Geriatric Rehabilitation. 3. Physical Medicine and Rehabilitation Interventions for Common Disabling Disorders

Randolph L. Roig, MD, Gregory M. Worsowicz, MD, MBA, Deborah G. Stewart, MD, David X. Cifu, MD


This self-directed learning module highlights physical medicine and rehabilitation (PM&R) interventions for common disorders that cause disability in older adults. It is part of the study guide on geriatric rehabilitation in the Self-Directed Physiatric Education Program for practitioners and trainees in PM&R and geriatric medicine. This article specifically focuses on PM&R interventions for arthritides, fractures, cardiovascular disorders, peripheral vascular disease, amputations, pulmonary disorders, cancer, stroke, traumatic brain injury, Parkinson’s disease, spinal cord injury, peripheral neuropathies, and diabetic complications.

Overall Article Objective: To summarize the physical medicine and rehabilitation interventions for commonly disabling conditions of older adults.

Key Words: Disabled persons; Geriatrics; Rehabilitation.
© 2004 by the American Academy of Physical Medicine and Rehabilitation

3.1 Educational Activity: To differentiate the nonpharmacologic management approach for gait instability in a 72-year-old avid gardener with degenerative arthritis, comparing it with inflammatory arthritis.

OSTEOARTHRITIS (OA) IS THE MAJOR disease that limits activities in elderly persons. By age 60, 100% have histologic changes of degeneration, 40% report arthritis, and 10% have activity limitations.1 Arthritis management focuses on reducing the risk for functional dependency. Regular exercise does not exacerbate pain or accelerate disease progression.2 In fact, evidence suggests that appropriate exercise can prevent and treat some arthritic disabilities.3,4 Exercise programs should be specifically tailored to the patient and should include him/her in creating the plan. Early patient involvement optimizes safety and increases compliance. The plan should initially focus on the patient’s most important functional problems. As these improve, a more generalized fitness program can be added.2 The few contraindications to exercise, such as acute and unstable cardiovascular conditions, are usually temporary.5 Although our patient’s gait instability requires safety planning, it is actually an indication for an exercise program. Approximately 20% of falls are caused by gait instability, a problem that can be rectified through strength and balance training programs.6 Research7 into high-intensity, progressive-resistance training in patients with rheumatoid arthritis (RA) showed no increase in the number of painful or swollen joints and showed reduced self-reported pain scores, fatigue scores, 50-ft (15.24-m) walking times, and balance. Low-load, high-repetition, resistive muscle training increased self-reported functional capacity and was a clinically safe form of exercise in persons with functional class 2 and 3 RA (mean duration, 10.5y).8

Compared with range of motion exercise, aerobic exercise, such as walking or aquatics, in both RA and OA patients, is reported to increase aerobic capacity and 50-ft walking time while decreasing depression and anxiety.4 No difference existed between the groups for flexibility, number of clinically active joints, duration of morning stiffness, or grip strength.9 Research on OA has revealed risk factors, some of which are preventable. After increased age, obesity is the strongest risk factor for knee arthritis. By losing just 4.5kg (10lb), a person can reduce his/her risk of developing symptomatic OA by 50%. In addition to obesity, quadriceps weakness, poor proprioception, heavy physical activity, lack of estrogen replacement therapy (in women), and knee injuries are all preventable risk factors in the development of symptomatic OA. A variety of nonpharmaceutical treatments have proven effective in managing OA: quadriceps strengthening, aerobic exercise programs, education and social support, well-cushioned and customized footwear, canes and assistive devices, icing, and heating pads.1

3.2 Clinical Activity: To analyze the challenges faced by an 80-year-old woman with multiple fractures after a motor vehicle crash.

Motor vehicle crashes (MVCs) that injure older adults, unlike the high-speed collisions typical of young adults, are most commonly low-speed collisions. Despite this lowered velocity at impact, older adults are more likely to die as a result of injuries sustained in MVCs. Collisions that are not initially fatal but that do result in severe trauma are 6 times more likely to cause intracerebral lesions than severe chest, abdominal, or pelvic injury in people over age 70 compared with crash survivors younger than 40 years.8

