Coronary Artery Disease

John A. Larry, MD
Associate Professor, Clinical Internal Medicine
Director of Cardiac Rehabilitation
Section Chief, OSU East Cardiovascular Medicine
The Ohio State University

Case Presentation

- 79 year old gentleman underwent CABG 10 years ago: SVG to the LAD, SVG to the obtuse marginal branch, and SVG to the ramus intermedius vessel
- After presenting with a small non ST elevation MI 4 years ago, CATH revealed occlusion of the SVG to the LAD, 80% stenosis of the native LAD, as well as significant stenosis of the grafts to the ramus and OM vessels; the RCA was occluded and filled via collaterals.
- PCI with stent was performed to the native LAD, as well as the SVG to the ramus and OM vessels

Case Presentation

- 3 years ago, he exhibited unstable angina
- Repeat cath demonstrated occlusion of the SVG to the ramus intermedius and medical therapy was recommended

AHA Statistics

Source: NCHS and NHLBI.
Case Presentation

• He had been doing well, exercising at a very modest pace 3x a week.
• 4-5 days prior to office visit, he noted substernal chest tightness without exertional provocation, radiation, or associated symptoms, lasting 5-10 minutes, resolved with a single NTG on 2 occasions. Since that time, he walked some, up to 10 minutes at a slow pace without symptoms, and he has exhibited no recurrent chest pain.

Case Presentation

• Exam
  – Pulse 56, BP 138/60 right, 134/60 left, resp. rate 16
  – JVP is normal. No carotid bruits are present
  – Lungs are clear to auscultation and percussion
  – PMI is nondisplaced. S1 and S2 are normal. A grade 1 systolic ejection murmur is noted. No gallops or rubs present

Case Presentation

• Current medications include
  – ASA
  – Clopidogrel 75 mg daily
  – Metoprolol XL 25 mg daily
  – Isosorbide120 mg daily
  – Simvastatin 80 mg daily
  – Lisinopril 10 mg daily
  – SL NTG

Case Presentation

• Exam
  – Abdomen is soft and nontender, with no organomegaly, aneurysm or bruits
  – Extremities free of edema, distal pulses are palpable.
Diagnostic studies for evaluation of ischemic heart disease

- Stress EKG
- Stress ECHO (treadmill or pharmacologic)
- Stress nuclear (treadmill or pharmacologic)
- Adenosine/dobutamine MRI
- Coronary CT angiography
- Cardiac catheterization with coronary angiography

Use of Baves theorem to calculate the probability of coronary artery disease

Prognostic Information in Exercise Treadmill Testing

- Abnormal BP response
- Abnormal Chronotropic Response
- Impairment in Heart Rate Recovery
- Exercise Duration
- Magnitude and Duration of ST Segment Depression
  ✓ Exercise time on Bruce protocol (mins): 5x maximum ST depression (mm) -4x anginal index
  (0-no angina, 1 mild angina, 2-limiting angina)
Prognostic Data in Stress Testing

<table>
<thead>
<tr>
<th>Risk Group (Score)</th>
<th>Percentage of Total</th>
<th>Four-Year Survival</th>
<th>Annual Mortality (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (≥ -5)</td>
<td>62</td>
<td>0.99</td>
<td>0.25</td>
</tr>
<tr>
<td>Moderate (0 to +4)</td>
<td>34</td>
<td>0.95</td>
<td>1.25</td>
</tr>
<tr>
<td>High (&lt; -10)</td>
<td>4</td>
<td>0.79</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Circulation. 1998;98:1622-1630

High Risk Features in Stress/Dobutamine Echo

- New or worsening wall motion abnormalities in multiple coronary territories
- Peak wall motion score index >1.7
- Drop in LVEF

Adverse Prognostic Features in Treadmill/Pharmacologic Nuclear Imaging

- Multiple reversible perfusion defects in 2 or more coronary territories
- Quantitatively large myocardial perfusion defects
- Transient ischemic dilation of the LV
- Lung uptake

Case Presentation

- Pharmacologic nuclear study ordered
  - His typical walking speed limited
  - HR independent study
  - Both issues raised concern a treadmill study would not be adequate
**Case Presentation**

- Pharmacologic nuclear study ordered
  - Previous revascularization
  - By appropriateness criteria published by the ACC/AHA, imaging study considered appropriate
  - As an aside, pharmacologic nuclear study is preferred in patients with LBBB or ventricular paced rhythm

**Coronary Artery Disease**

Richard J. Gumina, MD, PhD
Associate Professor, Cardiovascular Medicine
Director, Interventional Cardiovascular Research
The Ohio State University

**Case Presentation**

Pharmacologic nuclear study findings:
Large, moderate to severe reversible perfusion defect in the inferoapical, entire lateral/inferolateral and basal and mid anterior/anterolateral walls, concerning for ischemia.

