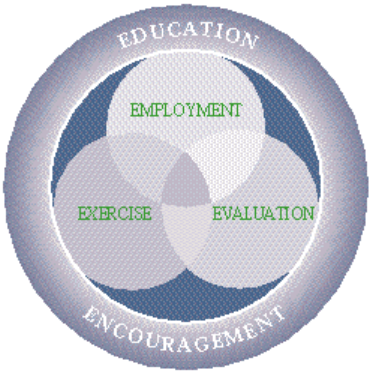
EXERCISE

FOR THE DIALYSIS PATIENT

A Prescribing Guide



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Exercise for the Dialysis Patient
A Prescription Guide

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Advisory Council: Members at Large

Christopher Blagg, MD
Northwest Kidney Centers
Seattle, Washington

Kenneth Chen, MS
Amgen Inc.
Thousand Oaks, California

Ann Compton, RN, MSN
Medical College of Virginia
Richmond, Virginia

Erwin Hytner
Safety Harbor, Florida

Nancy Kutner, PhD
Emory University
Department of Rehabilitation Medicine
Atlanta, Georgia

Bruce Lublin
Hartland, Wisconsin

Donna Mapes, DNSc, RN
Amgen Inc.
Thousand Oaks, California

Anthony Messana, BSC
Dialysis Clinics, Inc.
Nashville, Tennessee

Spero Moutsatsos, MS
ESRD Network of Florida, Inc.
Tampa, Florida

John Newmann, PhD, MPH
Health Policy Research & Analysis, Inc.
Reston, Virginia

Patricia Painter, PhD
UCSF Transplant Service
San Francisco, California

George Porter, MD
Oregon Health Sciences University
Portland, Oregon

John Sadler, MD
University of Maryland
Baltimore, Maryland

Michael Savin, PhD
Amgen Inc.
Thousand Oaks, California

Theodore Steinman, MD
Beth Israel Hospital
Boston, Massachusetts

Beth Witten, ACSW, LSCW
Johnson County Dialysis
Lenexa, Kansas

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About the Authors

Patricia Painter, PhD, is an exercise physiologist who has worked with both dialysis and transplant patients for more than ten years. She has conducted several studies about the effects of exercise on people with end-stage renal disease and has published numerous articles on the subject. She developed and tested one of the first protocols for in-center exercise programs for dialysis patients. She is currently affiliated with the University of California-San Francisco Transplant Rehabilitation Project and the Stanford Center for Research in Disease Prevention (SCRDP) at Stanford University Medical School, Palo Alto, California.

Christopher R. Blagg, MD, is Executive Director of the Northwest Kidney Centers and a Professor of Medicine in the Division of Nephrology at the University of Washington in Seattle. He is one of the founders of the Renal Physicians Association and is currently a member of the Executive Committee of the American Society of Artificial and Internal Organs. Dr. Blagg received his medical degrees and postgraduate training at the University of Leeds in England.

Geoffrey E. Moore, MD, is Medical Director, Cardiopulmonary Rehabilitation at the University of Pittsburgh Heart Institute in Pittsburgh. He is also a Fellow of the American College of Sports Medicine and former Research Associate at the Stanford Center for Research in Disease Prevention (SCRDP) at the Stanford University School of Medicine. Dr. Moore has conducted several studies concerning the effects of exercise on people with end-stage renal disease and has published articles on this subject. He received his medical degree at Southwestern Medical School.

The information in this guide is offered as general background for the clinician who is interested in encouraging patients to increase their physical activity. The guide is not intended to provide practice guidelines or specific protocols and cannot substitute for the physician's medical knowledge and experience with individual patients. Amgen Inc., the Medical Education Institute, Inc., or the authors cannot be responsible for any loss or injury sustained in connection with, or as a result of, the use of this guide.

How to Prescribe Exercise

Incorporating exercise into the medical care plan of dialysis patients offer great potential. Improvements in mental health and attitude, as well as physical functioning, are very real possibilities. Experience proves it!