Appropriate exercise for the given fracture is vital to recovery. The most studied fracture in the elderly is the proximal femur. Rehabilitation of hip fractures and joint replacements has been well described and is a cornerstone of the field. Reviews are abundant.11 In addition to functionally based inpatient, outpatient, and home health rehabilitation programs, additional focus on lower-extremity strength training is also beneficial. Progressive high-intensity quadriceps training produces increased extensor power and reduced disability in these patients.12 Patients with acute hip fractures who performed a daily, home-based program of weight-bearing exercises for 1 month showed significantly greater quadriceps strength in the
affected (hip-fractured) leg and had greater walking velocity than nonexercisers. The exercisers also improved their weight-bearing ability and (subjectively) reported reduced risk of falls. For proximal femur fracture, inpatient rehabilitation may be especially useful. A delay in transfer to a rehabilitation ward is associated with a disproportionate increase in total hospital stay for patients over the age of 75. In patients with known primary tumor or acute fracture after minor trauma, the possibility of a pathologic fracture should be considered.

Emotional health is extremely important in predicting recovery of functional ability 1 year after a bodily insult such as hip fracture, and studies have suggested that reducing depressive symptoms and increasing positive affect may aid recovery. A serious fracture in an elderly woman may cause severe anxiety and fear of impending death. Long-term management of anxiety includes education, exercise, and empowerment (involvement in her rehabilitation plan). Instruction in exercise, nutrition, and osteoporosis education was shown to reduce both depression and anxiety in a 4-day outpatient program for elderly patients.

The social impact of multiple fractures and a lengthy healing process are also severe. Valuable social roles involving the family, community, and workplace may be lost at least temporarily. Failure to function in social roles can lead to isolation and great stress. Efforts to preserve social roles or to redelegate them in meaningful ways are part of rehabilitation for multiple fractures.

Attention to prevention of venous thromboembolism (VTE) is also vital. Trauma, hip fractures, and major orthopedic surgery all present high risk for VTEs (25%-50%), which is even higher with increasing age. Evidence strongly supports use of prophylaxis, which most doctors report using, but studies show that only one third of high-risk patients actually receive prophylaxis in the hospital. The appropriate prophylaxis for VTE after hip fracture or joint replacement is full anticoagulation with warfarin (international normalized ratio, 2–2.5) or appropriate dosing of low-molecular-weight heparin (LMWH). Although considerable regional variation exists, studies show that appropriate use of warfarin or LMWH reduces risk of death after hip fracture. Intermittent compression devices and compressive stockings have limited efficacy for VTE but are useful for edema management. Aspirin has proven effective for VTE prevention and should have no role. Venous cava filters are expensive, and, although they reduce early pulmonary emboli, they do not prevent recurrent VTE. Despite adequate prophylaxis, patients undergoing surgery for hip fracture remain at significant risk to develop proximal deep vein thrombosis, which prolongs rehabilitation time and increases mortality rates. Recent research supports use of Doppler sonography to screen patients receiving prophylaxis. However, the economic cost-benefit analysis of this practice is unclear.

During her rehabilitation, skin breakdown may result from pressure, shearing forces, friction, and moisture. Preventive measures can significantly reduce the incidence of pressure ulcers. Successful management should address these etiologic factors as well as the general condition of the patient. Risk factors include prolonged immobilization, circulatory disturbances, poor nutrition, and sensory deficits—all potential effects of fractures in the elderly.

3.3 Clinical Activity: To design an exercise program for an 85-year-old retired executive, with a history of myocardial infarction, who now has claudication in the lower extremities.

Cardiovascular disease (CVD) rehabilitation in elderly persons can be particularly challenging. In older patients with underlying heart disease, acute vigorous physical exertion may trigger sudden death or myocardial infarction, particularly in people not accustomed to such activity. Adequate screening and evaluation are important to identify and counsel patients with underlying CVD before they begin exercising. For example, the American College of Sports Medicine recommends that men over 40 and women over 50 undergo exercise stress testing before starting a vigorous exercise program. Furthermore, fall risk must be considered when prescribing aerobic exercise. With these concerns, primary care clinicians are often hesitant to prescribe exercise for elderly patients with CVD. By individualizing the exercise prescription for each patient, risks can be greatly reduced. Our patient with intermittent claudication, for example, should be instructed to exercise to pain tolerance, with only very gradual increase in exercise duration, with an emphasis on duration, not intensity.