No scintigraphic evidence of prior injury.

He was referred for left heart catheterization with coronary and graft angiography.

**Coronary Angiogram Video 1**
Revascularization Options

- Indications for PCI
- Indications for Coronary Artery Bypass Graft Surgery
- Hybrid Revascularization Trial

Coronary Angiogram Video 2

Coronary Angiogram Video 3

Revascularization Options

Appropriateness Criteria

ACCF/SCAI/STS/AATS/AHA/ASNC 2009 Appropriateness Criteria for Coronary Revascularization

A Report by the American College of Cardiology Foundation Appropriateness Criteria Task Force, Society for Cardiovascular Angiography and Interventions, Society of Thoracic Surgeons, American Association for Thoracic Surgery, American Heart Association, and the American Society of Nuclear Cardiology Endorsed by the American Society of Echocardiography, the Heart Failure Society of America, and the Society of Cardiovascular Computed Tomography

Manesh R. Patel, MD, Chair, Coronary Revascularization Writing Group, Gregory J. Dehmer, MD, FACC, FACP, FSCAI, FAHA, Coronary Revascularization Writing Group, John W. Hirshfeld, MD, Coronary Revascularization Writing Group, Peter K. Smith, MD, FACC, Coronary Revascularization Writing Group and John A. Spertus, MD, MPH, FACC, Coronary Revascularization

February 2009

180 clinical scenarios

Appropriateness of revascularization and appropriateness of PCI or CABG individually as the primary mode of revascularization

### Appropriateness Criteria: Low-Risk

- Low-risk treadmill score (≥ 5)
- Normal or small myocardial perfusion defect at rest or with stress
- Normal stress echocardiographic wall motion or no change of limited resting wall motion abnormalities during stress

### Appropriateness Criteria: Intermediate Risk

- Mild/moderate resting left ventricular dysfunction (LVEF 35-49%)
- Intermediate-risk treadmill score (-11 to +5)
- Stress-induced moderate perfusion defect without LV dilation or increased lung uptake (thallium-201)
- Limited stress echocardiographic ischemia with a wall motion abnormality only at higher doses of dobutamine involving ≤ 2 segments

### Appropriateness Criteria: High Risk

- Severe resting left ventricular dysfunction (LVEF < 35%)
- High-risk treadmill score (≤ or equal to 11)
- Severe exercise left ventricular dysfunction (exercise LVEF < 35%)
- Stress-induced multiple perfusion defect (particularly if anterior)
- Stress-induced multiple perfusion defects of moderate size

### Appropriateness Criteria: High Risk

- Large, fixed perfusion defect with LV dilation or increased lung uptake (thallium-201)
- Echocardiographic wall motion abnormality involving > 2 segments developing with low dose dobutamine or at low heart rate (< 120)
- Stress echocardiographic evidence of extensive ischemia
### Appropriate Ratings by Risk Findings on Noninvasive Imaging Study and Symptoms

**Symptoms**
- Asymptomatic to CCS Class IV

**Medical therapy**
- Minimal to maximal

**Coronary anatomy**
- Chronic total occlusion 1 vessel
- 1-2 Vessel without Proximal LAD
- 1 Vessel disease
- 2 Vessel Disease
- 3 Vessel Disease

### Method of Revascularization of Advanced Coronary Artery Disease

<table>
<thead>
<tr>
<th></th>
<th>2-vessel CAD with proximal LAD stenosis</th>
<th>3-vessel CAD</th>
<th>Isolated Left Main Disease</th>
<th>Left Main disease and additional CAD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CABG</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No diabetes</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Normal LVEF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>Depressed LVEF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PCI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No diabetes</td>
<td>A</td>
<td>U</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Normal LVEF</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>A</td>
<td>U</td>
<td>I</td>
<td>I</td>
</tr>
<tr>
<td>Depressed LVEF</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

CABG indicates coronary artery bypass grafting; LAD, left anterior descending artery; LVEF, left ventricular ejection fraction; and PCI, percutaneous coronary intervention.

Syntax Trial

**Original Article**

*Percutaneous Coronary Intervention versus Coronary-Artery Bypass Grafting for Severe Coronary Artery Disease*

Patrick W. Serruys, M.D., Ph.D., Marie-Claude Morice, M.D., A. Pieter Kappetein, M.D., Ph.D., Antonio Colombi, M.D., David R. Holmes, M.D., Michael J. Mack, M.D., Elisabeth Ståhle, M.D., Ted E. Feldman, M.D., Marcel van den Brand, M.D., Eric J. Bass, B.A., Nico Van Dyck, N.N., Katrin Leadley, M.D., Keith D. Dorkins, M.D., and Friedrich W. Mohr, M.D., Ph.D., for the SYNTAX Investigators


- **Goal**: To compare the safety and efficacy of CABG v. PCI with TAXUS DES in patients with 3 vessel disease or left main disease, who were eligible for either procedure.

