Geriatric Rehabilitation. 4. Physical Medicine and Rehabilitation Interventions for Common Age-Related Disorders and Geriatric Syndromes

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This self-directed learning module highlights physical medicine and rehabilitation (PM&R) interventions for age-related physiologic changes. 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 (including exercise) for mobility alterations, activities of daily living alterations, osteoporosis, cognitive and behavioral changes, bladder changes, and bowel changes.

**Overall Article Objective:** To summarize the physical medicine and rehabilitation interventions for age-related physiologic changes.

**Key Words:** Activities of daily living; Behavior; Bladder; Bowel; Cognition; Disability; Exercise; Geriatrics; Osteoporosis; Rehabilitation.

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4.1 Clinical Activity: To analyze the long-term health implications for a 70-year-old woman whose bone mineral density is 2.5 standard deviations or more below the young adult mean.

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**Osteoporosis** is a systemic disease that affects primarily postmenopausal women. It is characterized by low bone mass and other abnormalities of bone tissue, leading to bone fragility and an increased susceptibility to fractures, especially of the hip, spine, and wrist. The incidence varies by both ethnicity and geography. The age-adjusted incidence is higher among white women in Scandinavia than in women of comparable age in Oceania (islands of the Central and the South Pacific). Variations in incidence are evident in the United States, with the highest rates seen in the southeastern United States. The estimated lifetime risk of hip fracture for a 50-year-old white woman in the United States is 17%, whereas it is only 6% for a white man of the same age. Importantly, osteoporosis in men is underrecognized. The specific evaluation and treatment of osteoporosis in men is covered by Lim et al. Fractures of the vertebrae (spine), proximal femur (hip), and radius (distal forearm) are considered to be quintessential osteoporotic fractures and commonly occur with only mild or moderate trauma. Osteoporosis can also limit mobility by increasing the fear of falling, an event that leads to many of the side effects of immobility (see Educational Activities 4.4 and 4.5).

**Diagnosis categorization of osteoporosis is based on the World Health Organization and International Osteoporosis Foundation criteria.** A T score is based on the expected distribution of bone mineral density (BMD) for "young, normal" adults of the same sex, with the difference expressed as a standard deviation (SD) above or below the mean. There are 3 categories: (1) osteopenia or low bone mass: hip BMD greater than 1 SD below the young adult female mean (T score, <−1 and ≥−2.5); (2) osteoporosis: hip BMD 2.5 SDs or more below the young adult female mean (T score, ≤−2.5); and (3) severe osteoporosis: hip BMD 2.5 SDs or more below the young adult female mean in the presence of 1 or more fragility fractures.

Using clinical risk factors to assess patients permits clinicians to do more accurate risk-stratification than assessing by BMD alone. Risk factors for fracture that are independent of BMD include age, previous fragility fracture, glucocorticoid therapy, poor visual acuity, low body weight, cigarette smoking, and neuromuscular impairment (impaired tandem walk and gait speed). Prediction of hip fracture risk is more accurate when a combination of fall-related factors and femoral neck BMD is used. Characteristics of the fall (direction, fall height) as well as body habitus, as indicated by body mass index, also predict the likelihood of hip fracture.

Treatment for osteoporosis is targeted primarily at decreasing the chance of fractures. This approach therefore decreases the source of the morbidity and mortality associated with this disease. Interventions take 2 forms: pharmacologic (estrogen hormone replacement therapy [HRT], other hormones, bisphosphonates) and nonpharmacologic (nutritional, physical activity). Nutritional interventions include calcium and vitamin D supplementation. In most countries, women need supplementation to achieve an adequate calcium intake of 1200 to 1500mg per day. Vitamin D supplementation is necessary in the northern United States and most likely in other climates where sun exposure is limited for a significant portion of the year. The recommended dose of vitamin D is between 400 and 2000IU per day. Regular weight-bearing physical activity enhances bone maintenance. Fitness also may protect people from fractures by reducing the risk of falls. Daily exercise that focuses on both balance and weight bearing—as in Tai Chi Chuan, for example—may help retard bone loss in the weight-bearing bones of postmenopausal women and decrease fall risk.

Several studies have shown that HRT with estrogen or estrogen plus progesterone decreases the risk of fractures. Although increased cardiovascular disease and breast cancer risks
were found in the Woman's Health Initiative trials, the HRT group had fewer hip and vertebral fractures than the control group (relative risk of 0.66 for both types of fractures). It is beyond the scope of this article to discuss the details of choosing to prescribe HRT for any individual patient.

