C A R D I A C  R E H A B I L I T A T I O N

A N A  B A R A C  M D ,  P H D

OBJECTIVES

• Rationale for cardiac rehabilitation
• Benefits of exercise
• Safety of exercise
• Components of cardiac rehabilitation
• Utilization of cardiac rehabilitation
• Guidelines
CASE

- 47 year-old male, executive, previously healthy and on no medications
- Developed substernal chest pressure after completing a 5K race in Washington DC
- Paramedics placed him on the monitor initially with no acute changes
- Symptoms returned
- Patient taken emergently to the catheterization lab
CASE
HISTORY

History of physical activity after an AMI:

• 1930s: bedrest for 6 weeks
• 1940s: chair therapy
• 1950s: walking 4 weeks after the event
• 1960s: concept of exercise benefit and modern Cardiac rehabilitation
CORONARY ARTERY DISEASE

Every year

- ~785,000 patients with an acute myocardial infarction in United States
- ~470,000 will have a recurrent attack

Within 5 years after the initial event, recurrent MI or cardiac events

- 15% men/ 22% women (45-64 years of age)
- 22% men & women (>65 years of age)
“GIVEN THIS HIGH RECURRENCE RATE, PREVENTING SECONDARY CARDIAC EVENTS IS AN ESSENTIAL PART OF THE CARE FOR PATIENTS WITH CARDIOVASCULAR DISEASE”

A Presidential Advisory from the American Heart Association

Referral, Enrollment, and Delivery of Cardiac Rehabilitation/Secondary Prevention Programs at Clinical Centers and Beyond. Balady G. et al. Circulation, 2011
EFFECT OF EXERCISE-BASED CARDIAC REHABILITATION

Meta-analysis: 48 randomized trials

- 8940 patients, 20% women, patients >65ys of age

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Mean Difference, %</th>
<th>95% Confidence Limit</th>
<th>Statistical Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mortality</td>
<td>−20</td>
<td>−7% to −32%</td>
<td>(P=0.005)</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>−26</td>
<td>−10% to −29%</td>
<td>(P=0.002)</td>
</tr>
<tr>
<td>Nonfatal MI</td>
<td>−21</td>
<td>−43% to 9%</td>
<td>(P=0.150)</td>
</tr>
<tr>
<td>CABG</td>
<td>−13</td>
<td>−35% to 16%</td>
<td>(P=0.400)</td>
</tr>
<tr>
<td>PTCA</td>
<td>−19</td>
<td>−51% to 34%</td>
<td>(P=0.400)</td>
</tr>
</tbody>
</table>

Taylor et al. Circulation 2006
601,099 Medicare enrollees, 65 years of older

- Hospitalized with CAD or coronary revascularization in 1997
- Survived 30 days after discharge
- Followed for 5 years
- Sessions of cardiac rehabilitation within 1 year of discharge
- Analysis: non-users, low-users (1-24 sessions), > 25 sessions

Suaya JA et al. Cardiac Rehabilitation and Survival in Older Coronary Patients. JACC 2009: 54.
CARDIAC MORTALITY BASED ON CARDIAC REHABILITATION USE

CR Users vs Non-CR Users

Suaya JA et al. Cardiac Rehabilitation and Survival in Older Coronary Patients. JACC 2009: 54.
CARDIAC MORTALITY BASED ON THE AMOUNT OF CR USE

CR high-users vs CR low-Users

Suaya JA et al. Cardiac Rehabilitation and Survival in Older Coronary Patients. JACC 2009: 54.
5-YR MORTALITY FOR MATCHED PAIRS OF CR USERS AND NONUSERS

Suaya JA et al. Cardiac Rehabilitation and Survival in Older Coronary Patients. JACC 2009: 54.

