Secondary Prevention of CAD: What Works?

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Disclosures
• None

Overview
• 3 things to know
• 1 thing to do
• Questions
Case Discussion: Patient D.E.

- 65 yo male
- HTN, Smoker, High Stress Job
- Golfing in Denver
- Mid-epigastric pain
- Subsides
- Recurs at midnight
- ECG 24 hours after symptom onset: Anterior MI

- Admitted to hospital
- Thrombolysis, PCI not available
- Anticoagulation Rx
- 6 weeks bedrest, then limited physical activity
- Retire

Case Discussion: Patient D.E.

- A Second Opinion.....

Case Discussion: Patient D.E.

- Novel care
  - Early ambulation
  - Stopped smoking
  - Returned to physical activity, golfing five months post-MI

- November 1956
  - Won re-election

- Died in 1969 (79 yo)
  - 1955-69, suffered at least 7 MI's, 14 arrests
  - (pheochromocytoma at autopsy)

- 1955-69, suffered at least 7 MI's, 14 arrests
  - (pheochromocytoma at autopsy)
Post-Event Care circa 1950

- Heart disease was an acute disease
- Treatments were limited
  - “There is no specific treatment for coronary disease per se…”
- Treatments that were tried
  - Iodides, Theobromine, Aminophyllin
  - Nitrites, Digitalis, Diuretics
  - Oxygen, Morphine
  - Paravertebral alcohol injections
  - Thyroidectomy for angina
- Rest – up to 6 months

Heart Disease, P.D. White, 1947, P. 499-502

Cardiovascular Disease (CVD) Mortality Rates: 1900-2000


Walk more,
Eat less,
Sleep more.

--Paul Dudley White
Case Presentation 2013

• 58 year old woman
• One month history of atypical chest pain
• Multiple CVD risk factors
  • HTN on ACE inhibitor therapy
  • Hyperlipidemia, no treatment
  • Smoker, 1 ppd x 40 years
  • Central obesity
  • Impaired fasting glucose
  • Family history: (Father, MI, 53, smoker)

Case Presentation 2013

• High risk findings on ETT (low ex capacity, BP drop, angina, NSVT)
• Angiogram: 3 vessel disease
• CABG (LIMA-LAD, SVG-RCA, Cx)
• BP 146/94
• TC 264, TG 135, HDL 45, LDL 192
• Glucose 145, Hgb A1C 7.9%
What Now?

Secondary Prevention

Secondary Prevention
Treatments that prevent having this view again!
3 Things to Know

1. CAD is not going away anytime soon

CAD

- 7% of adults have significant CAD
- 1.26 million new cases of CHD per year
- 935,000 new MI per year
- 801,000 survive MI per year
- 500,000 with stable angina per year
- 750,000 receiving SS disability for CVD
- CAD care accounts for $300 billion per year
**Patients Discharged with CVD**

![Graph showing patients discharged with CVD over time](image)

*Circulation 2012;125:e2-e220*

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**Trends in Age-adjusted Prevalence of Low Risk Factor Burden for Cardiovascular Disease**

*US Adults 25 to 74 years of age (NHANES)*

**A. Total and gender**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
<th>Men</th>
<th>Women</th>
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<td>11.0%</td>
<td>11.5%</td>
<td>10.5%</td>
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<tr>
<td>1996-1998</td>
<td>12.1%</td>
<td>12.3%</td>
<td>11.9%</td>
</tr>
<tr>
<td>2000-2004</td>
<td>14.0%</td>
<td>14.2%</td>
<td>13.8%</td>
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<tr>
<td>2005-2008</td>
<td>15.0%</td>
<td>15.2%</td>
<td>14.8%</td>
</tr>
</tbody>
</table>

*Low risk = non-smoker, TC<240 & no Rx, BP<140/90 & no Rx, no diabetes*

Ford, E. S. et al. Circulation 2009;120:1181-1188

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**Cartoon depicting comparison between 1990 and 2016**

*1990 vs. 2016*

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% Meeting At Least 5/7 Criteria For Ideal CV Health

Prevalence of CVD in USA

A New Wave of CHD?