Goals of Exercise

For a dialysis patient, the goal of an exercise prescription is to develop a program that safely and effectively increases physical activity and improves physical functioning.

Several standardized activities (see page 12) may be used to assess physical functioning. These activities require strength, flexibility, and agility and simulate activities of daily living. Clinicians may use the results of performance-based tests to guide their recommendations.

The types of activity that are "prescribed" vary greatly. Encouraging enjoyable physical activities will increase regular participation. Elderly patients with extremely low activity levels may respond well to the suggestion that they "do a little more" around the house. Although aerobic benefits may not be realized, low-level activities can improve confidence, flexibility, and mood.

Exploring the types of activity available to improve cardiovascular fitness, muscle strength, and flexibility can help both patients and physicians work together on a realistic exercise program.

Cardiovascular Fitness

Cardiovascular fitness can only be obtained by aerobic or cardiovascular exercise. This type of exercise puts a volume load on the heart, increasing venous return to the heart. Aerobic activities utilize large muscle groups in a rhythmic manner; walking, cycling, and swimming are examples.

Choosing an aerobic activity requires common sense; the risks of exercising outdoors in an unsafe area or in extreme weather, for example, are not worth the benefits. Indoor alternatives are often available.

Some patients find exercise bicycles to be a good way to maintain cardiovascular fitness without leaving home. Exercise bicycles are convenient and may be purchased "used" at low cost. Patients with muscle weakness or joint problems may be comfortable using an exercise bicycle because the bicycle supports their weight. This assistance may also allow them to work out for longer periods.

Water exercises can also be very beneficial. Water helps support body weight, which can be an advantage for patients who are obese or have orthopedic problems. Swimming distance is easily measured in laps, so progress can be followed. Even non-swimmers can benefit from walking against the resistance of waist-deep water. As fitness improves, walking in deeper water and moving the arms add more resistance.

There are a number of excellent water aerobics courses in many communities; they are easy on the joints, fun, motivational, and permit progress in an individualized manner.

Recommending Cardiovascular Exercise Parameters

Frequency

To improve cardiovascular fitness, the ultimate exercise goal is 30 minutes of

Activities that can be prescribed to build endurance include:

- Aerobics
- Bicycling
- Cross-country skiing
- Jogging
- Rowing
- Stair-stepping
- Swimming
- Walking

Other activities that may improve cardiovascular fitness if done at a moderate level:

- Badminton
- Basketball
- Canoeing
- Dancing
- Fencing
- Handball
- Jumping rope
- Martial Arts
- Racquetball
- Skating
- Skiing
- Soccer
- Softball
- Squash
- Table tennis
- Tennis
- Volleyball*

** A forearm protector, like those used in archery, may be helpful.*

activity three or four times per week. Ideally, patients could build up to this level of activity gradually. Realistically, however, dialysis patients just beginning to exercise may not be able to sustain even low to moderate cardiovascular activity for more than a few minutes. These individuals may benefit from several five-minute sessions each day, gradually increasing by a minute or two each day, until they are able to do a single 20-minute session. For some, this session may include several rest breaks which may decrease in length as conditioning progresses.

Duration

Exercise duration is the (recommended) length of an exercise session needed to achieve fitness benefits. Most studies have reported on sessions of 30-minute duration, three or four days a week, for cardiovascular benefits, enhanced blood pressure control, and improvement in lipoprotein and HDL cholesterol profiles. Recommended duration is often longer (up to one hour) if weight management is a goal.

For dialysis patients, duration begins with getting up to do something at *whatever* level they can. Even five minutes represents more activity than they would get sitting on the couch! The optimal prescription would suggest a gradual progression of activity – up to 30 minutes of continuous exercise.

Exercise Intensity

Perhaps the most difficult component of an exercise program to prescribe, exercise intensity outlines how hard a patient should work. It is at this point that the risks of exercise must be carefully considered. As an individual works harder (*ie*, closer to maximal capacity), the risk of precipitating a cardiovascular event increases – particularly in individuals at high risk for heart disease or with known heart disease.

