Physical Therapy Cardiac Rehabilitation Procedures

The physical therapist is responsible for establishing an appropriate level of intensity and duration of exercise for the individual with cardiac disease. This means monitoring the patient’s cardiovascular response to the exercise to ensure the patient’s safety and, in addition, the therapist must assess all of the medical data obtained from invasive and noninvasive testing procedures in order to select an appropriate level of activity for the patient’s program.

To help the physical therapist accomplish this activity, the individual with cardiac disease is generally classified based on the severity of the condition. Table 10-3 indicates how two classification systems use functional and therapeutic terms to determine the patient’s basic condition and the type of activity in which the individual might engage.\(^{10}\)

<table>
<thead>
<tr>
<th>Functional Classification</th>
<th>Therapeutic Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>I</td>
<td>Patients with cardiac disease, but without resulting limitations of physical activity. Ordinary physical capacity does not cause undue fatigue, palpitation, dyspnea, or anginal pain.</td>
</tr>
<tr>
<td>II</td>
<td>Patients with cardiac disease resulting in slight limitation of physical activity. Patients are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.</td>
</tr>
<tr>
<td>III</td>
<td>Patients with cardiac disease resulting in marked limitation of physical activity. Patients are comfortable at rest. Less than ordinary physical activity causes fatigue, palpitation, dyspnea, or anginal pain.</td>
</tr>
<tr>
<td>IV</td>
<td>Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of cardiac insufficiency or of the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort is increased.</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Adapted from Functional and Therapeutic Classifications of Patients with Diseases of the Heart. 1\(^\text{st}^\) TX. American Heart Association.
Chapter 10 CARDIOPULMONARY PHYSICAL THERAPY

Other guidelines used by the physical therapist to help establish appropriate cardiac rehabilitation activities include phases of recovery. Cardiac rehabilitation is typically divided into inpatient and outpatient stages. The inpatient stage is often referred to as Phase I (acute). The outpatient stage is generally broken down into Phase II (subacute), Phase III (intensive rehabilitation), and Phase IV (ongoing rehabilitation).12,15,23

This classification system varies a great deal and often remains specific to a program. For instance, Phase IV is frequently combined with Phase III.

As an inpatient, the person would participate in Phase I of the cardiac rehabilitation program. Table 10-4 lists the kinds of exercises and activities of daily living (ADL) a physical therapist or physical therapist assistant would supervise or monitor.24 The therapist or assistant must monitor the ECG, heart rate, blood pressure and other physiological parameters to ensure that the patient stays within the predetermined safety range. It is important to note that the patient is involved in educational activities, including risk factor modification, understanding the medications being taken, and discharge planning. This education program could also include flexibility exercises and learning how to take one's own pulse.

Following discharge, the individual proceeds to the outpatient phases of the cardiac rehabilitation program. These phases focus on exercises that will gradually and safely increase the individual's functional capacity. The early stages of outpatient rehabilitation (Phase II) are performed under supervision and monitored closely. Generally, patients attend outpatient cardiac rehabilitation programs that have representatives of the entire rehabilitation team (e.g., occupational therapy, physical therapy, nutrition, etc.). During Phase II, close physician management is always available. Depending on the severity of the problem, the patient will attend supervised training sessions three to four times per week for ten to twelve weeks. If recovery has continued well, the patient will have a stress test to help determine how he/she has improved or responded to the exercise program.

Progression to Phases III and IV involve more independent and aggressive activities. In order to proceed to these levels, the individual must: (1) be able to self-monitor the exercise program; (2) have no contraindications to exercise; and (3) be emotionally stable.4 These phases include a gradual increase in exercise intensities. Periodic check-ups by the professional team occur most frequently in Phase III. Once the patient has reached Phase IV, he/she should be functioning at the maximum safe capacity.

