Cardiac Rehabilitation

Past, Present and Future: An Overview

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Cardiac Rehabilitation

- Class 1 recommendation for the management and prevention of coronary artery disease (AHA/ACC)
- has evolved from a simple monitoring for the safe return to physical activities to a multidisciplinary approach that focuses on patient education, individually tailored exercise training, modification of the risk factors and the overall well being of cardiac patients
- is mainly involved with secondary prevention which relies on early detection of the disease process and application of interventions to prevent the progression of disease
Historical Background

- 1930’s - patients with acute coronary events were advised to observe 6 weeks of bed rest
- 1950’s – a very short daily walk of 3 to 5 minutes was allowed 4 weeks after the coronary events
- 1968 – Dallas Bed Rest and Exercise Study (Saltin et al.) provided a powerful proof of the importance of exercise and the detrimental effect of prolonged bed rest
Objectives of Cardiac Rehabilitation

- Help patients regain autonomy and improve regular physical activities
  - improvement of lipid panel (HDL cholesterol)
  - decreases visceral fat
  - reduces blood pressure
  - treatment and prevention of type 2 diabetes
Objectives of Cardiac Rehabilitation

- To control the modifiable risk factors such as...
  - smoking cessation
  - optimization of medication for blood pressure, diabetes and cholesterol
  - help manage psychosocial problems including anxiety, depression and stress management
Indications

- acute myocardial infarction
- stable angina pectoris
- coronary artery bypass graft surgery
- heart valve repair or replacement
- percutaneous transluminal coronary angioplasty
- heart transplantation or heart-lung transplantation
- heart failure (stable class II and III patients without complex arrhythmias)
- peripheral artery disease (PAD)
Contraindications

- unstable angina
- decompensated heart failure
- complex ventricular arrhythmias
- pulmonary arterial hypertension (>60 mmHg)
- intracavitary thrombus
- recent thrombophlebitis with or without pulmonary embolism
- severe obstructive cardiomyopathies
- severe or symptomatic aortic stenosis
- any musculoskeletal condition that prohibits physical exercise
Components of Cardiac Rehabilitation

- Phase I or inpatient phase
  - early progressive mobilization of the stable cardiac patient to the level of activity required to perform simple household tasks
  - brief counseling about the nature of the illness, the treatment, risk factors management and follow-up planning
Components of Cardiac Rehabilitation

- Phase II
  - supervised ECG monitored exercise sessions for 8 to 12 weeks and aggressive risk factor reduction
    - can be started as early as 1 to 2 weeks after hospitalization
    - before exercise training, a symptom-limited exercise test is undertaken for prognostic, diagnostic, and therapeutic purposes
Component of cardiac rehabilitation

- Exercise session
  - Phase 1 – warm up for 5-10 minutes
    - stretching, flexibility movements and aerobic activity that gradually increases HR into target range
  - Phase 2 – conditioning or training phase
    - 30 to 45 minutes of continuous aerobic activity
  - Phase 3 – cool down
    - 5-10 minutes of low-intensity exercise and permits a gradual recovery from the conditioning phase
Components of Cardiac Rehabilitation

- Phase III (lifetime maintenance phase)
  - consists of home- or gymnasium-based exercise with the goal of continuing the risk factor modification and exercise program learned during phase II.
Exercise Training

1) Standard exercise protocol
   - combination of aerobic and resistance training (to improve muscle strength)
     - moderate intensity exercise training (50-80% of maximum HR) at least 5 days a week for minimum of 30 minutes per day

2) High-intensity interval aerobic exercise training
   - more beneficial for exercise performance, hemodynamic benefit and weight loss
     - exercise protocol includes 10 minute warm-up followed by four 4 minute intervals at 90-95% peak HR with interval separated by 3 minute periods of walking at 50-70% peak HR
Effects of exercise training

1) improve physical fitness
   - improve exercise tolerance
   - normalize abnormal heart rate recovery

2) can be cardio-protective
   - slows the progression or partially reduces the severity of coronary atherosclerosis
   - improved endothelial function through nitric oxide
   - reduction in CRP suggests anti-inflammatory effects

3) promotes weight loss
4) blood pressure reduction
5) improvement in lipid panel
   - decrease triglycerides and increase HDL
6) reduce risk of type 2 diabetes mellitus
Effects of exercise training

7) potential anti-ischemic effects
   - raising ischemic threshold
   - increase coronary flow by improving arterial compliance and endothelium-dependent vasodilatation

8) decrease risk of SCD due to ventricular tachyarrhythmias
   - reducing sympathetic and enhancing parasympathetic (vagal) activity

9) favorable hemostatic effects
   - decrease risk of thrombotic occlusion of a coronary artery
     - reduced blood viscosity
     - decrease platelet aggregation
     - enhanced thrombolytic ability
Benefits of cardiac rehabilitation

1) Reduction in recurrent myocardial infarction and mortality
   - approximately half of the mortality reduction can be attributed to reductions in major risk factors
     - smoking, blood pressure, body weight, treatment and prevention of diabetes, lipid profile
   - reduction in inflammation (decrease in serum CRP)
   - ischemic preconditioning
   - improved endothelial function
   - more favorable fibrinolytic balance
   - normalize heart rate recovery
   - improve LV function and attenuate remodeling
Benefits of cardiac rehabilitation

2) life quality benefits
   - less angina
   - less dyspnea
   - less fatigue

3) stress reduction
   - meditation
   - relaxation breathing
   - yoga

4) improved overall sense of psychosocial well-being
   - anxiety
   - depression
   - substance abuse
Benefits of cardiac rehabilitation