Appropriate exercise intensity will depend on the patient's initial level of conditioning. A low-intensity program typically involves simply increasing routine physical activity. Prescribed activities may include gardening or just strolling down the street – moving the muscles, but not significantly increasing the work of the heart or respiratory system. This is probably the most appropriate initial exercise prescription for patients who are elderly, who have significant comorbidities, who have known cardiac disease or are at very high risk for cardiac disease, or who have been sedentary. Prescribing higher intensity exercise for these individuals may be discouraging.

A moderate exercise intensity involves activity at approximately 60% of an individual's maximal capacity, a level at which cardiovascular health benefits can be obtained. Because dialysis patients typically have a very low maximal capacity, activity at 60% does not represent tremendous exertion. Dialysis patients exercising at a moderate intensity should not sweat profusely in mild weather or become totally exhausted. Moderate exercise will increase respiration and heart rate somewhat above resting levels.

Individuals who are fairly fit and are accustomed to exercise can tolerate activity at a higher intensity (80% of maximal capacity). This is probably safe, except in cases of known heart disease. There may also be an increased risk of orthopedic or musculoskeletal problems at higher intensity.

Prescribing Exercise Intensity for Dialysis Patients

A common way to prescribe exercise intensity in healthy individuals is to recommend a target heart rate. Exercise heart rates are prescribed by calculating the age-predicted maximal heart rate (220 minus age) and multiplying by 60% to 75%. **Prescription of exercise intensity according to heart rate does not work in dialysis patients.** There are several reasons: (1) they have abnormal exercise heart rate responses; (2) medications that affect heart rate response to exercise may be prescribed and used by patients, depending on blood pressure readings; and (3) fluid status can affect heart response to exercise.

Instead of being guided by target heart rates, then, dialysis patients should learn to watch for symptoms and signs of excessive exertion.

The physician and staff may want to ensure that patients understand the following:

How to determine appropriate exercise intensity*:

- Make sure breathing is at a level where conversation is possible
- Feel complete recovery within one hour
- Start slowly, increase effort, end slowly
- Expect some mild discomfort of effort, but not pain
- Expect some mild soreness after exercise, but not so severe it prevents activity

When to discontinue exercise*:
(and re-evaluate medical status and/or program):

- When too tired to keep up the effort level
- If there is unusual shortness of breath
- If experiencing chest pains or pressure
- If nauseated
- If experiencing irregular or rapid heartbeats
- If experiencing leg cramps
- If dizzy or lightheaded during or after exercise
- If there is muscle or joint pain

Another appropriate way to prescribe exercise intensity for dialysis patients is to use a rating of perceived exertion. This rating, also called a work effort scale (see Figure 1), is an accepted and well-documented measure of subjective levels of effort. The scale ranges from 6 to 20, with effort descriptions at each level. Six is rest. The work effort is greater with progressively higher intensity exercise.

For dialysis patients, the prescription of effort should be in the 12 to 16 range: no greater than sixteen for individuals who can tolerate moderate activity; no greater than twelve for individuals in a low-intensity program.

Patients should be instructed that exercise does not have to feel hard. Instead, the exercise should be "fairly light" to start and gradually move to "somewhat hard" or "hard" as conditioning improves.

It is important to remember that day-to-day variations in endurance are normal for dialysis patients and the schedule of exercise may need to be adjusted accordingly.