During the outpatient phases of the cardiac rehabilitation program, the exercises emphasize aerobic training which includes rhythmic activity of large muscle masses. Appropriate aerobic training involves a warm-up period, a peak period and a cool-down period. The length of time for these periods may vary depending on the status of the patient, but generally the warm-up and cool-down phases should be at least 8-10 minutes each. The peak period should last 20-60 minutes. It is during the peak period that the patient must reach and maintain a target heart rate (see below).2,12
### Table 10-4: 7-Step Inpatient Rehabilitation Program For Myocardial Infarcti

<table>
<thead>
<tr>
<th>Step</th>
<th>Supervised Exercises</th>
<th>Activities of Daily Living</th>
<th>Educational Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Active and passive ROM all extremities, in bed; teach patients ankle plantar and dorsiflexion, repeat hourly when awake</td>
<td>Partial self-care; feed self; dangle legs on side of bed; use bedside commode</td>
<td>Orientation to CCU; personal emergencies; social service aid needed</td>
</tr>
<tr>
<td>2.</td>
<td>Active ROM all extremities; sitting on side of bed</td>
<td>Sit in chair 15-30 min 2-3 times/day; complete self-care in bed</td>
<td>Orientation to rehabilitation team, program; smoking cessation; educational literature requested; planning transfer from CCU</td>
</tr>
<tr>
<td>3.</td>
<td>Warm up exercises, stretching, calisthenics; walk 50 ft. and back at slow pace</td>
<td>Sit in chair; to ward class in wheelchair; walk in room</td>
<td>Normal cardiac anatomy and function; what happens with myocardial infarction</td>
</tr>
<tr>
<td>4.</td>
<td>ROM and calisthenics; walk length of hall (75 ft) and back, average pace; teach pulse counting</td>
<td>Out of bed as tolerated; walk to bathroom: walk to ward class; with supervision</td>
<td>Coronary risk factors and their control</td>
</tr>
<tr>
<td>5.</td>
<td>ROM and calisthenics; check pulse counting; practice walking few stairsteps; walk 300 ft bid</td>
<td>Walk to waiting room or telephone: walk in ward corridor</td>
<td>Diet; energy conservation; work simplification techniques (as needed)</td>
</tr>
<tr>
<td>6.</td>
<td>Continue above activities; walk down flight of stairs (return by elevator); walk 500 ft; instruct on home exercises</td>
<td>Tepid shower or tub bath with supervision; to occupational therapy, cardiac clinic teaching room with supervision</td>
<td>Heart attack management: medications; exercise; family, community adjustments on return home</td>
</tr>
<tr>
<td>7.</td>
<td>Continue above activities; walk up flight of steps; walk 500 ft; continue home exercise instruction; present information regarding outpatient exercise program</td>
<td>Continue all previous ward activities</td>
<td>Discharge planning: medications; diet; return to work; community resources; educational literature; medication cards</td>
</tr>
</tbody>
</table>

A target heart rate (THR) is calculated as a percentage of the individual's maximum heart rate. Maximum heart rate can be accurately determined only by a maximum stress test. However, it is commonly estimated by subtracting one's age from 220, which is passive and non-stressful. The THR is then determined to establish a person's "training zone" or minimum and maximum heart rates that must be achieved to produce an aerobic training effect. The percentage of the maximum heart rate that is selected will vary based on the individual's level of fitness, symptoms, and ECG findings. If the person is a patient with cardiac disease and is very de-conditioned, then the training zone levels would be small, perhaps only 120 beats per minute or 20 to 30 beats per minute above resting levels. By contrast, a training zone for a young athlete may fall between target heart rates of 60 to 85 percent of her/his maximum heart rate capacity. For this individual to produce a "training effect" or change her/his aerobic capacity, the person would have to reach a heart rate in the established "training zone." The important thing to remember is that as aerobic capacity improves, the amount of work the heart has to perform at a specific exercise intensity decreases. This, in turn, improves the patient's functional capacity without causing the heart to be overworked.

Other factors to consider when establishing an aerobic training program besides intensity of exercise (how hard a patient works during a single exercise period) and duration of exercise (how long each exercise period should last) include mode of exercise (what the patient does such as walking, jogging, bicycle riding, etc.) and frequency of exercise (how many times a day or week the patient exercises). The mode of exercise must allow for aerobic performance. This includes rhythmic contraction of large muscle groups over several minutes (20–60 minutes). Running, swimming, walking, and bicycle riding all promote this type of activity. The individual with cardiac disease, however, may not be able to sustain 20 minutes of exercise at one time; therefore, several periods of exercise throughout the day would be more appropriate. Frequency of exercise may also be determined by the patient's condition. Normally, individuals with cardiac disease in the latter phases of their program generally must perform a minimum of 20 minutes of exercise three to five times per week to promote or maintain aerobic training.