<table>
<thead>
<tr>
<th>Participant Groups</th>
<th>Number of Matched Pairs</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>
</tr>
<tr>
<td>By sex and age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>44,550</td>
<td>18.1%</td>
<td>25.2%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Age 65–74 yrs</td>
<td>30,003</td>
<td>14.2%</td>
<td>19.9%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Age 75–84 yrs</td>
<td>13,790</td>
<td>24.9%</td>
<td>34.7%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Age ≥85 yrs</td>
<td>757</td>
<td>47.3%</td>
<td>61.8%</td>
<td>14.5%</td>
</tr>
<tr>
<td>Women</td>
<td>25,490</td>
<td>14.2%</td>
<td>24.5%</td>
<td>10.4%</td>
</tr>
<tr>
<td>Age 65–74 yrs</td>
<td>15,678</td>
<td>11.5%</td>
<td>19.7%</td>
<td>8.2%</td>
</tr>
<tr>
<td>Age 75–84 yrs</td>
<td>9,135</td>
<td>17.2%</td>
<td>30.7%</td>
<td>13.4%</td>
</tr>
<tr>
<td>Age ≥85 yrs</td>
<td>677</td>
<td>34.4%</td>
<td>53.9%</td>
<td>19.5%</td>
</tr>
</tbody>
</table>
CARDIAC REHABILITATION AND CUMULATIVE RISK OF DEATH

30,161 Medicare patients
Followed for 4 years
Median age 74

Hammil BG. Circulation 2010: 121;63
CARDIAC REHABILITATION AND CUMULATIVE RISK OF MI

30,161 Medicare patients
Followed for 4 years
Median age 74

Hammil BG. Circulation 2010: 121;63
CARDIAC REHABILITATION AFTER CORONARY INTERVENTION (PCI)

2395 consecutive patients who underwent PCI

- Olmsted County registry, 1994-2008
- 40% of patients participated in cardiac rehabilitation
- Median number of CR sessions: 13
- Participation in cardiac rehabilitation was associated with ~45% decrease in all cause mortality

Goel K et al. Impact of cardiac rehabilitation on mortality and cardiovascular events after percutaneous coronary intervention in the community. Circulation 2011
CARDIAC REHABILITATION AFTER CORONARY INTERVENTION (PCI)

Goel K et al. Circulation 2011
Table 4. Association of Cardiac Rehabilitation Participation With Primary and Secondary Outcomes With 3 Types of Statistical Analysis

<table>
<thead>
<tr>
<th></th>
<th>Matched-Groups Analysis*</th>
<th>Propensity Score Stratification Analysis†</th>
<th>Landmark Analysis‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>P</td>
<td>HR (95% CI)</td>
</tr>
<tr>
<td>All-cause mortality</td>
<td>0.54 (0.41–0.71)</td>
<td>&lt;0.001</td>
<td>0.53 (0.42–0.67)</td>
</tr>
<tr>
<td>Cardiac mortality</td>
<td>0.89 (0.44–1.07)</td>
<td>0.095</td>
<td>0.61 (0.41–0.91)</td>
</tr>
<tr>
<td>Death/any MI</td>
<td>0.73 (0.59–0.90)</td>
<td>0.003</td>
<td>0.73 (0.61–0.88)</td>
</tr>
<tr>
<td>MI</td>
<td>1.11 (0.84–1.45)</td>
<td>0.47</td>
<td>1.07 (0.85–1.36)</td>
</tr>
<tr>
<td>Repeat PCI/CABG</td>
<td>1.16 (0.96–1.39)</td>
<td>0.13</td>
<td>1.06 (0.90–1.25)</td>
</tr>
<tr>
<td>Death/MI/PCI/CABG</td>
<td>0.92 (0.78–1.07)</td>
<td>0.28</td>
<td>0.85 (0.74–0.98)</td>
</tr>
</tbody>
</table>

Goel K et al. Circulation 2011
PHASES OF CARDIAC REHABILITATION

Phase I
• Inpatient service

Phase II
• Shortly after discharge from hospital and cleared by cardiologist/cardiothoracic surgeon
• 36 sessions - generally within the first 3-6 months after the event yet up to 1 year after the event

