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

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

Permanent Pacemakers

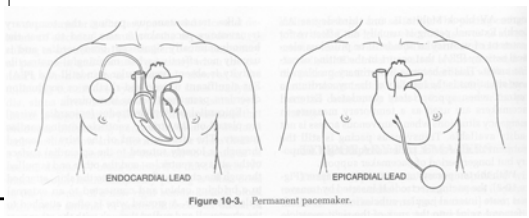

Figure 10-3. Permanent pacemaker.

Pacemaker Rhythms

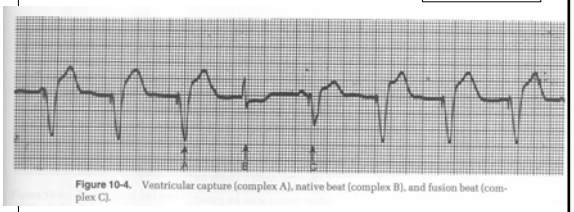
Figure 10-4. Ventricular capture (complex A), native beat (complex B), and fusion beat (complex C).

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
  - TSBP = T%(SBPmax-SBPrest) + SBP
    - T% = 50-80% SBPmax

Exercise in Patients with Pacemakers

- 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

Exercise in Patients with pacemaker, cont.

- 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

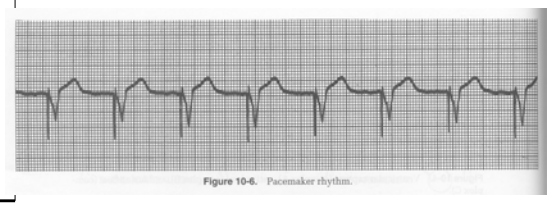

Figure 10-6. Pacemaker rhythm.

- A normal pacemaker rhythm
  - one stimulus per beat
  - automatic interval set by the pacemaker

Pacemaker Malfunctions

Loss of Capture

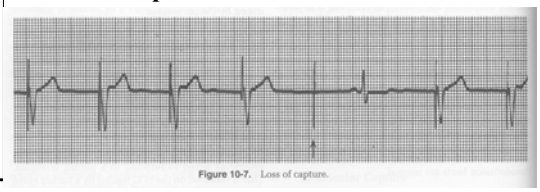

Figure 10-7. Loss of capture.

- catheter tip has dislodged
- catheter tip is in infarcted tissue
- increased stimulation threshold (inflammation)

Pacemaker manfunctions

Under-sensing

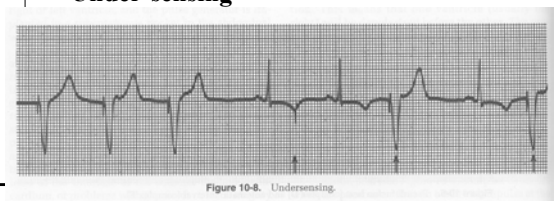

Figure 10-8. Undersensing.

- 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