Intensity Variations During Exercise

Warm-up periods are an important part of any cardiovascular exercise session. They serve to get muscles warm and get blood flowing to the working

When to exercise*:

- When temperatures are comfortable, avoiding the very hot or cold times of the day

When not to exercise*:

- When body temperature is over 101.0° F (38.3° C)
- When more than one dialysis session has been missed
- When there is a new illness that has not been diagnosed (*ie*, the person is medically unstable)
- When exercise causes pain

Signs and symptoms that should be reported to physicians*:

- Pain or pressure in chest, neck, or jaw
- Excessive fatigue, not related to lack of sleep
- Unusual shortness of breath
- Dizziness or lightheadedness during or after exercise
- Persistent rapid or irregular heart rate during or after exercise

* *Adapted from Fitness After Kidney Failure: Building Strength Through Exercise, copyright National Kidney Foundation, New York, New York, 1990, and used with permission.*

muscles. Jumping right into "somewhat hard" or "hard" exercise without warming up puts additional stress on the heart. Warming up may also help prevent dysrhythmia and muscle fatigue and can make the exercise itself feel easier.

It is equally important to cool down at the end of an exercise session. Working muscles demand increased blood flow. If an individual stops exercise abruptly after working at a "somewhat hard" or "hard" intensity, he or she will have blood pooling and may experience hypotension and dizziness that could lead to fainting.

In general, the intensity of exercise during a session should vary, starting with an easy warm-up for three to four minutes (low-level, very slow biking, walking) that feels "very light" on the scale. After the warm-up, the patient should eventually aim for "somewhat hard" or "hard" (12 to 16 on the scale) intensity activity lasting 30 minutes. Some people may want to push for higher levels of exertion for short periods. At the end of the session, there should be two or three minutes of "very light" cool-down.

Muscle Strengthening

Muscle strength is increased by placing an overload on the muscle. Overloading is achieved by making the muscle work harder than it is used to working. In strength training this means generating more force. The appropriate amount of resistance will depend on the initial strength of the muscle. Strengthening exercise may be particularly important for individuals who are elderly or for those who have lost significant muscle mass.

The primary concern with resistance training is the risk of orthopedic or musculoskeletal problems, especially in dialysis patients with bone disease. There is an additional concern related to excessive blood pressure responses, with high-intensity resistance training. It is recommended that individuals with poorly controlled hypertension use only very light weights (with increased repetitions) and avoid high-intensity strength training.

Figure 1. Work Effort Scale

6	Rest	
7	Very, Very Light	
8 9	Very Light	Warm-Up & Cool-Down
10 11	Fairly Light	
12 13	Somewhat Hard	Conditioning
14 15 16	Hard	
17 18	Very Hard	
19 20	Very, Very Hard	Slow Down!

How To Use This Scale

This scale can be used to monitor exercise intensity or work effort. Use the number six to rate the level of work you do while sitting in a chair at rest. When you exercise faster or harder, the work will feel harder to you. Use this scale to rate how hard it feels to you. Monitor your feelings of exertion throughout your exercise session.

Your warm-up should feel "Very Light" (rating of 8 - 9 on the scale). After your warm-up, increase your effort (by walking faster, pedaling against resistance, swinging your arms, etc.) until it feels "Somewhat Hard" or "Hard" (rating of 12 - 16 on the scale.) If your effort seems "Very Hard" or "Very, Very Hard," slow down! End your exercise with a cool-down period that feels "Very Light" (8 -9 on the scale).

A prescription for muscle strengthening can range from calisthenics-type exercises, to use of a Thera-Band®, hand weights, ankle weights, or multi-station resistance machines.

Calisthenics

Resistance training must be individualized. It may be helpful to begin with a physical therapy referral to design a program of calisthenics-type exercise that uses body weight against gravity as resistance, especially for people who are very unaccustomed to exercise and who are very weak. When the patient is ready, a follow-up program can be designed for independent use at home.

Hand Weights

Once an individual can do more than 10 repetitions of each calisthenics exercise, the next step is to add small hand weights or Thera-Band® exercises. Dialysis patients should begin with a weight that they can comfortably lift 10 or 12 times. Weight training first progresses by increasing the number of *times* the weight is lifted (repetitions). When the patient can do 10 or 12 repetitions of each of the exercises prescribed (one set), he or she should gradually work up to doing two sets and then three. After the patient is routinely doing three sets of 10 or 12 repetitions, it is time to increase the weight by one or two pounds. Small hand weights can be purchased inexpensively at sporting goods stores (often $.50/lb), or soup cans, syrup jugs, detergent bottles filled with water, socks filled with coins, or other household objects may be used.