CHD Rates at Autopsy for Non-Cardiac Deaths
Olmsted County, Minnesota, 1981-2004

1. CAD is not going away anytime soon

2. CAD is treatable, and even reversible

Atherosclerosis

- 70-80% of coronary artery disease risk is related to lifestyle
- Lifestyle and medication therapy can slow or even reverse atheroma and thrombosis risk
Cardiovascular Disease (CVD) Mortality Rates: 1900-2000

Deaths/100,000 population


Secondary Prevention of CAD
What Works?

ABC's of Effective CHD Prevention Therapies

A Antplatelet Rx, ACE/ARB, Aldo Blocker
B Beta blocker, blood pressure, body fat
C Cholesterol control, cardiac rehabilitation
D Dietary therapy, diabetes Rx, depression Rx
E Exercise therapy, end smoking
F Follow-up, Flu shot
First a test...

Question: Nutrition

- Which of the following has been shown in randomized, controlled trials to lower mortality rates in patients with CAD?
  A. Very low fat diet
  B. Mediterranean diet
  C. High protein diet
  D. All of the above
  E. None of the above

Lyon Heart Study

- 423 patients randomized post-MI 1988-92
- Mediterranean diet vs "prudent diet" prescribed by patients' physicians
- Planned 5-year follow-up
- Study terminated early (4 years) due to favorable interim analysis

de Lorgeril et al, Circ 1999;99:779-785
Mediterranean Diet
- Low in saturated and polyunsaturated fats
- Low in cholesterol
- High in monounsaturated fats (olive oil)
- Moderately high in fiber
- Fish primary protein source
- Low in beef and pork
- Lots of fresh fruits and vegetables, pasta

Lyon Heart Study
- Primary endpoints
  - cardiac death, non-fatal MI
- Secondary endpoints
  - peri-procedural MI, unstable angina, CHF, stroke, pulmonary or peripheral embolism
- Tertiary endpoints
  - stable angina, elective revascularization, post-PTCA restenosis, thrombophlebitis

d'orgeril et al, Circ 1999;99:779-785
Mediterranean Diet and Survival

Cumulative survival without nonfatal cancer and nonfatal recurrent acute myocardial infarction


Lyon Heart Study

• Conclusions
  • 70% improvement in event free survival
  • No differences in traditional risk factors
• Unanswered questions
  • Cause of benefits?
  • Would effects have been seen with concomitant aggressive medical therapy for lipids?

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  E. None of the above
Question: Exercise Training

- Randomized, controlled trials of which of the following treatments have been shown to reduce mortality in CAD patients?
  A. Exercise Training
  B. Smoking Cessation
  C. Both A and B
  D. None of the above

Exercise is Strong Medicine

Change in hsCRP in PCI and Exercise Training Groups

- 101 Men, Germany
- Stable CAD
- Randomized to
  - Percutaneous Coronary Intervention
  - Exercise Therapy
    - 70% maximum HR
    - 20 min/day plus one 60 min session/wk
- 24 month follow-up
- Outcomes
  - Inflammatory markers
  - Recurrent CAD events

Exercise is Strong Medicine

24 month event-free survival: PCI and Ex Training Groups

Smoking Cessation and Secondary CAD Prevention

- At time of CVD event
  - 40% are current smokers at time of CV event
  - 50% quit smoking after event
  - 20% continue to smoke, have 60% increase in mortality
- Among those who quit
  - 36% reduction in total mortality
  - 32% reduction in recurrent CV events

Am J Cardiol. 2011 Jan 15;107(2):145-50
Eur Heart J. 2006 Jan;27(1):35-41
Circulation. 2012;125:e2-e220

Question: Exercise Training

- Randomized, controlled trials of which of the following treatments have been shown to reduce mortality in CAD patients?
  A. Exercise Training
  B. Smoking Cessation
  C. Both A and B
  D. None of the above

