

Coronary Artery Disease

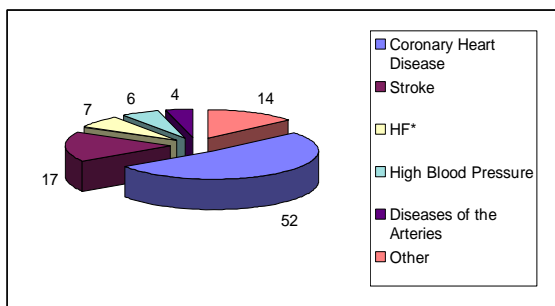
John A. Larry, MD

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

AHA Statistics



Percentage breakdown of deaths from cardiovascular diseases (United States:2004) * - Not a true underlying cause.
Source: NCHS and NHLBI.

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

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

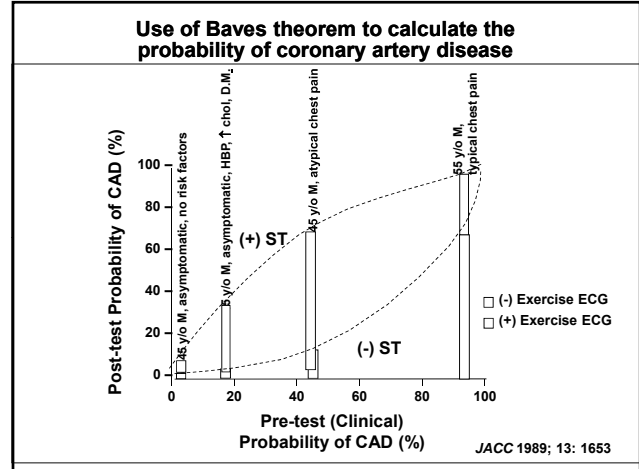
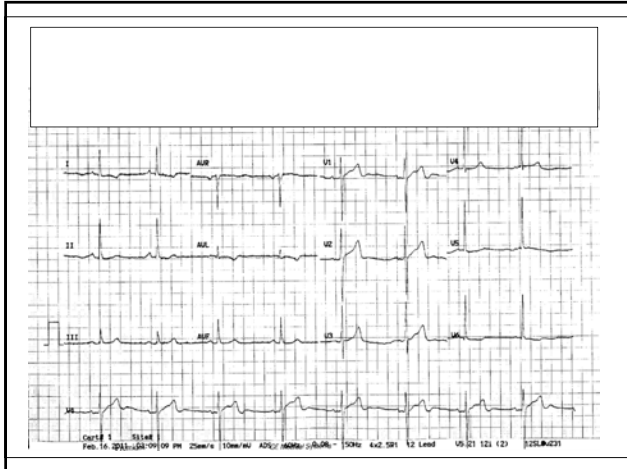
- Exam
 - Pulse 56, BP 138/60 right, 134/60 left, resp. rate 16
 - JVP is normal. No carotid bruits are present
 - Lungs are clear to auscultation and percussion
 - PMI is nondisplaced. S1 and S2 are normal. A grade 1 systolic ejection murmur is noted. No gallops or rubs present

Case Presentation

- Current medications include
 - ASA
 - Clopidogrel 75 mg daily
 - Metoprolol XL 25 mg daily
 - Isosorbide 120 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

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
- Duke Treadmill Score (Mark, et al Annals Int Med 1987)
 - ✓ 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

Survival According to Risk Groups Based on Duke Treadmill Scores

Risk Group (Score)	Percentage of Total	Four-Year Survival	Annual Mortality (Percent)
Low ($\geq +5$)	62	0.99	0.25
Moderate (-10 to $+4$)	34	0.95	1.25
High (< -10)	4	0.79	5.0

Circulation. 1998;98:1622-1630

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

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

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

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Case Presentation

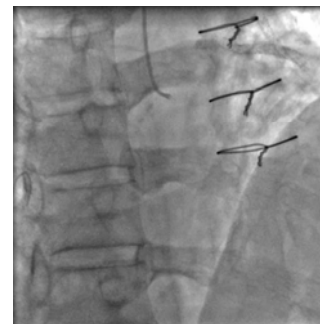
Pharmacologic nuclear study findings:

