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Rehabilitation is a critical component of geriatric health care, because disabling conditions, which are common among older adults, profoundly affect their quality of life and are amenable to treatment. In older adults chronic disease almost always underlies disability; for example, stroke occurs most commonly in people with other vascular diseases, and hip fractures occur most commonly in people with osteoporosis and gait disorders. Worsening disability also occurs in progressive chronic diseases, such as osteoarthritis, Parkinson's disease, and amyotrophic lateral sclerosis, or in the context of deconditioning from inactivity during acute illness. In order to provide the best functional recovery possible, those providing geriatric rehabilitation must

- use systematic approaches to assess the causes of disability,
- be familiar with the advantages and disadvantages of the various sites of rehabilitative care,
- understand the role of multidisciplinary teams and care plans,
- adapt care to other diseases and disabilities, and
- be familiar with the basic requirements for rehabilitation of common geriatric conditions.

CONCEPTUAL MODELS FOR GERIATRIC REHABILITATION

Geriatric rehabilitation services can be organized on the basis of a conceptual model of disability that allows optimum assessment of the status and needs of the patient, an appropriate match of treatments with specific conditions, and evaluation of rehabilitation outcomes. The revised *International Classification of Impairments, Disabilities, and Handicaps* (ICIDH-2) of the World Health Organization (WHO) offers a useful framework ([Figure 13.1](#)). The ICIDH-2 framework has two main parts: functioning and disability, and contextual factors. Functioning and disability include the activities and participation components. The body component is considered to have both structures such as organs and limbs and physiologic functions. Impairments are defined as problems in body function or structure, such as a significant deviation or loss. The activities and participation components address functioning from both an individual and a societal perspective. Activity is defined as the execution of a task or action by an individual and participation is defined as involvement in a life situation. Participation restrictions are problems a person experiences in his or her involvement in work, leisure, and social activities.

The second part of the WHO framework is the context, including environmental and personal factors. Environmental factors have an impact on all components of functioning and disability; they range from an individual's immediate environment to the general environment. Personal factors include age, race, gender, educational background, personality, fitness, and life style.

In the WHO model, interventions can be designed to modify impairments, limitations in activities, or restrictions in participation. For example, a treatment plan may be developed to improve strength (impairment level), but the significance of this intervention is due to its effect on physical mobility (activity) and ultimately the ability to return to social or physical roles (participation). The effect of gains in strength and physical mobility on participation could be modified by the person's motivation or social

support. If a person improves in strength and balance but family and friends continue to do everything for him or her and thus discourage independent function, the person may remain dependent.

The physical environment is another powerful modifier. Even if a person achieves improved function, he or she cannot regain prior public and personal roles if physical barriers to access are not removed with such facilities as ramps or modified bathrooms.

In summary, the interaction of disease and disability is particularly complex in older adults. The ICIDH-2 model is useful for structuring organized approaches to assessment, treatment, and evaluation of outcomes.

SITES OF REHABILITATION CARE

Rehabilitation services are offered in both inpatient and community-based sites. Inpatient care may be provided in rehabilitation centers (freestanding hospitals or units attached to acute hospitals), or nursing facilities. Outpatient rehabilitation services can be provided in hospital-based or independent clinics, in day hospital settings, or in the home. Eligibility requirements, the services provided, and costs vary across sites of care. These factors influence the balance of advantages and disadvantages for the individual patient and in turn influence the recommendations of the clinician.

An inpatient rehabilitation hospital program that is Medicare certified must demonstrate that 75% of the patients have at least one of ten conditions (nine are related to neurologic and musculoskeletal disorders; the tenth, to burns), and that at least 75% of patients receive 3 hours of therapy per day. Patients must be seen by a physician on a daily basis, have 24-hour rehabilitation nursing care, and be managed by a multidisciplinary team of skilled nurses and therapists. Medicare reimbursement is dependent on documented patient progress as a result of therapy. The maximum length of stay is 90 days per illness. The Medicare-approved skilled nursing facility must provide 24-hour nursing care. Dietary, pharmaceutical, dental, medical, and social services must also be available. Physicians must supervise patient care; they may visit the patient infrequently but must be available 24 hours a day for emergencies. Therapeutic services are available, but multidisciplinary coordination may not occur. In this setting, the maintenance of function without progress may be the goal of care. The amount of reimbursable therapy services provided is allocated on the basis of patient assessments by the use of the Minimum Data Set (MDS). Medicare limits reimbursement for rehabilitation therapy to 750 minutes per week. Current eligibility for Medicare skilled nursing benefits is restricted to persons who have had a hospital stay of at least 3 days in the past 30-day period. The length of Medicare coverage for rehabilitation in nursing homes is limited.