The physical therapist and physical therapist assistant must continually monitor the patient during all phases of the exercise program. Appropriate monitoring includes assessing heart rate, blood pressure, and respiratory rate responses to the specific exercise intensity. This monitoring is quite important, especially in the early phases of rehabilitation since this ensures that the patient does not exercise at an unsafe level. As the patient progresses, the therapist must teach self-monitoring for safe participation in activities, moving the patient one step closer to independent activity. When the patient can function independently at maximum functional capability, the therapist's responsibilities have been met.
Physical Therapy Pulmonary Rehabilitation Procedures

As with patients who have cardiac dysfunction, the physical therapist is responsible for establishing an appropriate level of exercise programming for the individual with pulmonary disease. The intensity and duration of the program must be at an appropriate level to promote a training effort that will enhance the patient's ability to perform daily functions aerobically. Aerobic performance occurs when the active muscles receive the oxygen they need to perform their task. To select the appropriate intensity and duration of exercise, the physical therapist must assess the results of all assessment procedures performed on the patient. From these data and the physical therapy evaluation, an appropriate exercise program can be established. It is important to remember that during aerobic exercise, the physical therapist and physical therapist assistant must monitor cardiovascular responses to the exercise such as heart rate, blood pressure, breathing rate and depth, and the feedback from the patient on how he or she feels. In this way excessive exercise is prevented, which could put the patient at risk.

Other components of physical therapy treatment for patients with pulmonary disease other than exercise, include secretion removal techniques, respiratory muscle training and breathing techniques, and energy-saving techniques.

Secretion removal techniques are administered to patients who produce excessive mucus secretions, such as those seen in obstructive pulmonary disease. The technique applied to promote mucus removal is called postural drainage. The patient is placed in a certain position ("posture") to passively drain fluid from a specific portion of the lung. Percussion (or clapping), vibration, and shaking are applied by the therapist to specific areas of the chest wall overlaying specific lobes of the lung (Fig. 10-8). Th percussion promotes mucus to move through the bronchial tubes. Having the patient assume the Trendelenburg (inversion) position and cough immediately after the percussion or vibration procedure, also helps move the mucus out of the different sections of the lungs.

Producing a good cough is essential for maintaining normal lung function in everyone. If the respiratory muscles are weakened or do not work properly, the efficiency of the cough mechanism is reduced. This can occur in both the obstructive and restrictive disease patterns. It also occurs in patients who have experienced trauma such as a individual with quadriplegia following spinal cord injury or patients who have had thoracic surgery.

The physical therapist can help the patient enhance coughing in three ways: by strengthening both the primary and secondary muscles of respiration; by changing the breathing pattern; and by teaching the patient how to use different devices to support the chest wall so that the expiration force generated during coughing is enhanced.
Fig. 10-8. Positions and guidelines for performing postural drainage to remove fluids from the lungs. See also Figure 2-9 A. B. (From Rothstein JM, Roy SH, Wolf SL: The Rehabilitation Specialist's Handbook, Philadelphia, 1991, FA Davis.)
Part II  PRACTICE

LOWER LOBES Lateral Basal Segments
Foot of table or bed elevated 20 inches.
Patient lies on abdomen, head down, then rotates 1/4 turn upward. Upper leg is flexed over a pillow for support.
Therapist claps over uppermost portion of lower ribs. (Position shown is for drainage of right lateral basal segment. To drain the left lateral basal segment, patient should lie on his right side in the same posture.)

LOWER LOBES Posterior Basal Segments
Foot of table or bed elevated 20 inches.
Patient lies on abdomen, head down, with pillow under hips. Therapist over lower ribs close to spine on each side.

UPPER LOBES Anterior Segments
Bed or drainage table flat.
Patient lies on back with pillow under knees.
Therapist claps between clavicle and nipple on each side.

LOWER LOBES Anterior Basal Segments
Foot of table or bed elevated 20 inches.
Patient lies on side, head down, pillow under knees.
Therapist claps with slightly cupped hand over lower ribs. (Position sh for drainage of left anterior basal segment. To drain the right anterior segment, patient should lie on his left side in same posture.)