Biphosphonates are stable pyrophosphate analogues with a strong affinity for bone apatite. Biphosphonates prevent further loss of bony mass. In women with vertebral fractures, alendroate cuts the incidence of subsequent vertebral fractures in half. Esophageal irritation is the most common side effect of the present generation of biphosphonates. Calcitonin is a peptide hormone produced by thyroid C cells. Nasal spray calcitonin has been shown to reduce vertebral but not peripheral fractures.

4.2 Clinical Activity: To counsel a 75-year-old, hypertensive, sedentary woman about beginning an exercise program.

The greatest impact of exercise in improving function occurs in those who are sedentary and becoming active. The beneficial effects that even a modest strength increase, gentle stretching, and moderate cardiovascular exercise have on a person's functional abilities and maintenance of independence can be dramatic. Furthermore, the potency of physical exercise to reduce overall mortality, morbidity, and disability even in elderly persons with multiple illnesses is shown (see Bean et al). The risks to beginning a gentle program of cardiovascular exercise, resistance exercise, and flexibility movements are minimal and far outweigh the certain pathology associated with continued sedentary behavior. The critical question should be: "Is this patient safe to be sedentary?" By following the universal recommendation of medical screening for elderly persons before they start an exercise program, these risks are further reduced. Resting systolic blood pressure higher than 200 mmHg or diastolic blood pressure above 110 mmHg should be treated before commencing exercise. However, more moderate hypertension will be improved with an exercise regimen. Resistance training may be a safer initial mode of exercise than aerobic conditioning; however, reductions in hypertension are seen with either type of exercise.

Initial instruction and monitoring of her blood pressure, heart rate, and symptoms may be accomplished by a physical therapist. Recommendations for cardiovascular fitness should meet the population-wide recommendations to accumulate 30 to 60 minutes of moderate-intensity exercise on most, and preferably all, days of the week. Brisk walking, stationary bicycling, and aquatic exercise are appropriate for people with reduced weight-bearing tolerance. Longer duration or higher-intensity aerobic conditioning will confer further benefits but with higher risk of cardiovascular and musculoskeletal injury.

Progressive resistance training is an optimal means of improving and maintaining independence in function in the elderly. Strength training can begin with resistance using light weights (cans of soda) lifted overhead 3 times per week. Prescribing exercises that are most specific to the desired functional outcome is prudent (eg, repeated chair rises to maintain the ability to transfer from a chair). A high-speed component of exercise is increasingly being recognized as a means of exercising to enhance mobility.

In all 3 types of exercise (cardiovascular, resistance, flexibility) elderly participants are advised to increase duration before increasing intensity to best reduce risk of injury. Support from the physician is critical, whether the patient is starting an exercise program or simply improving physical activity levels with longer walks each day or week. Indeed, lack of advice to exercise is often interpreted as condoning a sedentary lifestyle.

The patient should participate in setting goals that are SMART (specific, measurable, attainable, relevant, and time oriented). For example, useful encouragement is "Start with walking for 5 minutes each day and add 1 minute daily to achieve a 30-minute daily walk." Not useful are vague statements, such as "Get more active, do the best you can." Although a multitude of exercise strategies and patterns are available, initially, regularly scheduled, daily activity that can be integrated into one's life routine is recommended. Strategies to successfully motivate older adults to participate in regular exercise are summarized in a related review article.

4.3 Clinical Activity: To differentiate the causes of mental status changes in an 83-year-old woman with poor rehabilitation participation after a hip fracture.

The common diagnoses of delirium, depression, and dementia should be considered in this elderly woman who exhibits mental status changes. Premorbid cognitive and mental health history must be elicited from the medical records, prior caregivers, and family to best define the change from her baseline mental status. The patient's functional status before the hip fracture is critical because comorbid medical conditions, including decreased vision, hearing, and balance, debility, or decreased cognitive functioning, may have led to the fall (see Stewart et al). The etiology of her current mental status changes. Abnormal cognitive functioning, including forgetfulness, aphasia, executive dysfunction, and apraxias related to mobility, may be distinguished through diagnostic interview and testing.

Delirium is the most common and most overlooked diagnosis, particularly in elderly hospitalized patients. In the elderly, it is a common comorbidity associated with major medical illness or major surgery. The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV), defines delirium as a disturbance of consciousness with inattention that develops over a short time. Delirium is commonly described as an acute confusional state or metabolic encephalopathy. waxing and waning of attention and performance throughout the course of the day may be suggested by disparate reports from therapists treating the patient at different times of the day.