Medicare provides home-health benefits to patients who require intermittent or part-time skilled nursing care and therapy services and who are homebound, defined flexibly to include individuals who "occasionally leave the home." There is no prior hospitalization requirement or limit on the number of visits a person may receive. Home-health services provide skilled nursing and home-health aides, therapeutic services, medical and social services, and supplies. Even though physicians must certify the patient for services, they are rarely involved in the supervision of care, and multidisciplinary coordination of care may not be available. On October 1, 2000, Medicare began paying all home-health agencies under a prospective payment system. Payment rates are based on relevant data from patient assessments conducted by clinicians using the Outcome and Assessment Information Set (OASIS). The OASIS, originally developed to assess quality of care in home health, encompasses sociodemographic, environmental, support system, health status, and functional status attributes.

Inpatient rehabilitation facilities are also reimbursed by Medicare by the use of a prospective payment system. The system uses information from a patient assessment instrument, a functional independence measure, to develop Function Related Groups (FRGs), which supports classification of patients by case-mix groups.

The effect of site of care on rehabilitation outcomes is not well established. One study of outcomes among persons with stroke and hip fracture compared rates of discharge to home and recovery of function of those receiving inpatient or nursing rehabilitation services. The study, which controlled for case-mix differences, found that stroke but not hip-fracture patients were more likely to be discharged home and to recover activities of daily living if treated in an inpatient rehabilitation setting. Nursing homes with a high volume of Medicare patients were found to influence stroke outcomes more than did traditional nursing homes. Overall, there were no differences in outcomes for hip fracture patients by site of care. In a

comparison of stroke patients treated under fee-for-service and managed care, the managed-care patients were found to be more likely to receive rehabilitation in skilled nursing facilities than in inpatient rehabilitation hospitals. Patients in fee-for-service care improved more in activities of daily living (ADLs) during the treatment phase, but there were no differences in ADLs between groups 1 year later. However, at the 1-year follow-up, the patients in managed care were found to be 2.4 times more likely to reside in nursing homes. The effect of site of rehabilitation care outcomes for a more broad range of conditions has also been studied. Consecutive patients enrolled from 52 hospitals in three cities and having one of five targeted conditions (chronic obstructive pulmonary disease, congestive heart failure, hip procedures, hip fractures, stroke) were assessed. Researchers, using case-mix adjustment models, found that, in general, patients discharged to nursing homes fared the worst, and that those sent home with home-health services or to rehabilitation hospitals did best. Despite statistical adjusting, concerns remain about using observational data to assess the effects of site of care on outcomes, since patients with better prognoses may go to inpatient or home-health settings, whereas those with poorer prognoses for functional recovery go to nursing homes. Nevertheless, it appears that site of care might well be an important factor in recovery. The clinician may improve the older patient's outcomes in rehabilitation by selecting site of rehabilitation with care.

From the patient's perspective, each site of care has advantages and disadvantages. Inpatient care is the most intense but may not be possible for frail elderly patients, since it requires 3 hours per day of active (and fatiguing) therapy. Skilled nursing offers 24-hour care for those who cannot care for themselves or do not have a full-time caregiver. Outpatient services have clear advantages and disadvantages. Patients often prefer to return to their own homes but may not have the caregiving they need. Participation in a day hospital or outpatient clinic requires transportation, which can be costly and time consuming.

In summary, clinicians must be familiar with the services provided in a wide range of rehabilitation settings and with the advantages and disadvantages of each type of setting. The clinician is responsible for recommending the best match between patient needs and program services. However, in reality, under certain plans such as managed care, the choice of settings and services may be determined by costs. Systematic evaluation of rehabilitation outcomes in various settings is needed. The Health Care Financing Administration (in June 2001 renamed the Centers for Medicare & Medicaid Services) is currently funding initiatives to monitor the quality of patient care by the use of data from patient assessments in the MDS and OASIS.