Question: Preventive Medications

- Randomized, controlled trials of which of the following treatments have been shown to reduce morbidity and mortality in CAD patients?
  A. Aspirin
  B. Statin therapy
  C. Fish oil
  D. B and C
  E. A and B
Aspirin and Secondary CAD Prevention

- Meta-analysis of secondary prevention trials
- 20% reduction in cardiac events
- Non-significant increase in hemorrhagic stroke


4S Study

Lancet 344, 1994

Fish Oil and Secondary CAD Prevention

- Meta-analysis of randomized trials
- No significant impact on total mortality, CVD events, heart failure, TIA/stroke
- No difference by dosage

Arch Intern Med. 2012 May 14;172(9):686-94
Question: Preventive Medications

• Randomized, controlled trials of which of the following treatments have been shown to reduce morbidity and mortality in CAD patients?

A. Aspirin
B. Statin therapy
C. Fish oil
D. B and C
E. A and B

Question: The ABC’s of Prevention

• Which of the following is an AHA/ACCF class IA recommendation for secondary CAD prevention?

A. Statin therapy
B. Cardiac rehabilitation
C. Weight loss, in patients with obesity
D. A and B
E. A and C

Secondary CAD Prevention
Class IA Recommendations

• Smoking Cessation
• Anti-Hypertensive Therapy
• Lipid Lowering Therapy with TLC + Statin
• Antiplatelet Therapy
• ACE/ARB Therapy with EF ≤40%
• Beta-blocker Therapy post-MI or with EF ≤40%
• Aldosterone Blocker post-MI with EF ≤40%*
• Cardiac Rehabilitation
Secondary CAD Prevention
Class IB Recommendations

- Physical Activity
- Exercise testing for risk assessment
- Weight management
- Diabetes: TLC, BP and lipid control
- Influenza vaccine yearly

ABC's of Effective CHD Prevention Therapies

A  Antiplatelet Rx, ACE/ARB, Aldo Blocker
B  Beta blocker, blood pressure, body fat
C  Cholesterol control, cardiac rehabilitation
D  Dietary therapy, diabetes Rx, depression Rx
E  Exercise therapy, end smoking
F  Follow-up, Flu shot

Secondary Prevention of CAD
What About PCI?
**COURAGE Trial**

![Diagram showing the comparison between PCI and Optimal Medical Therapy (OMT)]

- Hazard ratio: 1.05
- 95% CI (0.87-1.27)
- P = 0.62


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**PCI vs Optimal Medical Therapy**

**Impact on Spontaneous Nonprocedural MI**

![Table showing the comparison between PCI and Optimal Medical Therapy for spontaneous nonprocedural MI]

- Hazard ratio: 1.05
- 95% CI (0.87-1.27)
- P = 0.62


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**PCI vs Optimal Medical Therapy**

**Impact on Procedural MI**

![Table showing the comparison between PCI and Optimal Medical Therapy for procedural MI]

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- 95% CI (0.87-1.27)
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Question: The ABC’s of Prevention

- Which of the following is an AHA/ACCF class IA recommendation for secondary CAD prevention?
  
  A. Statin therapy  
  B. Cardiac rehabilitation  
  C. Weight loss, in patients with obesity  
  D. A and B  
  E. A and C