After myocardial infarction or coronary artery bypass grafting, a submaximal exercise test can be performed for further risk stratification before hospital discharge. This test is not used for exercise prescription. Based on the patient’s recovery, wound healing, and medical status, a symptom-limited exercise stress test should be performed after 6 weeks. Test results will be helpful in prescribing an aerobic exercise program. In the elderly patient, dyspnea, with or without angina, may be a symptom of myocardial ischemia. Seventy percent of patients over the age of 70 years may have abnormal stress tests with asymptomatic ischemia. The treadmill exercise test may not be an option for the elderly patient because of preexisting lower-extremity disability, balance, or tolerance issues. Modifications for exercise testing and chemical stress tests (eg, Persantine-thallium stress test) should be considered.

Physical activity and exercise may ameliorate disease and delay functional decline in the geriatric population. Exercise can improve body composition, diminish falls, increase strength, reduce depression, reduce arthritis pain, reduce risks for diabetes and coronary artery disease (CAD), and improve longevity. Physiologic studies consistently support exercise interventions. For example, peak oxygen uptake (V̇O₂peak) is the most powerful predictor of cardiac and all-cause mortality for cardiac patients. A person’s V̇O₂peak increases with aerobic conditioning and thus improves prognosis after cardiac insult.

The very high rates of both disability and recurrent coronary events seen in older patients with CAD can be reduced with exercise. Disability rates are particularly high in women and in all persons older than 75 years. Despite the high levels of disability in older patients with CAD, physicians are less likely to refer these patients than younger patients to cardiac rehabilitation programs. The American Heart Association and the American College of Cardiology recently released secondary prevention guidelines to help physicians. Contemporary programs focus on all aspects of secondary prevention including clinical assessment and monitoring, supervised exercise, nutritional counseling, smoking cessation support, stress management, and other healthy behaviors. Poor compliance with cardiac rehabilitation is a multifactorial problem in the elderly, but several studies indicate that the most important predictor of participation is specific and direct endorsement from the physician.
3.4 Clinical Activity: To design a rehabilitation program for a 75-year-old woman with newly diagnosed lung cancer and chronic obstructive pulmonary disease, who complains of shortness of breath after ambulating 1 block.

Chronic obstructive pulmonary disease (COPD) is a major cause of hospitalization, morbidity, and decreased function in the elderly. Functional limitations caused by dyspnea and subsequent anxiety can lead to progressively decreased activity and further functional disability. Essential components of successful rehabilitation programs include appropriate medical management, necessary oxygen supplementation, education on breathing techniques, exercise training, nutritional evaluation, and psychosocial and stress (depression, anxiety) management. Oxygenation at rest and during exercise must be monitored for the need for oxygen supplementation. Oxygen supplementation may be required with exercise to achieve muscle-training effects. In general, low-dose oxygen supplementation is appropriate to maintain arterial oxygenation at no less than 85% saturation. However, because people with COPD on oxygen supplementation have a propensity to retain carbon dioxide and thus potentially diminish their respiratory drive, their arterial carbon dioxide levels must be closely monitored. Exercise programs increase endurance, decrease perceived dyspnea, increase quality of life (QOL), and increase self-efficacy.

Cancer is becoming an increasingly common diagnosis in patients requiring rehabilitation services. It is essential to give attention to the disease's effects (both end organ and systemic), the patient's prognosis, the cancer treatments and their potential side effects, and the patient's goals if one is to design an appropriate rehabilitation program. Reviews on the management of oncologic rehabilitation issues have been published.

Inpatient and outpatient pulmonary rehabilitation programs require the coordination of multiple professionals working within the interdisciplinary team model. Inpatient pulmonary programs have been shown to increase a patient's walking distance, decrease required oxygen supplementation (both during the day and at night), increase QOL, increase knowledge of the disease process, and decrease future rehospitalization. Benefits of outpatient programs include an increase in VO2 maximum, improved endurance as measured by better performance in the 12-minute walk test, an increase in cardiac work capacity, increased forced vital capacity, a decrease in dyspnea, and improved function in activities of daily life (ADLs).

3.5 Educational Activity: To justify a rehabilitation program for a 75-year-old widow with Parkinson's disease in an assisted-living center. Contrast your recommendations if she had been newly diagnosed with a stroke, traumatic brain injury, or spinal cord injury.

The efficacy of inpatient and outpatient interdisciplinary rehabilitation services for older adults with new onset of disability from stroke, traumatic brain injury (TBI), or spinal cord injury (SCI) has been shown, and age-specific differences in rehabilitation outcomes have been examined in these diagnoses. However, the influence of Parkinson's disease (PD) as a concurrent morbidity on outcome after a new neurologic insult has not been specifically studied. Specific therapy interventions, intensity and duration of services, treatment settings, and goal setting must be modified in accordance with the severity of the PD.