MULTIDISCIPLINARY TEAMS

For many older adults, health professionals in several fields are required if their rehabilitation needs are to be met. The primary goal of multidisciplinary team management is to ensure that patients receive comprehensive assessments and interventions for the disabling illness and for associated comorbid conditions. All health professionals who work with older adults should have a basic understanding of the roles and functions of various rehabilitation team members. An effective team establishes common goals and a cohesive treatment plan for each patient. The patient's and family's expectations and preferences must be integrated into care planning. Unlike many other interventions, rehabilitation treatments require active patient participation. A patient-centered decision-making framework makes sense, given the chronic nature of many disabilities of older adults, for example, arthritis, diabetes mellitus, hypertension, and congestive heart failure. Patient self-management incorporates self-monitoring, education about the disease, and personal control over many prevention and management practices.

IMPACTS OF COMORBIDITIES

Comorbidities often require adaptations in the rehabilitation care plan and may even prevent, interrupt, or delay treatment. Many illnesses that can interfere with the rehabilitation of the older patient are predictable in this high-risk population and are potentially preventable. A systematic approach to the assessment, prevention, and management of comorbidities can improve the patient's chance of receiving maximal benefit from rehabilitation services.

One of the most common complications of inactivity is thromboembolisms; their prevention should be a routine part of rehabilitation care for elderly patients. Bladder problems due to detrusor hyperactivity, obstruction, or neurogenic bladder are also prevalent among older patients. Indwelling catheters increase the risk of infection and are rarely appropriate. The assessment and treatment of bladder problems should

be a basic component of any rehabilitation service (see [Urinary Incontinence](#), and [Renal Diseases and Disorders](#)). The risk of pneumonia is increased by inactivity and disordered swallowing. Prevention includes increasing ventilation through mobilization and incentive spirometry, especially in persons with obstructive lung disease. The prevention of aspiration pneumonia poses difficult tradeoffs: Routine radiologic screening for aspiration has precipitated a marked increased awareness of this problem, but the clinical relevance of modest amounts of aspiration detected radiologically are unknown. (See [Eating and Feeding Problems](#).)

Cognitive functioning is critical for rehabilitation, which depends on the patient's ability to follow directions and to learn. Older adults who have been acutely ill or who are newly disabled should be screened for delirium, dementia, and depression. (See [Delirium](#), [Dementia](#), and [Depression and Other Mood Disorders](#).)

Conditions that do not prevent or delay rehabilitation may nonetheless require ongoing modifications of the rehabilitation care plan ([Table 13.1](#)). Since activity level is a powerful factor in glucose metabolism, diabetic patients are likely to experience changes in glucose levels and medication requirements during rehabilitation. Increased caloric intake during recovery may also affect medication needs. Since most abnormal gaits increase the energy requirements of walking, coronary artery disease symptoms may worsen, and persons with poor cardiac output may have extreme exercise limitations. Medication adjustments for heart disease may be necessary but can cause side effects of their own, such as orthostasis. Patients with one vascular disease often have others; peripheral vascular disease is common, often associated with insensitive or painful feet and a high risk of skin breakdown. Treatment of painful peripheral neuropathy may foster increased activity. Immobility or altered weight bearing can precipitate pressure ulcers that heal poorly. The clinician should monitor pressure and weight-bearing areas and be prepared to modify footwear, wheelchairs, and bedding, as needed.

REHABILITATION STRATEGIES: AN OVERVIEW

The primary goals of rehabilitation are restitution of function, compensation or adaptation to functional losses, and prevention of secondary complications. Rehabilitation should maximize the older person's potential for participation in social, leisure, or work activities. Rehabilitation should not be defined simply as improving independence in ADLs but also as a program to prevent disability. A wide variety of strategies can be used to achieve these goals.

Restitution of physical function usually depends on therapeutic exercises to improve flexibility, strength, motor control, and cardiovascular endurance. Although exercise has been shown to improve strength and motor control in well-defined populations of disabled older adults, there is still uncertainty about whether these gains translate into changes in mobility, activities of daily living, participation, or risk of falling.

Speech and language therapy can be used to treat aphasia in stroke patients, and cognitive rehabilitation can be used to improve their alertness and attention. As yet, however, there is no clear evidence that speech and language therapy or cognitive rehabilitation improves functional deficits.