- **Hypothesis**: DES-PCI would be non-inferior to CABG in the management of patients with 3VD and/or LM.

- **All patients in PCI arm received TAXUS DES.**

1800 pts randomised (897 CABG, 903 PCI)

Rates of Outcomes among the Study Patients, According to Treatment Group at 12 months

Rates of Major Adverse Cardiac or Cerebrovascular Events among the Study Patients, According to Treatment Group and SYNTAX Score Category.

“Redo” CABG Surgery - considerations

Reoperative coronary artery bypass procedures: risk factors for early mortality and late survival

J.T. Christenson*, M. Schmutziger, F. Simonet

The Cardiovascular Surgery Unit, Hôpital de la Tour, 1, av. J.-D. Maillard,
CH-1217 Meyrin-Geneva, Switzerland


## “Redo” CABG Surgery - considerations

Reoperative coronary artery bypass procedures: risk factors for early mortality and late survival

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### High SYNTAX scores

(233, indicating the most complex disease)

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>REDO CABG (n=594)</th>
<th>Primary CABG (n=3148)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergent operation</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>Urgent operation</td>
<td>0.008</td>
<td>1.86</td>
</tr>
<tr>
<td>CCS class 3 and 4</td>
<td>0.005</td>
<td>1.96</td>
</tr>
<tr>
<td>LVEF &lt;40%</td>
<td>0.011</td>
<td>1.62</td>
</tr>
<tr>
<td>Multifocal vascular disease</td>
<td>0.007</td>
<td>1.77</td>
</tr>
<tr>
<td>Preoperative renal insufficiency</td>
<td>0.002</td>
<td>1.56</td>
</tr>
<tr>
<td>IDDM</td>
<td>0.029</td>
<td>1.12</td>
</tr>
<tr>
<td>Age &gt;65 years</td>
<td>0.028</td>
<td>1.13</td>
</tr>
<tr>
<td>Interval from primary CABG &gt;1 year</td>
<td>0.012</td>
<td>1.81</td>
</tr>
</tbody>
</table>

Hybrid Approach

Simultaneous Hybrid Revascularization Versus Off-Pump Coronary Artery Bypass for Multivessel Coronary Artery Disease

Shengshou Hu, MD,* Qi Li, MD,* Peixian Gao, MD,* Hui Xiong, MD, Zhe Zheng, MD, Lihuan Li, MD, Bo Xu, MD, and Runlin Gao, MD

Departments of Surgery, Anesthesiology, and Cardiology, and Research Center for Cardiovascular Regenerative Medicine, Ministry of Health China, Cardiovascular Institute and Fuwai Hospital, Beijing, China

The Annals of Thoracic Surgery
Volume 91, Issue 2, February 2011, Pages 432-438

<table>
<thead>
<tr>
<th>Complication</th>
<th>Hybrid (n = 104)</th>
<th>OPCAB (n = 104)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACCE</td>
<td>1 (1.0%)</td>
<td>10 (9.6%)</td>
<td>0.03</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>1 (1.0%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>0</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Neurologic event</td>
<td>0</td>
<td>5 (4.8%)</td>
<td>0.07</td>
</tr>
<tr>
<td>Repeat revascularization</td>
<td>1 (1.0%)</td>
<td>3 (2.9%)</td>
<td>0.34</td>
</tr>
<tr>
<td>Readmitance</td>
<td>9 (8.7%)</td>
<td>26 (25.0%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Survival</td>
<td>104 (100%)</td>
<td>103 (98.0%)</td>
<td>0.50</td>
</tr>
</tbody>
</table>

AMACE = major adverse cardiac or cerebrovascular events; OPCAB = off-pump coronary artery bypass grafting.


Our Patient

- Underwent Redo-CABG
- Free RIMA to the left anterior descending artery

Coronary Artery Disease

John A. Larry, MD
Associate Professor, Clinical Internal Medicine
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The Ohio State University
Importance of Dual Antiplatelet Therapy Post Drug Eluting Stent Implantation

- AHA/ACC/SCAI/ACS/ADA Science Advisory 2007
- Because premature discontinuation of dual antiplatelet therapy greatly increases the risk of stent thrombosis, myocardial infarction, and death
- Dual antiplatelet therapy should be continued uninterrupted for one year post implantation of a drug eluting stent

Aspirin Evidence: Dose and Efficacy

Indirect comparisons of aspirin doses on vascular events in high-risk patients

<table>
<thead>
<tr>
<th>Aspirin Dose</th>
<th>No. of Trials (%)</th>
<th>Odds Ratio for Vascular Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-1500 mg</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>160-325 mg</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>75-150 mg</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>&lt;75 mg</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Any aspirin</td>
<td>65</td>
<td></td>
</tr>
</tbody>
</table>

