 77.2
  - Medical Rx: 75.9
  - **P=0.70**

- **No. at risk**
  - 2,368 2,094 1,984 1,807 1,459 823

Survival, Insulin Sensitization vs Insulin Provision

- **Survival (%)**
  - Years since randomization
  - Insulin sensitization: 88.2
  - Insulin provision: 87.9
  - **P=0.89**

- **No. at risk**
  - 2,368 2,296 2,247 2,197 1,892 1,196

Freedom from Major CV Events, Insulin Sensitization vs Insulin Provision

- **Event-free survival (%)**
  - Years since randomization
  - Insulin sensitization: 77.7
  - Insulin provision: 75.4
  - **P=0.13**

- **No. at risk**
  - 2,368 2,094 1,984 1,807 1,459 823

NEJM 360:2503, 2009
The BARI 2D Study Group

Rates of Survival and Freedom from Major CV Events According to PCI and CABG Strata

<table>
<thead>
<tr>
<th>Survival in PCI Stratum</th>
<th>Survival in CABG Stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years since randomization</strong></td>
<td><strong>Years since randomization</strong></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td><strong>No. at risk</strong></td>
<td><strong>No. at risk</strong></td>
</tr>
<tr>
<td>1,605</td>
<td>763</td>
</tr>
<tr>
<td>1,562</td>
<td>734</td>
</tr>
<tr>
<td>1,529</td>
<td>718</td>
</tr>
<tr>
<td>1,505</td>
<td>692</td>
</tr>
<tr>
<td>1,529</td>
<td>586</td>
</tr>
<tr>
<td>1,505</td>
<td>333</td>
</tr>
<tr>
<td><strong>Survival (%)</strong></td>
<td><strong>Survival (%)</strong></td>
</tr>
<tr>
<td>Medical Rx</td>
<td>89.8</td>
</tr>
<tr>
<td>Revasc</td>
<td>89.2</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>0.48</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Freedom from Major CV Events in PCI Stratum</th>
<th>Freedom from Major CV Events in CABG Stratum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Years since randomization</strong></td>
<td><strong>Years since randomization</strong></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>P</strong></td>
</tr>
<tr>
<td><strong>No. at risk</strong></td>
<td><strong>No. at risk</strong></td>
</tr>
<tr>
<td>1,605</td>
<td>763</td>
</tr>
<tr>
<td>1,426</td>
<td>668</td>
</tr>
<tr>
<td>1,350</td>
<td>634</td>
</tr>
<tr>
<td>1,239</td>
<td>568</td>
</tr>
<tr>
<td>1,012</td>
<td>421</td>
</tr>
<tr>
<td>593</td>
<td>230</td>
</tr>
<tr>
<td><strong>Event-free survival (%)</strong></td>
<td><strong>Event-free survival (%)</strong></td>
</tr>
<tr>
<td>Medical Rx</td>
<td>78.9</td>
</tr>
<tr>
<td>Revasc</td>
<td>77.0</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>0.15</td>
</tr>
</tbody>
</table>

| Medical Rx | 83.8 |
| Revasc | 86.4 |

**NEJM 360:2503, 2009**
There are no facts, only interpretations.

-Friedrich Nietzsche