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



Coronary Angiogram Video 2



Revascularization Options

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

Coronary Angiogram Video 3



Revascularization Options Appropriateness Criteria

ACC/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

Patel, M. R. et al. J Am Coll Cardiol 2009;53:530-553

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: High Risk

- Severe resting left ventricular dysfunction (LVEF $< 35\%$)
- High-risk treadmill score (\leq 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: 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

- 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

Appropriateness 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

		2-vessel CAD with proximal LAD stenosis	3-vessel CAD	Isolated Left Main Disease	Left Main disease and additional CAD
CABG	No diabetes Normal LVEF	A	A	A	A
	Diabetes	A	A	Syntax	A
	Depressed LVEF	A	A	Syntax	A
PCI	No diabetes Normal LVEF	A	U	I	I
	Diabetes	A	U	I	I
	Depressed LVEF	A	U	I	I

CABG indicates coronary artery bypass grafting; LAD, left anterior descending artery; LVEF, left ventricular ejection fraction; and PCI, percutaneous coronary intervention
 Modified from Patel, M. R. et al. J Am Coll Cardiol 2009;53:530-553

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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 Colombo, M.D., David R. Holmes, M.D., Michael J. Mack, M.D., Elisabeth Stähle, M.D., Ted E. Feldman, M.D., Marcel van den Brand, M.D., Eric J. Bass, B.A., Nic Van Dyck, R.N., Katrin Leadley, M.D., Keith D. Dawkins, M.D., and Friedrich W. Mohr, M.D., Ph.D. for the SYNTAX Investigators

N Engl J Med 2009; 360:961-972. March 5, 2009

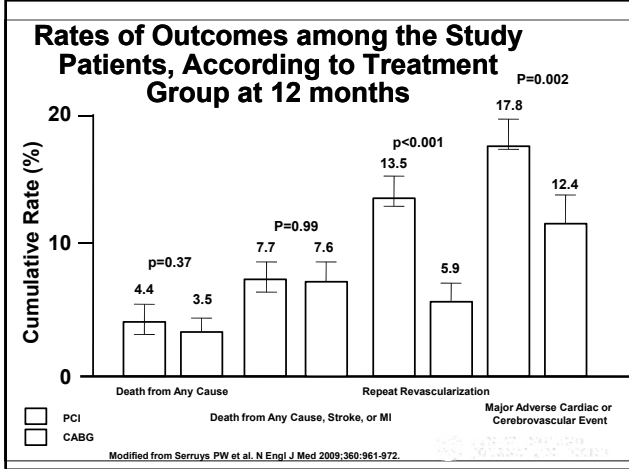
• **Goal:** To compare the safety and efficacy of CABG v. PCI with TAXUS DES in patients with 3 vessel disease or left main disease, who were eligible for either procedure.

• **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)

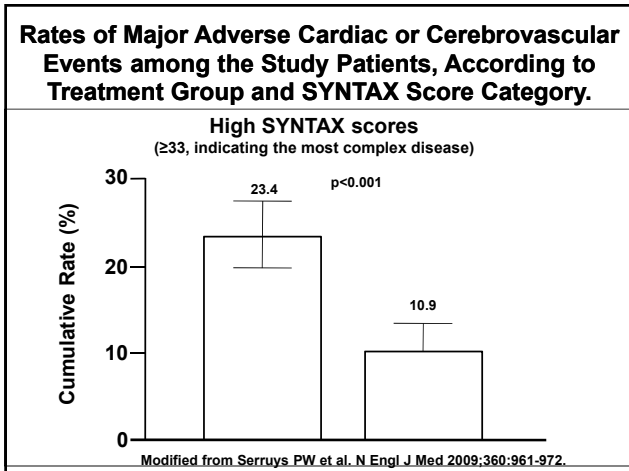
Serruys PW et al. N Engl J Med 2009;360:961-972.



“Redo” CABG Surgery - considerations

Reoperative coronary artery bypass procedures: risk factors for early mortality and late survival
 J.T. Christenson*, M. Schmuziger, F. Simonet
The Cardiovascular Surgery Unit, Ho'pital de la Tour, 1. a6. J.-D. Maillard, CH-1217 Meyrin-Geneva, Switzerland
 European Journal of Cardio-thoracic Surgery 11 (1997) 129–133

REDO CABG (n=594)	Primary CABG (n=3148)
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“Redo” CABG Surgery - considerations

Independent risk factors for mortality. Multivariate logistic regression analysis