Aspirin evidence: dose and efficacy (AHA/ACC/SCAI/ACS/ADA Science Advisory 2007)

Clopidogrel Evidence: Secondary Prevention

Clopidogrel in Unstable Angina to Prevent Recurrent Events (CURE) Trial

12,562 patients with a NSTE-ACS randomized to daily aspirin (75-325 mg) or clopidogrel (300 mg load, 75 mg thereafter) plus aspirin (75-325 mg) for 9 months

Dual antiplatelet therapy is more efficacious in NSTE-ACS

\[ P = 0.001 \]

β-blocker Evidence: Secondary Prevention

Summary of Secondary Prevention Trials of β-blocker Therapy

<table>
<thead>
<tr>
<th>Phase of Treatment</th>
<th>Total # of Patients</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute treatment</td>
<td>20,570</td>
<td>0.87 (0.77-0.98)</td>
</tr>
<tr>
<td>Secondary prevention</td>
<td>24,298</td>
<td>0.77 (0.70-0.84)</td>
</tr>
<tr>
<td>Overall</td>
<td>53,268</td>
<td>0.81 (0.75-0.87)</td>
</tr>
</tbody>
</table>

CI=Confidence Interval, RR=Relative risk

Blood Pressure Control

- Goal is less than 140/90 or
- Less than 130/80 in patients with diabetes or chronic kidney disease

- Initially, utilize B-blockers and ACE inhibitors and add additional therapy as needed
### Lipid management goals

- Current secondary prevention recommendations for lipid management recommend:
  - LDL goal < 100, reasonable target of 70 mg/dL
  - Non HDL < 30 points above the LDL target
  - There may be need to consider additional therapy beyond statin agents to achieve NCEP goals

(Circulation 2006;113;2363-2372)

### Vaccination

- Patient with CAD should receive appropriate vaccination for influenza

### OSUMC Comprehensive Lipid Management Clinic

- Patients that may benefit
  - Difficulty achieving NCEP lipid goals, intolerance to therapy, low HDL, elevated TG
- Appointments/Referrals
  - (614) 293-ROSS (7677)
  - Offices located at Ross ACC, OSU East, Gahanna and Stoneridge (Dublin)

### Smoking Cessation

- Ask about tobacco use status at every visit. I (B)
- Advise every tobacco user to quit. I (B)
- Assess the tobacco user’s willingness to quit. I (B)
- Assist by counseling and developing a plan for quitting. I (B)
- Arrange follow-up, referral to special programs, or pharmacotherapy I (B)
- Urge avoidance of exposure to environmental tobacco smoke at work and home. I (B)
Cardiac Rehab Programs

• Indications for Cardiac Rehab
  – Angina with documented evidence of myocardial ischemia within 6 mos.
  – MI within 12 months
  – PCI within 6 mos.
  – CABG within 6 mos.
  – Valve replacement/repair within 6 mos.
  – Heart transplant within 12 mos

• OSU Heart Center at Morehouse 293-6937
• OSU East 257-3974

Effects of Cardiac Rehabilitation

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Mean</th>
<th>95% conf. intervals</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mortality*</td>
<td>-20%</td>
<td>(-7 to -32%)</td>
<td>0.005</td>
</tr>
<tr>
<td>Cardiac Mortality*</td>
<td>-26%</td>
<td>(-10 to -29%)</td>
<td>0.002</td>
</tr>
<tr>
<td>Nonfatal MI</td>
<td>-21%</td>
<td>(-43 to 9%)</td>
<td>0.15</td>
</tr>
<tr>
<td>CABG</td>
<td>-13%</td>
<td>(-35 to 16%)</td>
<td>0.4</td>
</tr>
<tr>
<td>PCI</td>
<td>-19%</td>
<td>(-51 to 34%)</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note: Regarding total calories, balance energy intake and expenditure to maintain desirable body weight.

ATP III Dietary Recommendations

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommended Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated fat*</td>
<td>&lt;7% of total calories</td>
</tr>
<tr>
<td>Polyunsaturated fat</td>
<td>Up to 10% of total calories</td>
</tr>
<tr>
<td>Monounsaturated fat</td>
<td>Up to 20% of total calories</td>
</tr>
<tr>
<td>Total fat</td>
<td>25%–35% of total calories</td>
</tr>
<tr>
<td>Carbohydrate (esp. complex carbs)</td>
<td>50%–60% of total calories</td>
</tr>
<tr>
<td>Fiber</td>
<td>20–30 g/d</td>
</tr>
<tr>
<td>Protein</td>
<td>~15% of total calories</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>&lt;200 mg/d</td>
</tr>
</tbody>
</table>

*Trans fatty acids also raise LDL-C and should be kept at a low intake


Chest Pain Clinic

366-1279

ATP=Adult Treatment Panel
JAMA 2001;285:2486-97