Thera-Band®

Thera-Bands are stretchy strips of material available for sale by the yard at sporting goods and medical supply stores. Thera-Bands come in varying levels of resistance and are gentle to the muscles. The muscle movements in Thera-Band exercises are exactly the same as those done with hand weights.

Resistance Machines

Dialysis patients who begin to use weight machines should use only the lightest weight setting for the first several sessions to determine how well they tolerate the resistance. If their muscles are adapted to the movement and to the weight, and if they are lifting the weights properly, they can then move up to the next weight. Any increase in the amount of weight lifted should come very slowly and gradually. Particularly in patients with known bone disease or patients who have not adhered to their phosphate binder regimen, there is a risk of tendon rupture with sudden, heavy weight lifting. Using light weights with additional repetitions is probably most appropriate.

Flexibility

Flexibility is improved through calisthenics, which stretch muscles gently and gradually. These exercises are important for increasing range of motion and facilitating the reaching, bending, and lifting activities of daily living. Gentle stretching may also help prevent muscle pulls or tears during other activities – either daily living, recreational, or associated with an exercise training program. Illustrated flexibility exercises are included in *A Guide for People on Dialysis*.

Thera-Band is a registered trademark of The Hygenic Corporation.

Special Exercise Concerns in the Dialysis Population

When possible, it is best to recommend that patients establish an exercise routine.

For Hemodialysis Patients

Hemodialysis patients may be most comfortable, have the most normal metabolic/physiological conditions, and respond most appropriately to exercise on the day after dialysis. During the first hour or two following dialysis, patients may feel fatigued and uncomfortable. After dialysis removes fluid, the cardiovascular system compensates by vascular constriction to maintain blood pressure. Exercise causes vasodilation, which could result in hypotension. This is especially true of maximal testing done immediately after dialysis.

In general, then, high-intensity exercise is not appropriate right after dialysis. Scheduling exercise on nondialysis days is an obvious solution. Stable patients who adhere to diet and fluid regimens can exercise at moderate intensity on dialysis days.

Individuals who gain excessive amounts of weight between dialysis treatments probably should avoid exercise immediately *before* dialysis because they already have additional cardiac stress from the extra fluid. Particular care must also be taken with individuals who have problems maintaining a stable potassium level or who are noncompliant with their diet.

For CAPD Patients

CAPD patients may feel more comfortable if they drain fluid out of the abdomen and exercise when they are empty or partially empty, to permit optimal diaphragm expansion. Attempting to exercise with a full abdomen increases intra-abdominal pressure and may compromise the catheter, causing leaks. Mechanisms can be developed to clamp off the tubing so patients can exercise empty, then continue with the exchange after the session.

CAPD patients can use an exercise bicycle even with the bag attached – of course it is vital to keep the bag away from the pedals. Swimming is also possible, with extra effort to cover the catheter site and clean it diligently afterward to prevent infection. Choice of swimming site is important. Sea water and chlorinated pool water have less bacteria than freshwater lakes or ponds.

For Nonambulatory Patients

Exercise modes may have to be modified to facilitate exercise for patients who cannot walk. Patients who have lower extremity amputations should be referred to physical therapy for design of an appropriate program that utilizes the patient's remaining capabilities or employs altered equipment (such as an exercise bicycle) so that a patient with an amputation can use it safely. Many upper body exercises for strengthening and flexibility can be done in a seated position.

For Patients with Diabetes*

Daily exercise can play an important role in glucose management for patients with all types of diabetes. Exercise facilitates rapid uptake of glucose into the muscles, and, like insulin, lowers the level of glucose in the blood. The magnitude of change in blood glucose level induced by exercise will vary depending on exercise intensity, duration, and the individual patient.