Delirium has a fluctuating course with changes in cognitive function not explained by dementia. The etiology is commonly a medical condition or medication. The mnemonic DELIRIUM (Drugs, Electrolyte imbalance, Lack of drugs, Infection, Reduced sensory input, Intracranial, Urinary retention and fecal impaction, Myocardial and pulmonary) summarizes the common causes of delirium in the older adult. More than half of delirium cases are not diagnosed, particularly in patients over age 80, in those with coexisting dementia, and especially in persons with hypoactive variants of delirium. Although hyperactive delirium with behavioral dyscontrol and agitation is overt and more easily detected, hypoactive variants of delirium are often misdiagnosed as depression.

A thorough medication review to find the cause of delirium should include over-the-counter medications and medications taken on an as-needed basis. Recent additions, discontinuations, or changes in dosing may determine the offending agent. Particular attention should be paid to sedative hypnotic medications, opioid analgesics, and any medications with strong anticholinergic properties. In this case, a review of sedating pain medications after hip fracture is critical. Other etiologies include current use or withdrawal from alcohol or illicit drugs.

Depression is a very common and very treatable diagnosis in the elderly. Depression often accompanies declines in physical
functioning. Older people may attribute their depressive symp-
toms to old age or other physical conditions or may complain of lack of energy and other somatic complaints rather than reporting depressed mood. Of note, late-life depression may present with symptoms of agitation, confusion, and anxiety rather than reports of depressed mood or melancholy. Therefore, recognizing and diagnosing late-life depression is more difficult. Referral to a geriatric psychiatrist (or geropsychiatrist) should be considered.

The common mnemonic SIG: E-CAPS (Sleep, Interest, Guilt, Energy, Concentration, Appetite, Psychomotor agitation and/or retardation, Suicidality) may be used to review symptoms of depression. The DSM-IV criteria for major depression are useful but not specific for the elderly. A more formal screening battery, the Geriatric Depression Scale with 15 yes or no items, is commonly used.

The diagnosis of dementia in this woman should be made only after delirium and depression are excluded as causes of cognitive impairment. Onset is generally more gradual than described in this case, but a review of her prior function may indicate progressive cognitive impairment at home now made more apparent in a formal rehabilitation program.

Dementia is a clinical syndrome of persistent intellectual deterioration that is severe enough to interfere with social or occupational functioning. A mnemonic for its causes and aggravators is DEMENTIA (Drugs, Emotional illness, Metabolic/endocrine disorders, Eye/ear/environment, Nutritional/neurologic, Tumors/trauma, Infections, Alcohol/anemia/atherosclerosis). Memory deficits are the main features, but amotivational syndrome and language deficits are common and impact directly on the rehabilitation process. In addition to memory and language dysfunction, dementia is characterized by the presence of 1 of the following symptoms: aphasia, apraxia, agnosia, or executive dysfunction.

The attempt to distinguish delirium, dementia, and depression by their DSM-IV characteristics may be difficult. Anxiety may also be included in the differential diagnosis. Premorbid anxiety may be worsened by pain, physical dysfunction, or hospitalization. To make matters more complex, these diagnoses may coexist, particularly in hip fracture patients. Significantly, dementia is a strong risk factor for both delirium and depression because the brain is more vulnerable. The etiology of this woman's mental status changes is likely viewed as multifactorial. A chronic underlying condition with exacerbating factors is common.

Therefore, to best discriminate the complexities of mental status changes in the elderly consider the more unified, simple definition of cognitive impairment as a decline in cognitive function from baseline. The 2 major categories then include the potentially reversible diagnoses of delirium and depression from the chronic changes in cognitive impairment seen in dementia. It is important to treat all reversible factors and not stop at just 1 factor. Mental illness in the elderly is generally underrecognized and undertreated. However, when treatment is rendered, it is as effective as treatment in younger individuals.

4.4 Educational Activity: To design an algorithm for managing a 70-year-old truck driver who has urinary incontinence since her total knee arthroplasty 3 days ago.

There are many elders who consider urinary incontinence to be a normal part of aging (table 1). Because of this, many will not offer information about preexisting problems with maintaining continence. Ten to 30% of community-dwelling elders, 25% to 30% of older patients discharged after a hospitalization, and more than 50% of home-bound and institutionalized elders report urinary incontinence. Many of the causes of transient, treatable urinary incontinence are associated with other prob-