3. Effective CAD treatments are underutilized
Underuse of Secondary Prevention Treatments

- Suboptimal prescription of treatments
- Low adherence to prescribed treatments

Suboptimal Prescription of Preventive Therapies

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Denominator</th>
<th>Numerator</th>
<th>Compliance Rate</th>
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</thead>
<tbody>
<tr>
<td>Beta blocker therapy after myocardial infarction</td>
<td>Patients</td>
<td>4,792</td>
<td>4,792</td>
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<tr>
<td>Blood pressure measurement</td>
<td>Lost in follow-up</td>
<td>7,086</td>
<td>7,086</td>
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<td>Aspirin therapy</td>
<td>Patients</td>
<td>4,742</td>
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<tr>
<td>Screening for diabetes mellitus</td>
<td>Patients</td>
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<tr>
<td>Smoking status</td>
<td>Patients</td>
<td>8,132</td>
<td>8,132</td>
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<tr>
<td>Smoking cessation</td>
<td>Patients</td>
<td>569</td>
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<td>Non烟-activity assessment</td>
<td>Patients</td>
<td>9,132</td>
<td>9,132</td>
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<tr>
<td>ACE or ARB therapy</td>
<td>Patients</td>
<td>4,623</td>
<td>4,623</td>
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<td>Arterial blood pressure assessment</td>
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<td>Drug therapy for treating LDL cholesterol</td>
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<tr>
<td>Cardiac rehabilitation referral</td>
<td>Patients</td>
<td>5,139</td>
<td>5,139</td>
</tr>
</tbody>
</table>

Low Adherence To Secondary Prevention Medications

- Olmsted County residents, 1997-2006
- 292 post-MI patients
- Adherence to Statins, BB, ACE
- Pharmacy data
- 3-year continuation rates
Low Adherence To Secondary Prevention Medications

Predictors of adherence
• Cardiac rehabilitation participation
  • Statin: 34% less likely to be discontinued
  • BB: 30% less likely to be discontinued

1 Thing to Do
1. Optimize CAD secondary prevention with systematic care

Perfect Care

What if all effective CHD therapies were applied?

Primordial and Primary Prevention

↓ 33%

Secondary Prevention

↓ 23%

Continuum of CAD Care

Put Prevention Into Your Practice
- Make Prevention a Priority
- Systematic Approach
- Data collection and feedback
- Adaptive system

Cardiac rehabilitation is a systematic, cost-effective approach to secondary prevention
Why Cardiac Rehabilitation?

- Cardiac Rehabilitation is Multidimensional
  - Education
  - Exercise training
  - Nutrition counseling/therapy
  - Psychosocial health
  - Other medical conditions
  - Monitor progress, problems
  - Coordination of heart-related care

Phases of Cardiac Rehabilitation

- In-patient
  - Start treatments, refer to out-patient program
- Early Out-patient
  - Entry: 1-4 weeks after event
  - 36 monitored sessions, 2-3 per week
- Late Out-patient:
  - Long-term follow-up
Covered Indications for Cardiac Rehabilitation

- MI
- PCI
- CABG
- Heart valve repair/replacement
- Heart transplantation
- Chronic stable angina

Cardiac Rehabilitation
Mechanisms of Benefits

- Beneficial effects of exercise
- Beneficial effects of healthy dietary habits
- Control of cholesterol, blood pressure, smoking
- Assess, treat co-morbid conditions
- Psychosocial support
- Identify, treat symptoms
- Sticking with medications

Benefits of Cardiac Rehabilitation

- Improvements
  - Total mortality
  - CVD events
  - Re-hospitalization
  - Risk factor control
  - Quality of life
  - Functional status
- Recent studies similar to older ones
- Primarily in non-Hispanic men

Cardiac Rehabilitation after MI

- 1812 heart attack patients
- 1982-1998
- Average age: 67 years
- 765 (42%) women
- 55% in cardiac rehabilitation
  - 38% of women
  - 67% of men

P<0.001

Cardiac Rehabilitation after Intracoronary Stent Therapy

- Patients undergoing stent placement
- 1994-2008
- Cardiac rehabilitation or not
- 5-year death rates 45% lower for CR participants
- Benefits began in first year and persisted


CR and All Cause Mortality Medicare Data

- Observed (Crude) Rates
- Regression Modeling
- Instrumental Variables

JACC 2009;54:25-33
CR and All Cause Mortality
Medicare Data

All-cause 5-year cumulative mortality rates for matched pairs of CR users and nonusers by demographic characteristics