** For more information, refer to The Fitness Book for People with Diabetes, Guyton Homsby, Jr (ed), American Diabetes Assn. Council on Exercise, 1994.*

For the most part, diabetic dialysis patients exercise at very low intensity and are unable to exercise for long periods of time. Therefore, exercise-induced changes in blood glucose levels may not be significant.

As patients become more fit and increase exercise intensity and duration, close monitoring of blood glucose may be required. Physicians and patients will need to note the timing of medications, insulin administration, and food intake as well as blood glucose levels before and after exercise. This is especially important if exercise sessions are longer than one hour. A comparison of pre- and post-exercise blood glucose levels will reveal changes and aid in glucose management.

If blood glucose falls dramatically, then food intake prior to exercise may be recommended. In general, an additional 15 to 30 grams of carbohydrates for every hour of exercise may be required.

If blood glucose level prior to exercise is greater than 250 mg/dL and ketones are present, exercise is contraindicated on that day. Exercise may exacerbate the glucose imbalance, and glucose control should be improved before beginning exercise.

If blood glucose is lower than 100 mg/dL, exercise should be deferred since the risk of hypoglycemia is great. In most situations, patients can eat carbohydrates and allow blood glucose to increase before beginning the exercise session.

Risk of Hypoglycemia

Hypoglycemia can occur during exercise or up to 24 hours following exercise. To counteract this response, the diabetic patient may need to reduce insulin dosage or increase carbohydrate intake prior to exercising. Patients need to be cautioned that exercise may have prolonged effects on glucose uptake.

The risk of exercise-induced hypoglycemia may be minimized if patients take the following precautions:

- Monitor blood glucose frequently when initiating an exercise program to determine patient response. Note that changes induced by low level activities may be less than changes associated with more intense activities or longer exercise sessions
- Decrease insulin dose by 1 to 2 units as prescribed by the physician, or increase carbohydrate intake (10 to15 grams per one-half hour of exercise) prior to each exercise session
- Inject insulin into an area, such as, the abdomen, that is not active during exercise
- Avoid exercise during periods of maximum insulin activity
- Eat carbohydrate snacks before and during prolonged exercise sessions (*ie*, greater than 60 minutes)
- Know the signs and symptoms of hypoglycemia. (Patients who take beta-blockers may be unable to experience symptoms and must closely monitor changes in blood glucose levels)
- Exercise with a partner

Recommended exercise intensity for patients with diabetes is similar to recommended intensity for other patients, ie., between 40% to 80% of peak exercise capacity. Patients should use the Work Effort Scale (pg 6) to gauge intensity.

For insulin-dependent diabetics, an exercise program that calls for frequent

(daily) exercise sessions of short duration (20 to 30 minutes) may be preferred. For noninsulin-dependent diabetics, caloric expenditure will be optimized in an exercise program that calls for less frequent exercise sessions of longer duration (40 to 60 minutes).

Exercise is contraindicated for diabetic patients with an active retinal hemorrhage or recent treatment for retinopathy (*eg*., laser treatments). Patients with retinopathy should not perform activities that cause excessive jarring or marked increases in blood pressure. Therefore, any weight training for these patients should avoid use of heavy weights.

For Patients with Bone or Joint Disease

Individuals with bone disease, joint problems, or orthopedic problems should avoid activities such as jogging, heavy weight training, and high-impact aerobic dance. Individuals who begin to experience joint discomfort in their exercise training program may have to change to a nonweight-bearing activity such as cycling or swimming.

It is possible to develop increased flexibility and muscle strength despite renal bone disease. However, patients with bone disease may be at high risk for fractures or tendon ruptures, since the connections at the tendon level and bone level may be weakened. In addition to avoiding high-impact activities, these patients should not attempt significant grades on a treadmill that would put tremendous stress on the Achilles tendon. Very light weight training, strengthening, and resistance exercises will probably be well tolerated and may prevent or slow the progression of bone disease.