PD is a progressive neurologic disease resulting from a reduction in the release of dopamine within the striatum of the basal ganglia. In the older adult population, 1% suffers from PD, which has a prevalence of 128 to 187 per 100,000 and an incidence of 20 per 100,000 in the United States. Symptoms are varied and include tremor, rigidity, bradykinesia, akinesia, postural abnormalities, hypokinetic dystardia, and dementia. Rehabilitation interventions are diverse and depend on the clinical findings. A critical review of the exercise therapy literature supports the efficacy of several different types of physical and occupational therapies for improving ADLs, independence, and walking ability (walking speed, stride length) but not for neurologic symptoms or QOL. A descriptive review of the speech and language pathology similarly supports the efficacy of speech therapy for improving voice and speech function. Education regarding appropriate dietary modifications and swallowing techniques (eg, chin tuck, head positioning) has also been reported to assist in dysphagia with PD.

There is no available literature that critically examines the specific efficacy of interdisciplinary rehabilitation services (inpatient or outpatient) on functional limitations because of PD. Stroke occurs most commonly in the older adult, with nearly 75% of all strokes occurring in people at or over the age of 65 years. A person's risk for stroke doubles with each decade of life after age 55. Stroke rehabilitation has been shown to improve outcomes while decreasing morbidity and mortality: compared with their younger cohorts, older adults require longer lengths of rehabilitation stays, show slower and less overall functional improvements, and need nursing home placement at discharge more frequently.

Unlike their younger cohorts, older adults sustain the majority of TBIs and SCIs in domestic falls. Older adults with concomitant PD are at an extremely high risk for falls. The factors that contribute to fall risk also predispose the elderly to motor vehicle, pedestrian, and recreational accidents, all of which may result in TBI or SCI. The decrease in reaction time and speed of ambulation commonly seen in the older adult additionally predisposes them to MVCs and pedestrian MVCs, respectively. Strategies for injury prevention include consistent primary physician care to manage medical morbidities, regulate medications, and provide ongoing education. Additionally, focused rehabilitation interventions can be used to maximize physical abilities (gait, balance, strength), procure adaptive and assistive devices (canes, walkers, handicap parking stickers), and provide education. Finally, efforts to reduce violence against older adults are necessary to prevent this increasing cause of injury.

Most of our knowledge about outcomes of older adults with TBI or SCI comes from studies involving all age groups. These investigations report the strong associations between increasing age and mortality. Injury severity—matched analyses of data from the National Institute on Disability and Rehabilitation Research Traumatic Brain Injury Model Systems and the Model Spinal Cord Injury Systems projects reveal age-specific differences in older adults.48 These analyses show that in older adults with traumatic central neurologic injuries, improvements in neurologic and functional status and successful return to home are common and achievable with rehabilitation. An injury severity—matched investigation in TBI revealed that people 55 years and older had twice the rehabilitation length of stay (LOS) and costs, half the rate of functional recovery, greater cognitive impairment at discharge, and twice the nursing home placement rate of people who were 50 years and younger. At discharge, the level of physical impairment was comparable for the 2 groups. The association between age and outcome is quite complex and appears closely related to injury severity as measured by the patient's score on the motor
Glasgow Coma Scale, duration of coma, duration of posttraumatic amnesia, history of alcohol intake, postinjury behavior (eg, presence of depression and/or agitation), and a variety of formal and informal social support factors. 

Injury severity–matched investigations in SCI revealed that subjects 55 years and older with paraplegia had increased rehabilitation LOS and less functional recovery and efficiency than subjects who were 50 years and younger. No differences in acute care LOS, nursing home placement or neurologic recovery were noted. Subjects 55 years and older with tetraplegia had an increased nursing home placement rate, a decrease in neurologic recovery, and a decrease in functional recovery and efficiency than subjects who were 50 years and younger. No differences in rehabilitation and acute care LOS or nursing home placement were noted.

3.6 Clinical Activity: To evaluate an 80-year-old diabetic man who has complaints of bilateral lower-extremity numbness.

Age-related changes of skin, muscle, and the peripheral nervous system (PNS) can make the diagnosis of a concurrent peripheral neuropathy challenging. These systems undergo a "normal" decrement in function with the aging process. These age-related changes can be observed clinically, anatomically, and electrophysiologically. Normal changes of skin integrity, muscle atrophy, and weakness may be difficult to distinguish from foot deformity, pain, skin ulceration, and decreased mobility associated with a peripheral neuropathy. Electrophysiologic studies demonstrate slowed nerve conduction and decreased motor- and sensory-evoked responses in the elderly.

