Populations with Special Needs (ACSM guidelines)

- Congestive Heart Failure (CHF)
- Pacemakers
- Cardiac Transplant

Congestive Heart Failure

- CHF, heart cannot deliver oxygenated blood to tissues
- Impaired cardiac output and cardiac function
- Impaired skeletal muscle metabolism, greater glycolysis, metabolic acidosis, early fatigue
- Catecholamines unusually elevated
- Abnormal beta-receptor density-reduced cardiac contractility

CHF, Benefits of exercise

- Improves functional capacity and quality of life
- Peripheral muscle adaptations are largely responsible for improved exercise tolerance
- Exercise for patients
  - Who are stable on medical therapy
  - Without contraindications
  - Functional capacity > 3 Mets
- Special precautions from meds
  - Digoxin, diuretics may pre-dispose to arrhythmias

CHF, Exercise Prescription

- Exercise intensity based on symptom-limited exercise test
- THR 40-75% VO2max
- 3-7 d/wk
- Work slowly towards 20-40 min/sessions
- Warm-up and cool-downs of 10-15 min
- If HR is altered, use RPE (11-14) and dyspnea to target workloads
- Complement with resistance training
  - High volume, low intensity

Patients with Pacemakers

- A pacemaker is a battery-powered device that delivers an electrical stimulus to the myocardium
- Implanted in patients with
  - Symptomatic sinus bradycardia
  - Sinus arrest
  - Sick sinus syndrome
  - Slow atrial fibrillation
  - 2nd degree type 2 or 3rd degree heart blocks

Pacemakers
Permanent Pacemakers

Pacemaker Rhythms

A = stimulus with ventricular capture
B = a native beat
C = a fusion beat (pacemaker fires at the same time as the ventricle)

Types of Pacemakers

- Pacemaker with a fixed rate
- Dual chamber pacing with AV synchrony
- Dynamic adjustment to match met demand
  - sensors that respond to physiologic, mechanical or electrical signals
- Pacemakers with implantable cardioverter defibrillator (ICD)
  - electrically terminate tachy-dysrhythmias

Exercise in Patients with Pacemakers

- Fixed-rate pacemaker: HR does not increase appropriately with exercise, attenuated functional capacity
  - Still show some training effects
  - Intensity determined using SBP
  - $T_{SBP} = T\%(SBP_{max} - SBP_{rest}) + SBP$
  - $T\% = 50-80\% SBP_{max}$

Exercise in Patients with Pacemakers, cont.

- Rate-modulating pacemakers
  - Use normal HR methods to set rate, but consider HR limits of the pacemaker
  - Rate sensor is non-physiologic (motion sensitive or accelerometer)
  - carefully designed exercise modes—eg. Increase treadmill load by increasing speed, not grade. Cycle may not produce sufficient feedback to regulate HR

- Pacemaker with ICD
  - Know the critical HR or HR interval that triggers shock treatment
    - stay well below that HR
    - monitor HR continuously
  - A magnet should be available to override or inactivate the device
Normal Rhythm

- A normal pacemaker rhythm
- One stimulus per beat
- Automatic interval set by the pacemaker

Pacemaker Malfunctions

Loss of Capture

- Catheter tip has dislodged
- Catheter tip is in infarcted tissue
- Increased stimulation threshold (inflammation)

Pacemaker malfunctions

Under-sensing

- The pulse generator does not sense the patient’s intrinsic beat
- Normally the pacemaker is set to fire only after a set period
- Due to problem with the sensing catheter tip
- Sensitivity setting is too low

Patients with Cardiac Transplants

Cardiac Transplant

- 3000 patients/yr
- 1 and 3-yr survival rates are 83 and 77%, respectively
- Loss of ventricular innervation
  - Except for PS post-ganglionic fibers
- Adverse effects of immunosuppressive drugs
- Prolonged inactivity

Exercise Response in Cardiac Transplant Patients

- 2 separate P waves
- Resting sinus tachycardia (90-100)
- Hypertension (Sys and Dias)
- Elevated catecholamines
- Increase in HR with exercise
  - Due primarily to HR, less to SV
  - Increase in HR is delayed
- Initial increase in CO is due to Frank-Starling effect (increase SV)
- Later HR increases in response to humoral (catecholamine) response
Exercise Response in Cardiac Transplant patients, cont.

- Submax Exercise Responses
  - increased RER, Ve, NE
- Peak Exercise Responses
  - increased lactate
  - decreased HR, BP, VO2, AT, SV, CO, exercise time
  - VO2pk ~ 17 ml/kg/min

Exercise Prescription for Cardiac Transplant Patients

- Base prescription on exercise testing
  - intensity, 50-75% VO2pk
  - RPE, 11-15
- Initial exercise HR response altered, so initially use target work loads or Met loads; later HR, RPE and dyspnea.
- Prolonged warm-up and cool-downs
  - aerobic, 4-6 d/wk
  - duration slowly increasing from 16-60 min/session
  - low-mod intensity resistance training 2-3d/wk

Training and Qualifications to work in Cardiac Rehab (Robergs, 97)

- Minimum Qualifications
  - BS in exercise physiology or related field
  - Certification, experience and training equivalent to Exercise Specialist (ACSM)
  - Experience in exercise planning, counseling, supervision with cardiac rehab patients
  - BLS
- Preferred Qualifications
  - MS
  - ACLS