Phase III
• Wellness
• After completion of a Phase II program
CARDIAC EVENTS QUALIFYING FOR CARDIAC REHABILITATION

• Acute myocardial infarction (AMI)
• Coronary intervention (PCI)
• Coronary artery bypass grafting (CABG)
• Stable angina
• Heart valve repair/replacement surgery
• Heart or heart/lung transplant
• Heart failure
  • New indication (HF ACTION)
  • ≤ LVEF 35%, stable, NYHA class II-IV
GOALS OF CARDIAC REHAB

• Risk factor modification
• Improvement in functional capacity
• Attenuate myocardial ischemia
• Retard progression/foster the reversal of coronary disease
• Reduce future events/hospitalizations
COMPONENTS & BENEFITS OF A CARDIAC REHAB PROGRAM

- Increased Exercise
- Improved blood pressure control
- Improved lipid control
- Stress reduction
- Weight loss, Improved glycemia control
THE BENEFIT OF EXERCISE 1

Weight (Blair, Ann Intern Med 2002)

- In randomized trials exercise showed average losses of 2-3 kg when combined with dietary changes

Blood pressure (Whelton SP, Ann Intern Med 2002)

- Meta analysis of 54 RCTs (2419 patients)
- Aerobic exercise associated with 3.84 mmHg decrease in mean SBP, 2.58 mmHg in mean DBP

Diabetes (Knowler WC NEJM 2002)

- Diabetes Prevention Program demonstrated that physical activity reduced a 58% relative risk reduction in the onset of type 2 diabetes over 2.8 years
THE BENEFIT OF EXERCISE 2

Lipids (Leon AS, Med Sci Sports Exerc 2001))

- Meta analysis of 52 exercise training trials lasting more than 12 weeks that included 4700 patients
- Average 4.6% increase in HDL, 3.7% reduction in TG, and 5% decrease in LDL

Thrombosis (Smith DT et al. J Physio 2003)

- Among sedentary older men, 3 months of aerobic exercise increased endothelial capacity to release t-PA by 55% similar to levels of younger men.

Autonomic function (Iellamo F et al, Circulation 2009)

- Exercise training significantly improves heart rate variability which has been associated with decreased CHD risk
IMPACT OF CARDIAC REHABILITATION ON DEPRESSION

CHANGES IN PREVALENCE OF DEPRESSION FOLLOWING CR AND EXERCISE TRAINING, N=522

63% decrease in depressive symptoms

Milani RV and Lavie CJ, The American Journal of Medicine 2007. 120, 799
SHOULD EVERYONE EXERCISE?
CARDIORESPIRATORY FITNESS AS A PREDICTOR OF ALL-CAUSE MORTALITY

Meta-analysis: relationship of cardiorespiratory fitness (CRF) to coronary disease events

33 eligible studies

102,980 patients

- All studies assessed CRF by exercise stress test
- Included all cause mortality
- CRF could be assessed in METs
  - Low 5.5-7.8 METs
  - Int 7.9-10.7 METs
  - High 11.0-15.2 METs

Kodama, Satori et al., *JAMA* 2009
WHAT ARE THE RISKS OF EXERCISE?
## Physicians’ Health Study

22,071 male physicians

Age 40-84 years

Excluded participants with history of MI, CVA, TIA, cancer

### Aim

To compare the risk of sudden death during and up to 30 min after an episode of vigorous exercise versus periods of lighter exertion or none