Massage, heat, cold, and ultrasound are used to decrease pain and muscle spasm. These and other pain management strategies may contribute to increased function and tolerance for further rehabilitation. There is little evidence supporting objective benefits from these modalities, but patients commonly report symptomatic relief.

Equipment such as mobility aides, orthotic and prosthetic devices and splints, and dressing and bathroom aids can augment or replace the function of impaired body parts and thereby reduce limitations in activities and participation. For example, an ankle orthosis can prevent foot drop and improve safety and speed of walking.

Repeated practice of task-specific activities, such as bed mobility, transfers, and walking, can improve functional mobility. Upper-extremity function can also be improved with specific functional training activities, such as grasps, reaches, and fine manipulations. Balance training may reduce the risk of falls. (See [Falls](#).) Many older adults benefit from retraining in instrumental activities of daily living (IADLs), such as cooking, managing finances, or driving a car.

Contextual factors, both environmental and personal, need to be addressed in rehabilitation to minimize restrictions on the older person's activities and participation. Environmental modifications such

as grab bars and raised toilet seats in the home or curb cutouts on public streets may be required to optimize the older person's independence in the home and the community.

A collaborative approach to goal setting, good patient and family education, and support groups may be used to address such personal factors as motivation. Each patient must be encouraged to accept responsibility for managing his or her condition and well-being.

ASSESSMENT AND REHABILITATION PLANNING

Comprehensive assessment of each elderly patient is necessary for appropriate clinical management and evaluation of outcomes. The treatment plan should be guided by the results of the assessment. The primary components of any assessment include patient demographics, social support, place of residence prior to illness, medical comorbidities, severity of current illness, and patient's prior functional status. Impairments such as deficits in range of motion and flexibility, strength, sensory functions, balance, cognition, and mood should always be assessed. In conditions such as stroke there should also be an evaluation of swallowing and language function. The patient's functional status should be assessed with standardized measures of ADLs (eg, the Functional Independence Measure, the Barthel ADL Index), and of IADLs. The patient's participation or quality of life should also be assessed. (For specific screens, see the [Appendix](#).)

STROKE

Natural History

Stroke is a major cause of mortality and morbidity in the United States, particularly among persons aged 55 years and older. Acute stroke occurs in more than 700,000 persons each year, and more than 80% of them are likely to survive, many with residual neurologic difficulties. Stroke-related deficits are severe in approximately one third of the survivors and moderate or mild in the other two thirds. Many patients with mild and moderate stroke become independent in ADLs, but other more complex dimensions of health status may be affected. Rehabilitation programs must address a broad range of stroke-related disabilities, including not only deficits in the patient's basic ADLs but also deficits in IADLs and in the ability to participate fully in social activities.

Assessment and Management

The overall goals of rehabilitation for the stroke patient are restitution of function, compensation for or adaptation to functional losses, and prevention of secondary complications. The specific objectives of stroke rehabilitation include:

- preventing, recognizing, and managing comorbid illness and medical complications;
- assessing the patient's status comprehensively, using standardized instruments,
- matching the rehabilitation program to the patient's needs and capabilities;
- maximizing the patient's independence in ADLs and IADLs;
- facilitating the patient's and the family's psychosocial coping and adaptation;
- preventing recurrent stroke and other vascular conditions, such as myocardial infarction; and
- assisting the patient in reintegrating into the community.

Rehabilitation for elderly stroke patients is complex because of the heterogeneity of causes and residual symptoms of stroke, site and size of the brain lesions, and prestroke status of older patients. The most common type of neurologic deficit is hemiparesis; other residual symptoms may include sensory deficits, aphasia, dysarthria, cognitive deficits, motor incoordination, hemianopsia, visual-perceptual deficits, depression, dysphagia, and bowel and bladder incontinence. The patient's degree of initial recovery and the time he or she needs to reach maximal recovery is affected by the number of deficits. For example, those who have hemiparesis, hemianopsia, and sensory deficits are less likely to ambulate independently and will require a longer time to regain skills than do those with hemiparesis only.