<table>
<thead>
<tr>
<th>Participant groups</th>
<th>Matched pairs (no.)</th>
<th>CR users (%)</th>
<th>Nonusers (%)</th>
<th>Difference* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All matched pairs</td>
<td>70,040</td>
<td>16.3</td>
<td>24.6</td>
<td>8.3</td>
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<tr>
<td>By sex and age group</td>
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<tr>
<td>Men</td>
<td>52,020</td>
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<td>Age 65-74 yr</td>
<td>14,010</td>
<td>16.4</td>
<td>24.5</td>
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<tr>
<td>Age 75-84 yr</td>
<td>9,010</td>
<td>14.8</td>
<td>24.8</td>
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<td>Age &gt;85 yr</td>
<td>11,010</td>
<td>25.7</td>
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<tr>
<td>Women</td>
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<td>Age 65-74 yr</td>
<td>5,008</td>
<td>12.6</td>
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<tr>
<td>Age 75-84 yr</td>
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<td>18.0</td>
<td>28.0</td>
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<tr>
<td>Age &gt;85 yr</td>
<td>8,010</td>
<td>30.8</td>
<td>40.8</td>
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<td>By race</td>
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<td>White</td>
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<tr>
<td>Nonwhite</td>
<td>7,430</td>
<td>18.1</td>
<td>28.1</td>
<td>9.9</td>
</tr>
</tbody>
</table>

* Estimated mortality rate differences between nonusers and cardiac rehabilitation (CR) users were all significantly different than 0 at P<0.001

JACC 2009;54:25-33

CR and All Cause Mortality
Medicare Data

All-cause 5-year cumulative mortality rates for matched pairs of CR users and nonusers by clinical groups

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<th>Difference* (%)</th>
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<tr>
<td>All matched pairs</td>
<td>70,040</td>
<td>16.3</td>
<td>24.6</td>
<td>8.3</td>
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<td>By presence of AMI diagnosis</td>
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<td>AMI</td>
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<td>By type of treatment</td>
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<td>6.1</td>
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<td>No</td>
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<td>Yes</td>
<td>13,860</td>
<td>30.9</td>
<td>46.6</td>
<td>15.7</td>
</tr>
</tbody>
</table>

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JACC 2009;54:25-33

Cardiac Rehabilitation: Dose Response

- 1 to 11 sessions
- 12 to 23 sessions
- 24 to 35 sessions
- >35 sessions
- 30,161 Medicare pts
- Attended CR
- MI
- Stable Angina
- CABG
- With or without HF

Hammill, B. G. et al. Circulation 2010;121:63-70
Cardiac Rehabilitation
Cost Effectiveness

• $4950 per year of life saved (1995 dollars)
• More cost-effective than other post-MI treatments
  • Thrombolytic therapy
  • CABG surgery
  • Cholesterol-lowering medications
  • (Less cost-effective than smoking cessation therapy)


Cardiac Rehabilitation
Performance Measures

• Jointly developed, published (AACVPR/ACC/AHA)
• Endorsed by National Quality Forum
• Included in other performance measure sets
  • STEMI, NSTEMI, PCI
• Included in ACC/AHA databases
  • Inpatient, Outpatient
• CMS
  • Included in PQRS (CMS incentive program)
  • To be audited by CMS starting in 2014 (outpt)

Summary

• 3 things to know
  • CAD is not going away anytime soon
  • CAD can be slowed, even reversed
  • Secondary treatments are underused

• 1 thing to do
  • Provide systematic secondary CAD prevention—Cardiac rehabilitation is a great example

Case Presentation: Poor Ending

Acute Care → Recurrent Event

Misses Follow-up
Stops Medications
Keeps Smoking

Discharged on New Treatments

Case Presentation: Good Ending

Optimal Secondary Prevention → Acute Care

Cardiac Rehab
Excellent Follow-up
On Treatments
Quits Smoking

Discharged on New Treatments
“...The “last frontier of cardiovascular health” is the translation and application of our knowledge to improve the cardiovascular health of all people.”

-Claude Lenfant

Questions?