### Table: Characteristic

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No sudden death (N=21,359)</th>
<th>Sudden death (N=122)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>53.0±9.42</td>
<td>60.5±9.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Body-mass index†</td>
<td>24.9±3.0</td>
<td>25.2±2.9</td>
<td>0.32</td>
</tr>
<tr>
<td>Frequency of vigorous exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1 time/wk</td>
<td>5,890 (27.6)</td>
<td>32 (22.5)</td>
<td>0.41</td>
</tr>
<tr>
<td>1 time/wk</td>
<td>3,941 (18.4)</td>
<td>27 (20.1)</td>
<td></td>
</tr>
<tr>
<td>2–4 times/wk</td>
<td>8,063 (37.7)</td>
<td>40 (38.8)</td>
<td></td>
</tr>
<tr>
<td>5 or 6 times/wk</td>
<td>2,328 (10.9)</td>
<td>9 (9.9)</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>1,137 (5.3)</td>
<td>14 (8.6)</td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td>0.05</td>
</tr>
<tr>
<td>Current smoker</td>
<td>2,366 (11.1)</td>
<td>20 (19.8)</td>
<td></td>
</tr>
<tr>
<td>Past smoker</td>
<td>8,367 (39.3)</td>
<td>53 (40.3)</td>
<td></td>
</tr>
<tr>
<td>Never smoked</td>
<td>10,592 (49.6)</td>
<td>48 (40.0)</td>
<td></td>
</tr>
<tr>
<td>Medical conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>477 (2.2)</td>
<td>13 (10.7)</td>
<td>0.001</td>
</tr>
<tr>
<td>High cholesterol level†</td>
<td>1,264 (6.7)</td>
<td>10 (8.2)</td>
<td>0.73</td>
</tr>
<tr>
<td>Hypertension§</td>
<td>2,852 (13.5)</td>
<td>40 (32.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Parental myocardial infarction before 60 years of age</td>
<td>2,761 (13.0)</td>
<td>17 (17.1)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Albert, Christine et al., *NEJM* 2000
THE RISKS OF VIGOROUS EXERCISE

Physicians’ Health Study

• 1 per 1.42 million of episodes of sudden death during vigorous exercise compared to 1 per 23 million for light or exercise

• Relative risk 16.9 (95% CI 10.5-27 p<0.001)

Albert, Christine et al., NEJM 2000
CARDIAC ARREST DURING LONG DISTANCE RUNNING

Analysis of cardiac arrest that occurs during the running or within 1 hr after finishing

- 59 cardiac arrests among 10.9 million registered race participants
- 40 in marathons, 19 in half-marathons
- Overall incidence: 1 per 184,000 participants

Kim, J et al., NEJM 2012
Incidence of cardiac arrest increased in the last 5 years of the study

- Effect is most pronounced in men

None of the runners with coronary artery disease had acute plaque rupture

- Demand ischemia seems to have played an important role in the etiology of the cardiac arrest
- Authors contend there may be a role for exercise stress testing before marathons to identify ischemia causing lesions
Exercise and Acute Cardiovascular Events: Placing the Risks Into Perspective: A Scientific Statement From the American Heart Association Council on Nutrition, Physical Activity, and Metabolism and the Council on Clinical Cardiology

SAFETY OF CARDIAC REHABILITATION

**IMMEDIATE POST - EXERCISE**
- Abrupt Cessation of Activity
  - ↓ Venous Return
  - ↓ Cardiac Output
- Arterial Vasodilatation
  - ↓ Blood Pressure
- ↓ Coronary Perfusion
- Altered Depolarization/Repolarization
- ↑ Ventricular Ectopic Activity

**ACUTE EXERCISE STRESS**
- ↑ Sympathetic Activity
- ↑ Catecholamines
- Na+/K+ Imbalance
  - ↓ Vagal Stimulation
  - ↑ HR, SBP
  - ↑ MVO₂
  - (CHD)
  - ↑ Ischemia
  - ↑ Myocardial Irritability
  - Altered Conduction Velocity

SAFETY OF CARDIAC REHABILITATION

Summary of Contemporary Exercise-Based Cardiac Rehabilitation Program Complication Rates