- 600,000 Medicare patients hospitalized for ACS, PCI or CABG (Hammill et al. 2010)
  - 73,049 (12.2%) participated in cardiac rehabilitation
  - after 1 year - 2.2% mortality rate for participants vs. 5.3% for nonparticipants
  - at 5 years - 16.3% mortality rate for participants vs. 24.6% for nonparticipants
  - participants who attended 25 or more sessions had a 20% lower 5 year mortality rate than those who attended less than 25 sessions
Tobacco cessation

- The most important and cost-effective of all the lifestyle modifications recommended to prevent cardiovascular disease
- Overall mortality risk of smokers who quit decreases by 50% in the first couple of years and tends to approach that of nonsmokers in approx. 5 to 15 years of cessation of smoking
Nutritional counseling

- General dietary recommendations include...
  - reduce intake of saturated fats (<7% of total calories) and cholesterol (<200mg/d)
  - increase intake of polyunsaturated (~10% of total calories) and monounsaturated fats (20% of total calories)
  - repartition of calorie sources (50-60% of total calories for carbohydrates, 15% for protein and 25-35% for fat)
  - increased fiber intake (20-30 g/d)
Weight management

- Goals of weight management
  - initial goal is to reduce body weight by ~10% from baseline
  - BMI of 18.5 to 24.9
  - waist circumference of...
    - <40 inches (men)
    - <35 inches (women)
Lipid management

- Hypercholesterolemia is the risk factor with the highest percentage of attributable risk post myocardial infarction
  - as little as 1 mmol/L (38.7 mg/dL) decline in LDL cholesterol results in 21% decrease in cardiovascular events (Yusuf et al. 2009)
- Cardiac rehabilitation can improve a patient’s lipid profile through physical exercise, nutritional counseling and weight management
Blood pressure management

- High prevalence of hypertension in patients referred for cardiac rehabilitation
  - a decrease in SBP by 10 mmHg can decrease cardiovascular mortality by 20-40%
  - a decrease in DBP by 5-6 mmHg can result in a reduction of stroke risk by 42% and coronary heart disease events by 15%
Diabetes management

- approximately 26% of patients referred to cardiac rehabilitation have diabetes
- therapeutic education helps improve diabetes control and achieve better glycemic control
  - goal HgbA1c of < 7%
Management of Psychosocial issues

- Up to 20% of patients will suffer from depression, anxiety and denial following myocardial infarction
- The INTERHEART Study (Yusuf et al. 2004)
  - Psychosocial stress was the 3rd most important risk factor for coronary events following lipids and smoking
- Psychosocial stress can lead to...
  - 1) increase blood pressure
  - 2) increase blood glucose
  - 3) increase lipid levels
  - 4) increase body weight
  - 5) promotes the progression of atherosclerosis, inflammation and endothelial dysfunction (Ranjit et al. 2007)
Risks of cardiac rehabilitation

- Cardiac rehabilitation is safe!!
  - 25,000 patients participating in 65 cardiac rehabilitation centers (Pavy et al. 2003)
    - one cardiac event for every 50,000 patient hours of exercise training
    - 1.3 cardiac arrests for every million patient hours of exercise
Risks of cardiac rehabilitation

• 2007 AHA scientific statement on exercise and acute cardiovascular events (cardiac arrest, death or MI)
  • estimates the risk of any major cardiovascular complication (cardiac arrest, death or MI) at one event in 60,000 to 80,000 patient-hours of supervised exercise

• Patients most at risk are those with...
  • residual myocardial ischemia
  • complex ventricular arrhythmia
  • severe LV dysfunction (LV EF < 35%); NYHA III or IV
Cardiac rehabilitation cost and effectiveness

- Cost-effective and clinically effective
  - Ades et al. (1997)
    - shown to be more cost effective than lipid lowering drugs
    - only smoking cessation was more cost effective than cardiac rehabilitation
  - Levin et al. (1991)
    - at 5 year follow-up...
      - decreased rehospitalizations from 16-11 days
      - increased rate of return to work from 38% to 53%
      - overall cost savings of $12,000 per patient
Underutilization of cardiac rehabilitation

- In US, only 30% of patients post MI and CABG are referred to cardiac rehabilitation
  - only 18% of participants complete 36 sessions
- In Europe, approximately 50% of patients are referred

- Early enrollment (within 30 days) improves subsequent attendance and outcomes
Barriers to cardiac referral and participation

- Factors include...
  - Age
    - Older patients are less likely to be referred
  - Sex
    - women participate less than men
    - lack of financial resources, transportation difficulties and lack of social or emotional support
  - Race
    - limited participation in racial and ethnic minority patients due to lack of accessibility to program sites, lack of insurance coverage and low referral rates
  - Physician recommendation
  - Patient’s expectation about cardiac rehabilitation
  - Feelings of self-efficacy
  - Mood and coping style
Exercise is Medicine
"1 HOUR OF EXERCISE A DAY EQUALS 1.95 ADDED HOURS OF LIFE."
Conclusions

1) Class 1 recommendation for the management and prevention of coronary artery disease (AHA/ACC)
2) cardiac rehabilitation has been proven to be safe and effective in improving cardiovascular patients’ quality of life and reducing morbidity and mortality
3) cardiac rehabilitation remains underused
4) need to improve referral and encourage participation in cardiac rehabilitation programs