Risk Factor	REDO CABG (n=594)		Primary CABG (n=3148)	
	P	Odds	P	Odds
Emergent operation	<0.001	2.12	0.001	1.92
Urgent operation	0.008	1.86	----	----
CCS class 3 and 4	0.005	1.96	0.006	1.67
LVEF <40%	0.011	1.62	0.022	1.28
Multifocal vascular disease	0.007	1.77	0.014	1.73
Preoperative renal insufficiency	0.012	1.48	----	----
IDDM	0.029	1.12	----	----
Age >65 years	0.028	1.13	0.011	1.08
Interval from primary CABG >1 year	0.012	1.81		

Modified from: European Journal of Cardio-thoracic Surgery 11 (1997) 129–133

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 of China, Cardiovascular Institute and Fuwai Hospital, Beijing, China

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

Our Patient

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

Hybrid Approach

Complication	Hybrid (n = 104) No. (%)	OPCAB (n = 104) No. (%)	p Value
MACCE	1 (1.0%)	10 (9.6%)	0.03
Death	0	1 (1.0%)	0.50
Myocardial infarction	0	0	1.00
Neurologic event	0	5 (4.8%)	0.07
Repeat revascularization	1 (1.0%)	3 (2.9%)	0.34
Readmittance	9 (8.7%)	26 (25.0%)	0.001
Survival	104 (100%)	103 (99.0%)	0.50

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

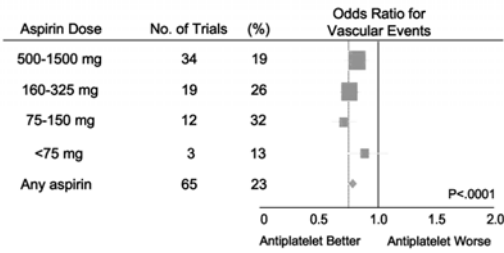
Modified from: The Annals of Thoracic Surgery Volume 91, Issue 2, February 2011, Pages 432-438

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Aspirin Evidence: Dose and Efficacy

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



Antithrombotic Trialist Collaboration. *BMJ* 2002;324:71-86

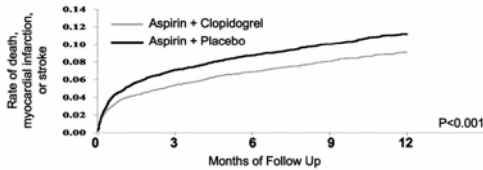
Importance of Dual Antiplatelet Therapy Post Drug Eluting Stent Implantation

- 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

Clopidogrel Evidence: Secondary Prevention

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

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

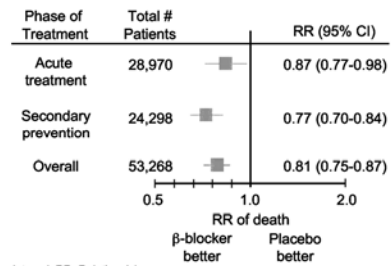


Dual antiplatelet therapy is more efficacious in NSTEMI-ACS

NSTEMI-ACS=Non ST-segment elevation acute coronary syndrome
The CURE Trial Investigators. *NEJM* 2001;345:494-502

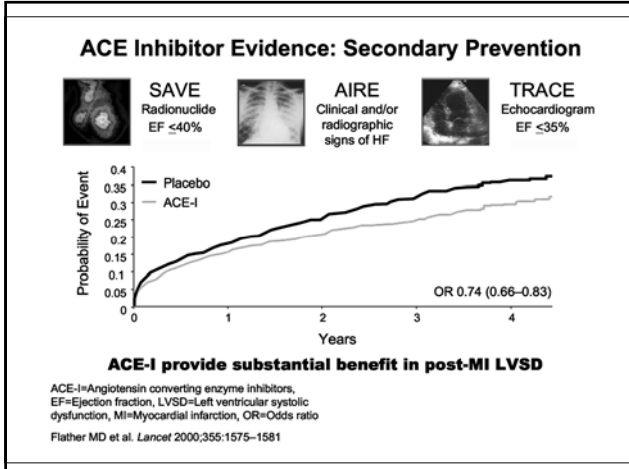
β-blocker Evidence: Secondary Prevention