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<th>Table 1: Classification of Urinary Incontinence</th>
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<td><strong>Definition</strong></td>
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<tr>
<td><strong>Urine</strong></td>
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<td><strong>Stress</strong></td>
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<td><strong>Overflow</strong></td>
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<td><strong>Functional</strong></td>
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Abbreviation: DHIC, detrusor hyperactivity with impaired bladder contractility.
problems frequently seen and treated in rehabilitation patients. Urinary tract infections (UTIs), constipation, delirium (see Activity 4.3), reduced mobility, and many medications—including β-blockers, diuretics, and caffeine—are all associated with incontinence problems. Assessing should include a history focused on risk factors, a voiding diary, physical examination, measurement of postvoid residuals, and a urinalysis. The mnemonic DIAPERS (Delirium, Infection—urinary, Atrophic urethritis and vaginitis, Pharmaceuticals, Psychologic disorders, Excessive urine output, Restricted mobility, Stool impaction) is useful to remind physicians of the most common causes of transient urinary incontinence in the geriatric population.24 UTIs are the most common bacterial infection in the older population.25 The prevalence of bacterial colonization, or bacteruria, in the older community-dwelling population ranges between 5% and 20% and is more commonly found in women. Chronic urinary symptoms or incontinence and a high frequency of positive urinary cultures, associated with bacteriuria, result in older persons receiving unnecessary antibiotic treatments. The high rate of benign prostatic hypertrophy in men and the postmenopausal vaginal and urethral changes in women require that treatment for a documented UTI be in accordance with the guidelines for complicated UTI.26 Antibiotic treatment should be reserved for symptomatic UTIs. A pretherapy urinary specimen should be obtained, and, if possible, antibiotic treatment should be withheld until culture results are available.23

In addition to treating the underlying cause, behavioral interventions can be successful. Timed voiding or prompt timed voiding, depending on cognitive abilities, are effective ways for the patient without urinary retention to establish continence.19 Decreasing fluid intake after dinner and voiding before bedtime can be helpful for persons with nocturnal incontinence.27 Bladder training, or "holding" urine for 5 minutes after the urge to void is noted, can increase the voiding interval from 2 to 4 hours over the course of 2 months. This method is most effective for persons with urge incontinence.25,27

4.5 Educational Activity: To formulate an appropriate bowel regimen for a sedentary, constipated, depressed 79-year-old woman.

The prevalence of chronic constipation and fecal incontinence is 24% and 3% to 7%, respectively, in healthy seniors. Fecal incontinence is more common in women but increases with aging among men.28 Among nursing home residents, constipation is endemic and fecal incontinence ranges from 10% to 50%.29,30 Bowel incontinence is a significant predictor of nursing home placement.31 Short of institutionalization, defecation problems cause great inconvenience, embarrassment, and isolation in the elderly. Fecal impaction can lead to urinary incontinence. Patients often do not report these problems to doctors because of social stigma. Yet, fecal incontinence can usually be managed effectively by avoiding fecal impaction and by using a systematic bowel training protocol.

Assessing constipation starts with history taking. Normal stool frequency ranges from twice daily to twice weekly. Factors affecting stool frequency include dietary fiber (20g/d ideally), activity level, obstetric history, prior pelvic or abdominal surgery, medications (eg, narcotics, antihypertensives), and laxative use or abuse. The etiology should be classified as colonic inertia (slow transit time) or functional outlet problem, or both, because this determines treatment. A digital rectal examination can confirm an anorectal outlet problem. In this examination, the physician can assess the reaction of the pelvic floor muscles and sphincter during stimulation and can determine consistency of stool. Colon cancer must be excluded in any senior with chronic constipation.29 Physicians must ask about fecal incontinence as a routine matter because many patients are reluctant to report it. The differential diagnosis includes obstetric trauma, rectal strictures, pelvic floor dysfunction, sensory and sphincter problems because of denervation, and overflow around a fecal impaction. After a detailed bowel history and physical examination, anorectal imaging (ultrasound, magnetic resonance imaging) and testing (balloon insufflation, manometry) can further differentiate causes, if needed.32

Treatments to optimize bowel transit include medication review and lifestyle changes such as adequate hydration, high-fiber diet, prune juice, and increased activity. In general, daily laxative use should be discouraged. Bulking agents (eg, psyllium) improve transit time but will not help outlet problems. Osmotic laxatives that modify stool consistency (eg, milk of magnesia, lactulose) can help with functional outlet problems. As part of a salvage regimen, consider docusates and stimulant laxatives, such as cascara. Surgery is reserved for well-defined anatomic problems.29

Conservative treatment for bowel incontinence begins by correcting underlying causes. Subsequently, consider using pads or diapers, anal plug, diet change, biofeedback, habit training, and sphincter exercises. For resistant bowel incontinence, loperamide remains the drug of choice. A variety of surgical treatments may be indicated in intractable cases, including sphincteroplasty and salvage operations (eg, colostomy).33

References

Suggested Readings

Key references.