Stroke patients usually experience the most dramatic recovery in the first 30 days but may continue to improve more gradually for months. The Framingham study showed that improvement in motor function and self-care slowed 3 months after stroke but continued at a reduced pace throughout the first year.

Language and visual-spatial function recovered over 12 months, but cognitive function improved only during the first 3 months.

In 1995 the Agency for Health Care Policy and Research (now the Agency for Healthcare Research and Quality) convened a multidisciplinary panel of stroke experts to review the evidence for stroke rehabilitation practice and make recommendations (Table 13.2). A considerable body of evidence indicates that better clinical outcomes are achieved when patients with acute stroke are treated in a setting that provides coordinated, multidisciplinary stroke-related evaluation and services. Coordinated care has been shown to reduce 1-year mortality and improve functional independence. The apparent benefits are not restricted to any particular subgroup of patients. There is less evidence to support specific therapeutic interventions for stroke. Treatment approaches based on theories of proprioceptive neuromuscular facilitation have been most commonly used for restitution of motor control. A new approach introduced in the late 1980s incorporates active practice of motor tasks with appropriate feedback and promotion of motor learning and recovery. Studies have compared techniques, but there is no convincing evidence that one technique is superior. In the past few years several new therapeutic interventions for restitution of motor function have been introduced. Constraint-induced movement therapy discourages the use of the unaffected extremity and encourages active use of the hemiparetic extremity, with the goal of improving motor recovery. The early results from several studies suggest that this technique may be useful. However, the results are not generalizable to all stroke survivors and have not been tested in large randomized trials. Walking on a treadmill with body-weight support using a harness connected to an overhead support is a new method of training for walking. Several randomized clinical trials and several case studies of this method suggest that gait velocity, balance, and motor recovery may be enhanced with this therapy.

Speech and language therapy are often provided for stroke patients with aphasia. However, there is no universally accepted treatment, and analysis of evidence from studies of speech and language therapy for stroke survivors indicates that this therapy has not been shown to be either effective or ineffective.

Tertiary Prevention

The patient who has had a stroke is at very high risk for recurrence, at a rate of 7% to 10% annually. The rehabilitation phase is an appropriate time to assure that assessment and treatment for stroke prevention has occurred. Assessments for significant carotid stenosis and for atrial fibrillation should be completed. Indications for carotid endarterectomy and anticoagulation with warfarin should be reviewed. The use of aspirin or other antiplatelet agents should be considered. Other risk factors to be targeted include hypertension, diabetes mellitus, hyperlipidemia, and smoking.

HIP FRACTURE

Natural History

Currently, more than 250,000 people fracture a hip each year in the United States. Risk of fracture is higher with older age and among women, nursing-home residents, and persons with dementia. Mortality is about 5% during the initial hospitalization but up to 20% in the year following fracture. Recovery to the prior level of function is achieved by about 75% of survivors, but overall mobility is limited, requiring assistive devices in half of survivors. Up to 50% of patients have an initial decline requiring temporary long-term care, and about 25% remain in long-term care 1 year later.

About one third of hip fractures involve the femoral neck and about two thirds are intertrochanteric. Fractures can be displaced or nondisplaced, affecting surgical approach. Traditionally, displaced femoral neck fractures are treated with a prosthetic femoral head. Nondisplaced femoral neck fractures are often treated by internal fixation with pins or nails, and intertrochanteric fractures are often treated with open reduction and internal fixation with compression screws or sliding nails.

Assessment and Management

Initial assessment includes prior mobility and functional status, comorbid conditions, cognitive status, and social support. Other information includes type of injury and repair as well as pain status. Mobility performance should be systematically assessed.

Rehabilitation of hip fracture consists of mobilization, pain management, prevention of complications, and functional adaptation. Coordinated inpatient care has shown a modest benefit (about 10%) in the

reduction of pooled outcomes such as death, worsened function, and institutionalization. Organized rehabilitation is beneficial for those older patients with mild to moderate dementia. Factors that influence recovery include the timing of mobilization and the frequency of therapy. Delay in mobilization is often driven by surgical recommendation. Some surgeons prescribe limited or no weight bearing for up to 6 weeks after surgery in order to maximize healing and stabilization. Partial weight bearing may be difficult for many elderly patients to achieve, although they will spontaneously shift weight in response to discomfort. Prolonged inactivity is clearly associated with poorer functional outcomes, and early weight bearing as tolerated has been shown to be associated with low rates of surgical failure.