LOWER LOBES Superior Segments
Bed or table flat.
Patient lies on abdomen with two pillows under hips.
Therapist claps over middle of back or tip of scapula on either side of spine.

Fig. 10-8. Continued.
Patients are taught energy-saving techniques so that they can perform their daily activities more efficiently, thereby decreasing the demand on the pulmonary system. The physical therapist assesses the activity needs for the patient in the home or work environment and then helps select assistive devices that can be used to perform certain tasks. Examples of such devices include a bathtub seat for showering in a seated position or a long shoe horn to help make putting on shoes easier. The therapist also teaches these patients how to break an activity into components so that each part of an activity is performed in stages. This is sometimes referred to as pacing. 2, 9, 12

The physical therapist and physical therapist assistant engage in direct intervention during pulmonary rehabilitation. They also participate in helping modify the patient’s risk factor profile, such as promoting weight management, good nutrition, smoking cessation, and a positive psychological state. They must be prepared to monitor the activities of other health care professionals and ensure that their treatment program is integrated into a comprehensive care plan. The primary goal for pulmonary rehabilitation is to help the patient achieve the highest functional level allowed by the pulmonary impairment.

The “Well” Individual

A discussion of cardiopulmonary physical therapy would not be complete without reviewing the concept of the “well” individual (individual without a diagnosis of any cardiopulmonary disease). These individuals may be candidates for fitness programs aimed at improving their functional work capacity. A physical therapist or physical therapy assistant needs to be prepared to offer guidance to this type of person. Generally, these exercise programs focus on a specific purpose for starting exercise. These may include stress reduction, weight management, improving physique and body image, alteration of cardiac risk factors, or enhancing functional capacity. 12

The aging population represents a large group of “well” individuals who can benefit from exercise but have a tendency to be sedentary. Specific cardiopulmonary changes occur with aging. One of the most specific cardiac changes is a decrease in safe maximum heart rate. It is well established that heart rate is inversely related to age. As one grows older, heart rate declines. At the same time, the pulmonary system demonstrates a decline in both static and dynamic measurements. However, while endurance training in the elderly cannot reduce cardiac changes, it can reduce pulmonary changes. 16

Just as an individual with cardiac or pulmonary disease needs an assessment, so does the “well” individual. This assessment should include reviewing the risk factor profile including smoking and family history. The physical therapist should evaluate the functional status of the musculoskeletal system. The performance results of an exercise stress test, body composition (percentage of body fat), strength and flexibility should also be assessed. Any preexisting conditions, such as orthopaedic abnormalities, must also be considered. An important aspect of the assessment is to determine the individual’s specific interests. Does the individual like to swim, run, or ride a bicycle? Understanding this will help the person comply with the exercise routine.
Box 10-2 presents a summary of benefits gained from aerobic and strength training programs. This type of information can be used to encourage a sedentary person to engage in a regular exercise program. However, appropriate assessment and monitoring must accompany any regular exercise.

Box 10-2

Benefits of Aerobic Exercise and Strength Training Programs*  

Benefits of an Aerobic Exercise Program
- Improvement in aerobic capacity
- Increased efficiency to extract oxygen in trained muscles
- Increase in stroke volume
- Decrease in resting heart rate
- Decrease in submaximal heart rates
- Changes in body composition (loss of fat)
- Decreased clotting factors in blood
- Decrease in resting blood pressure in hypertensive individuals
- Altered method of cholesterol transport
  - Increase in high-density lipoproteins (HDLs)
  - Slight decrease in low-density lipoproteins (LDLs)
- Decrease in various fats produced by the body
- Increase in using carbohydrates as an energy source
- Improvement in psychological well-being
  - Improved response to stress
  - Decrease in physiologic responsiveness to stimuli
  - Improved self-image
- Decrease in risk for developing heart disease owing to elimination of a number of the risk factors

Benefits of a Strength Training Program
- Increase in strength of trained muscles
- Increase in utilization of anaerobic metabolism
  - Improved ease in performing many activities of daily living especially with upper body strength training
- Increase in bone mass
- Increase in size, endurance, or both, of trained muscles
- Improvement of body image and self-esteem