<table>
<thead>
<tr>
<th>Investigator</th>
<th>Year</th>
<th>Patient-Exercise Hours</th>
<th>Cardiac Arrest</th>
<th>MI</th>
<th>Fatal Events Major Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Camp and Peterson⁵⁵</td>
<td>1980–1984</td>
<td>2 351 916</td>
<td>1/111 996†</td>
<td>1/293 990</td>
<td>1/783 972</td>
</tr>
<tr>
<td>Digenio et al⁵⁶</td>
<td>1982–1988</td>
<td>480 000</td>
<td>1/120 000‡</td>
<td>1/160 000</td>
<td>1/120 000</td>
</tr>
<tr>
<td>Vongvanich et al⁵⁸</td>
<td>1986–1995</td>
<td>268 503</td>
<td>1/89 501§</td>
<td>1/268 503§</td>
<td>0/268 503</td>
</tr>
<tr>
<td>Franklin et al⁵⁷</td>
<td>1982–1998</td>
<td>292 254</td>
<td>1/146 127§</td>
<td>1/97 418§</td>
<td>0/292 254</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>1/116 906</td>
<td>1/219 970</td>
<td>1/752 365</td>
<td>1/81 670</td>
</tr>
</tbody>
</table>

✓ Medically supervised
✓ Equipped to deal with emergencies
✓ Patients evaluated before participation
ELEMENTS OF PHASE II CARDIAC REHABILITATION PROGRAM

- Pre-enrollment stress test
- Individualized exercise prescription
- Individual risk factor modification
- Continuous ECG monitoring during exercise
- Education and counseling
- Modification of each patient’s program
- Open communication with referring physician
- Triage to facilitate patient’s progress
- Discharge evaluation/assessment
- Referral to Phase III Cardiac Rehab
The **Karvonen formula** uses the heart rate reserve to calculate training zones based on both maximum AND resting heart rate.

**Calculating Target Heart Rate with the Karvonen Formula**

- $220 - \text{age} = \text{maximum heart rate}$
- Maximum heart rate $- \text{Resting heart rate} = \text{Heart rate reserve}$
- $(\text{Heart rate reserve} \times \text{Training \%}) + \text{Resting heart rate} = \text{Target Heart Rate Zone}$
INDIVIDUALIZED EXERCISE PRESCRIPTION

(Heart rate reserve x Training %) + Resting heart rate = Target Heart Rate Zone

Recovery Zone - 60 to 70%
Active recovery training

Aerobic Zone - 70 to 80%
Continuous, long distance endurance training

Anaerobic Zone - 80 to 90%
Interval training
RATING OF PERCEIVED EXERTION (RPE)

- Instead of pulse rate to monitor exercise workload if having difficulty determining pulse rate or if on medication that alters heart rate

- To monitor effort during exercise:
  - If the RPE is too high, decrease the effort of exercise
  - If RPE is too low, increase the effort of exercise

- To monitor RPE during daily activities to determine the level of effort perceived outside of Cardiac rehab

- Important education tool!
**RATING OF PERCEIVED EXERTION (RPE)**

6-20 point scale (modified Borg scale)
- 6 very very light
- 20 very very hard

“Try to estimate how hard you feel the amount of physical work or effort is during activity (rate your perceived exertion)”
“Despite the clear benefits of cardiac rehabilitation, the use of such programs remains dismally low.”

“Of eligible patients, only 14-35% of MI and ~31% of CABG patients participate.”
Cardiac Rehabilitation is underutilized secondary:

- Lack of referral
- Limited facilitation of enrollment after referral
- Strength of the endorsement by patient’s practitioner
- Distance to the program
- Hours of operation
- Parking and public transportation access