Tertiary Prevention

Persons who have had a hip fracture are often osteoporotic and unstable. They are at increased risk for further fractures. Efforts to treat osteoporosis, improve balance, and reduce injury risk are a key part of treatment planning during rehabilitation. Hip protectors have been shown to reduce hip fracture rates, although adherence may be a barrier to use.

AMPUTATION

Natural History

Approximately 50,000 people have a lower-extremity amputation each year in the United States. Most have widespread vascular disease, with or without diabetes mellitus. Many have other manifestations of systemic vascular disease, such as cardiac or cerebrovascular deficits. Diabetic patients often have other end organ disease, such as blindness, end-stage renal disease, and peripheral neuropathy. Mortality rates of those with amputations secondary to peripheral vascular disease is high: 50% at 2 years and 70% at 5 years. Up to 20% lose the other extremity within the first 2 years after an initial amputation. Most amputees with peripheral vascular disease have so much comorbid disease that limited mobility for transfers and ambulation within the home are the major goals of prosthetic use.

Assessment and Management

Initial assessment includes prior functional status, status of comorbid conditions, mental status, status of the stump and the other lower extremity, and function of the upper extremities. Predictors of functional ambulation with a prosthesis include prior independent ambulation, weight-bearing ability of the contralateral leg, medical stability, and mental status. Blindness and end-stage renal disease do not necessarily preclude rehabilitation.

The rehabilitation phase should start promptly after surgery, starting with teaching about the recovery process and exercises for strength and flexibility of the lower and upper extremities. Amputation of the lower extremity generally aims to preserve the knee, since the below-the-knee amputee has a much lower energy requirement for walking than does the above-the-knee amputee. This decision must be weighed against risks of poor wound healing with more distal amputation.

Postoperative rehabilitation focuses on mobilization, wound healing, and shaping of the stump. Poor wound healing delays rehabilitation in about 25% of cases. A rigid removable dressing can facilitate early weight bearing without increasing wound breakdown and allows direct monitoring of the healing tissues. Prostheses vary in weight, socket type, style of foot, and type of suspension; the older amputee does better with prostheses of low weight, stability, and ease of use. Prostheses may also need to be adapted to other medical conditions. For example, the patient with frequent changes in stump volume due to edema from heart or kidney disease must have a prosthesis that is adaptable to wide swings in the size of the stump. Rehabilitation for patients with amputations includes teaching the patients and their caregivers about prosthesis and stump care and self-monitoring for stump injury.

Tertiary Prevention

Since the amputee's risk of contralateral amputation reaches 20% at 2 years, the monitoring and care of the other lower extremity is important. Vascular risk reduction includes smoking cessation, cholesterol reduction, and glucose control. Programs of endurance exercise can improve function and reduce claudication. Daily monitoring for infection and skin breakdown are essential.

ASSISTIVE DEVICES, ADAPTIVE TECHNIQUES, AND ENVIRONMENTAL MODIFICATIONS

Assistive devices and adaptive techniques are effective for patients with disabilities and handicaps. It is important to identify the underlying causes of disability before prescribing a device because medical or surgical treatment for individual diseases and impairments may be more effective or may enhance the usefulness of these devices.

Mobility Aids

Canes typically support 15% to 20% of the body weight. The tips, handles, materials, and lengths of canes vary. As the number of tips increases, the degree of support also increases, but the cane becomes heavier and more awkward to use. The cane tip is fitted with a 5-cm diameter rubber tip with a concentric ring to prevent slipping. The handle of the cane may be curved or have a pistol grip; the pistol grip offers more support but is less aesthetically pleasing to some people. Canes can be made of a variety of materials, but most are made of wood or light-weight aluminum. The length of the cane is important for stability. Some canes are adjustable, but wooden canes must be cut to size. One of three methods may be used to evaluate the proper cane length: measuring the distance from the distal wrist crease to the ground when the patient is standing erect, measuring the distance from the greater trochanter to the ground, or measuring the distance between the ground 15 cm in front of and to the side of the tip of the shoe and the elbow flexed at 30 degrees. The first method is preferred.