For Patients with Cardiovascular Disease

Patients with coronary artery disease and angina are at higher risk for cardiac events during exercise. It is important to assess these individuals thoroughly and initiate appropriate medical or surgical therapy before permitting them to start on a vigorous exercise program. Cardiac rehabilitation programs are specifically designed to provide exercise monitoring and supervision for individuals with cardiac disease, myocardial infarction, angina, angioplasty, mild valvular disease, or bypass surgery. Medicare does cover cardiac rehabilitation for many patients.

If appropriate, patients can be discharged to exercise independently at home or in supervised exercise at a YMCA or other community program. Many cardiac rehabilitation programs "graduate" patients into a program where they are minimally supervised.

Aerobic exercise that puts an increased volume/pressure load on the heart is probably *contraindicated* for individuals with severe valvular disease. Medical management of the valvular disease and/or surgical treatment may be indicated, depending on the medical plan for the patient. If the valvular disease is mild, the patient may benefit from exercise training. However, if regurgitation or insufficiency increases with exercise, as evidenced by exercise echocardiography, exercise training is probably not appropriate. If there is no change with exercise, the patient is probably fairly stable with exercise and will probably tolerate it well.

Patients with a pericardial effusion should not exercise if the effusion is large. Appropriate medical management should be initiated and the effusion resolved before an exercise training program is initiated. Small effusions should not prohibit low-level exercise.

Finally, an individual in congestive heart failure due to volume overload associated with inadequate dialysis, or who is just starting dialysis, should be adequately dialyzed and have fluid balance stabilized before starting an exercise training program.

For Blind Patients

Blind patients can be physically active. The dialysis unit may want to seek out special programs for the blind, but, in general, use of an exercise bike or pool can be appropriate. Vision is not necessary for use of an exercise bicycle; listening to television or audiotapes may make the exercise more interesting. Walking is also a possibility for patients with guide dogs or walking companions or on a treadmill with handrails.

For Patients with Neuropathy

Foot care is always a concern for any patient with neuropathy. These patients must be taught to inspect their feet daily, maintain good hygiene, and wear appropriate socks and shoes. It may be advisable for patients with neuropathy to wear aqua-shoes, reef-walkers, or other protective footwear when participating in water exercise because they may not feel their feet hitting the bottom of the pool.

Performance Based Tests

Physicians and staff who want to assess their patients' physical functioning or establish baseline performance measures prior to the start of an exercise program may consider conducting one or more of these performance-based tests.

Please Note: These tests have not been validated, nor is there currently any data that show that these tests can measure change resulting from any exercise intervention.

Sit to Stand Test

This test is performed using a standard chair (46 cm height). Subjects sit down, then stand completely, then sit down again as many times as possible in a period of one minute.

Walking Performance

This test is performed on a marked distance (indoors) of 20 feet. Patients first walk the distance at the "normal comfortable speed," then again at their "maximum safe speed without running." The time required to traverse the 20 feet each time can be recorded.

Stair Climbing

Stair climbing ability is assessed by scoring three components.

The first component is assistance, which has five categories:

0 = fully dependent;
1 = requires maximum assistance *(assistance effort > subject effort);*
2 = requires moderate assistance *(subject effort > assistant effort);*
3 = requires minimum assistance *(touch or light help);* and
4 = requires no physical assistance.

The second component is handrail use, which has two categories:

0 = requires handrail;
1 = does not require handrail.

The third component is stair climbing, which has two categories:

0 = does not alternate steps; and
1 = alternates steps.

The highest possible score is 6. Higher scores indicate higher physical functioning.

Lift/Reach

This is a test of upper extremity strength and endurance. The patient stands facing a table with two shelves above it – one at shoulder height and the second slightly above the head. The patient lifts an object that weighs 25% of the patient's body weight. The patient lifts the object from the table to the first shelf then to the second shelf. The number of lifts performed in one minute can be recorded.

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