The aging PNS is more susceptible to neuropathies caused by toxins, drugs, nutritional deficiencies, alcohol use, RA, carotenodermatous disease, and other causes of peripheral neuropathy. 

Evidence of callus formation, tight heel cords, hammer toes, and muscle imbalances of the foot must be assessed. Clinical findings of decreased ankle jerks, decreased vibratory sensation, atrophic skin changes, muscle weakness (proximal greater than distal), and muscle atrophy may be part of the aging process. However, absence of Achilles' and patellar reflexes, alteration in lower-extremity vibratory sensation, and decreased toe position sense may be abnormal signs, indicative of a concomitant peripheral neuropathy and not just signs of normal aging. Electrophysiologic studies consistent with peripheral neuropathy have been found in elderly patients with 2 of the 3 clinical findings of absent Achilles' reflex, abnormal vibratory sensation, or altered position sense in the lower extremities. This distinction between normal aging and an underlying peripheral neuropathy is important for clarifying the diagnosis. 

Associated peripheral vascular disease (PVD) and its severity must also be recognized because it will affect activity tolerance and future wound healing. Full evaluation of PVD and its treatment have been documented.

Treatment plans must include appropriate medical management, proper skin care, and appropriate footwear. Frequent skin inspections and hygienic nail care by the patient or his/her caregiver should be done on a regular basis. Footwear modifications, such as extra-depth shoes with custom inserts (to appropriately distribute plantar weight-bearing surfaces) and/or toe box adjustments (to accommodate hammer toes), should be evaluated. Diabetic foot care and education is critical because 15% of people with diabetes will develop some type of foot ulcer. People with diabetes with chronic ulcers have a 70% to 80% rate of requiring an amputation. People with diabetes are 15 to 17 times more likely to require amputation than the general population and have a 3-year survival rate of 25% to 50% at the time of amputation. People who undergo an amputation will require extensive rehabilitation services.

Proper treatment and management of diabetic-related lower-extremity amputation impacts the amputee and the entire health care system. The US Department of Health and Human Services has published in Healthy People 2010 its goal of decreasing diabetes-related lower-extremity amputation from 41.0 to 18.0 per 10,000 diabetic persons by the year 2010. The World Health Organization and the International Diabetes Federation have set a goal of reducing diabetes-related amputations by 50% over 5 years.

3.7 Clinical Activity: To design rehabilitation interventions for a 70-year-old hypertensive woman with known CAD presenting to your office with shoulder pain.

Concurrent morbidity or comorbidity is the presence of multiple pathologic conditions in the same patient. Such conditions as arthritis (50%-64%), hypertension (41%-48%), heart disease (19%-25%), cancer (17%-23%), and diabetes mellitus (12%-13%) are more common in people over the age of 70 years. 

Selected medical management of common comorbidities is covered in a review by Lin and Armour. In managing geriatric patients, it is imperative to account for the impact of comorbidity. The presence of comorbid conditions affects the degree of disability, likely outcome or prognosis, and the therapeutic options available. Comorbidity correlates with disability and the more comorbid conditions a patient has, the greater the severity of the disability. In addition to the number of chronic conditions, the severity of the condition is also pivotal in predicting disability. LOS for hospitalized stroke patients in the Copenhagen Stroke Study did not correlate with comorbidity. However, other investigators showed that charge per hospital day is affected by medical comorbidities. In stroke patients, comorbidities are associated with older age, more days from onset to rehabilitation admission, and more severe functional impairment.

Comorbidity is also an important determinant in the formula used for the rehabilitation prospective payment system implemented by Centers for Medicare and Medicaid Services in January 2002. Each of the rehabilitation impairment categories can be further defined by 3 tiers, which characterize the burden of care, by accounting for comorbidities and other factors such as age and functional measures. Utilization review processes, such as InterQual, also use comorbid conditions as necessary components for certain diagnoses to qualify for various levels of care.

Providing a rehabilitation prescription for geriatric patients necessitates factoring in the primary diagnosis, comorbid conditions, effects of aging and disuse, as well as social factors, which can affect outcome.

References