Harlan M. Krumholz, Jeffrey L. Anderson, Brian L. Bachelder, Francis M. Fesmire, Stephan D. Fihn, JoAnne M. Foody, P. Michael Ho, Mikhail N. Kosiborod, Frederick A. Masoudi, and Brahmajee K. Nallamothu
<table>
<thead>
<tr>
<th>Measure Name</th>
<th>Diagnostics</th>
<th>Patient Education</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance measures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Aspirin at arrival</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>2. Aspirin prescribed at discharge</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>3. Beta-blocker prescribed at discharge</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>4. Statin prescribed at discharge</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>5. Evaluation of LVSF</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. ACEI or ARB for LVSD</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Time to fibrinolytic therapy</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Time to primary PCI</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Reperfusion therapy</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Time from ED arrival at STEMI referral facility to ED discharge from STEMI referral facility in patients transferred for primary PCI</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Time from ED arrival at STEMI referral facility to primary PCI at STEMI receiving facility among transferred patients</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Adult smoking cessation advice/counseling</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Cardiac rehabilitation patient referral from an inpatient setting (6)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
AHA / ACCF SECONDARY PREVENTION AND RISK REDUCTION OF CVD. 2011 UPDATE

PRACTICE GUIDELINE

AHA/ACCF Secondary Prevention and Risk Reduction Therapy for Patients With Coronary and Other Atherosclerotic Vascular Disease: 2011 Update

A Guideline From the American Heart Association and American College of Cardiology Foundation

J. Am. Coll. Cardiol. 2011
### Table 1. Continued

<table>
<thead>
<tr>
<th>Area for Intervention</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>β-Blockers cont’d</strong></td>
<td><strong>Class IIb</strong></td>
</tr>
<tr>
<td></td>
<td>1. β-Blockers may be considered as chronic therapy for all other patients with coronary or other vascular disease. <em>(Level of Evidence: C)</em></td>
</tr>
<tr>
<td><strong>Influenza vaccination</strong></td>
<td><strong>Class I</strong></td>
</tr>
<tr>
<td></td>
<td>1. Patients with cardiovascular disease should have an annual influenza vaccination (144–147). <em>(Level of Evidence: B)</em></td>
</tr>
<tr>
<td><strong>Depression</strong></td>
<td><strong>Class IIa</strong></td>
</tr>
<tr>
<td></td>
<td>1. For patients with recent coronary artery bypass graft surgery or myocardial infarction, it is reasonable to screen for depression if patients have access to case management, in collaboration with their primary care physician and a mental health specialist (148–152). <em>(Level of Evidence: B)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Class IIb</strong></td>
</tr>
<tr>
<td></td>
<td>1. Treatment of depression has not been shown to improve cardiovascular disease outcomes but may be reasonable for its other clinical benefits. <em>(Level of Evidence: C)</em></td>
</tr>
<tr>
<td><strong>Cardiac rehabilitation</strong></td>
<td><strong>Class I</strong></td>
</tr>
<tr>
<td></td>
<td>1. All eligible patients with ACS or whose status is immediately post coronary artery bypass surgery or post-PCI should be referred to a comprehensive outpatient cardiovascular rehabilitation program either prior to hospital discharge or during the first follow-up office visit (55,154,161,163). <em>(Level of Evidence: A)</em></td>
</tr>
<tr>
<td></td>
<td>2. All eligible outpatients with the diagnosis of ACS, coronary artery bypass surgery or PCI <em>(Level of Evidence: A)</em> (55,154,155,161), chronic angina <em>(Level of Evidence: B)</em> (161,163), and/or peripheral artery disease <em>(Level of Evidence: A)</em> (158,164) within the past year should be referred to a comprehensive outpatient cardiovascular rehabilitation program.</td>
</tr>
<tr>
<td></td>
<td>3. A home-based cardiac rehabilitation program can be substituted for a supervised, center-based program for low-risk patients (153,159,160). <em>(Level of Evidence: A)</em></td>
</tr>
<tr>
<td></td>
<td><strong>Class IIa</strong></td>
</tr>
<tr>
<td></td>
<td>1. A comprehensive exercise-based outpatient cardiac rehabilitation program can be safe and beneficial for clinically stable outpatients with a history of heart failure (159,159a–159c). <em>(Level of Evidence: B)</em></td>
</tr>
</tbody>
</table>
GRACIAS!

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