Summary of Secondary Prevention Trials of β-blocker Therapy

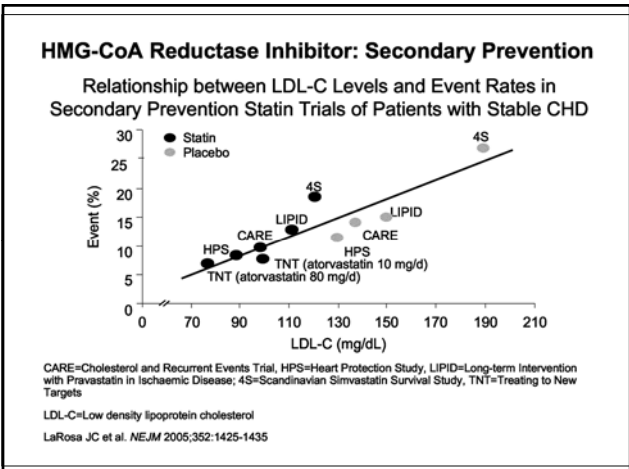
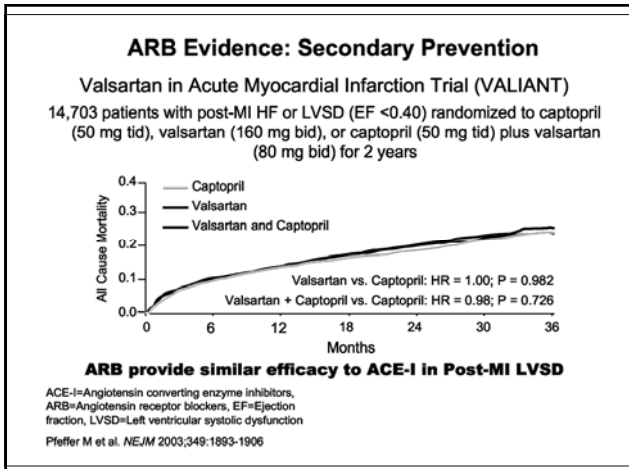


CI=Confidence interval, RR=Relative risk

Antman E, Braunwald E. Acute Myocardial Infarction. In: Braunwald E, Zipes DP, Libby P, eds. Heart Disease: A textbook of Cardiovascular Medicine, 6th ed., Philadelphia, PA: W.B. Saunders, 2001, 1168.



- ## 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

ATP III Dietary Recommendations

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

*Trans fatty acids also raise LDL-C and should be kept at a low intake
 Note: Regarding total calories, balance energy intake and expenditure to maintain

desirable body weight.
 ATP=Adult Treatment Panel

Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults.
 JAMA 2001;285:2486-97

Effects of Cardiac Rehabilitation

Outcome	Mean	95% conf. intervals	p-value
• Total Mortality*	-20%	(-7 to -32%)	p=.005
• Cardiac Mortality*	-26%	(-10 to -29%)	p=.002
• Nonfatal MI	-21%	(-43 to 9%)	p=.15
• CABG	-13%	(-35 to 16%)	p=.4
• PCI	-19%	(-51 to 34%)	p=.4

Taylor, et al Am J of Medicine 2004; 116:682-97

Chest Pain Clinic

366-1279

The Ohio State University Medical Center and Richard M. Ross Heart Hospital
 Rapid Response Chest Pain Clinic
 PHYSICIAN REFERRAL REFERENCE SHEET

Ohio State's Richard M. Ross Heart Hospital
 Rapid Response Chest Pain Clinic

To refer a patient, call (614) 366-1279 with the patient's name and date of birth.

Ohio State's Richard M. Ross Heart Hospital created the Rapid Response Chest Pain Clinic to provide prompt care to patients experiencing chest pain or other serious ischemic symptoms and stabilize immediate emergency department assessment.

Referral Guidelines

Located in the Ambulatory Care Center (ACC) at the Ross Heart Hospital, the clinic provides consultative assessment for higher-risk patients with:

- Chest pain or possible acute coronary syndrome
- Non-steady anginal or angina equivalent
- Known coronary disease with change in symptoms

Ohio State's Interventional Cardiologists

Charles Buhl, MD	Ernest MacLennan, MD
Quinn Casper, MD	Vincent Pompili, MD
Richard Gurmisa, MD, PhD	Thomas Ryan, MD
Raymond Magorien, MD	Kamranfaris Chen, MD

To help expedite referrals, after calling the Chest Pain Clinic, please fax referral to (614) 293-7285.

The Ohio State University Medical Center