Crutches can support full body weight but are seldom used with older persons. Problems with crutches include the large amount of arm strength required, the risk of brachial plexus injury, and the necessity to use an unnatural gait pattern.

A walker is prescribed when a cane does not offer sufficient stability. A walker can completely support one lower extremity but cannot support full body weight. Walker types include pick-up and wheeled walkers. The pick-up walker is lifted and moved forward by the patient, who then advances before lifting the walker again; the result is a slow, staggering gait. It requires strength to repeatedly pick up the walker and cognitive ability to learn the necessary coordination. A wheeled walker allows for a smoother, coordinated, and faster gait and takes advantage of overlearned gait patterns. It is more likely to be correctly used by persons with cognitive impairment. The most commonly used type is the two-wheeled walker, which brakes automatically with increased downward pressure. Four-wheeled walkers are rarely used because they are less stable and more difficult to control, although they are occasionally useful for persons with Parkinson's disease. Three-wheeled walkers may offer some advantages in ease of turning but are not yet in common use. The Merry Walker® Ambulation Device has a seat and bars all the way around. It is the same size as a wheelchair and is best reserved for those with severe balance problems. It is also useful for severely demented patients.

Patients who cannot safely use or are unable to ambulate with an assistive device will require a wheelchair. A wheelchair must be fitted according to the patient's body build, weight, disability, and prognosis. Incorrect fit may result in poor posture, joint deformity, reduced mobility, pressure sores, circulatory compromise, and discomfort. For the elderly patient with only one functional arm, the wheelchair may be lowered to allow for foot propulsion. Patients with lower-extremity amputations may have the wheels set posteriorly to compensate for a change in the center of gravity. Motorized wheelchairs may be used by mentally alert persons with bilateral upper-extremity weakness or severe cardiopulmonary disease who lack the endurance to push a wheelchair. Motorized scooters offer less trunk support than motorized wheelchairs but are more acceptable to some people. Motorized scooters and wheelchairs increase patients' mobility but increase their risk of deconditioning, as they might otherwise push a wheelchair or ambulate. The use of a wheelchair commonly requires home modifications, including ramps and widened doorways. Cars may need to be adapted with lifts.

Orthotics, Adaptive Methods, and Assistive Devices

Orthotics are exoskeletons designed to assist, resist, align, and stimulate function. Orthotics are named by the use of letters for each joint that the device involves in its structure. Thus, an AFO is an ankle and foot orthotic device used to support weak calf or pretibial muscles (eg, for a stroke patient with lower-extremity weakness).

Adaptations to facilitate dressing may be necessary for patients with problems such as frequent soiling or diminished flexibility, coordination, and endurance. Their clothing should be easy to clean, and tops should fit easily over the head or fasten in the front and allow for freedom of movement. Fastening clothes is frequently a problem for elderly persons. Hooks and loops are usually easier to use than buttons, and they may be sewn on to replace buttons and zippers. When buttons are necessary, button hooks with customized grips may be used, or the buttons can be sewn on with elastic thread, which may eliminate the need to unbutton the buttons. Donning shoes and socks is particularly difficult for elderly persons with decreased agility. Longer, looser socks (eg, tubular socks) are easier to don. For patients who find that reaching the feet to put on shoes is a problem, a long-handled shoehorn may be useful. Elastic shoelaces eliminate the need for tying and untying.

Environmental modifications can have a major impact on the elderly person's ability to function independently or with minimal assistance at home. A variety of assistive devices, such as reachers, special utensils, and adapted telephone, can reduce the difficulty of performing daily tasks and have a significant impact on a person's quality of life.

The bathroom is a common place for falls. Any older person with impaired balance or lower-extremity weakness should have bars installed near the toilet and tub or shower. Raised toilet seats and bathtub benches are available to assist those with lower-extremity weakness. These are also useful for persons with arthritis of the hips or knees because they reduce biomechanical stress on the joint. Long-handled bath brushes, hand-held shower, and "soap on a rope" may be helpful for persons with upper-extremity impairment.

ANNOTATED REFERENCES

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This sensible document, recognizing that the number of stroke patients is large, focuses on those who have had a first stroke, survive, do not recover fully, and, though not overwhelmingly disabled, have hemiparesis. Using this as a modal situation, the authors outline the principles of stroke rehabilitation. They acknowledge the extreme limitation of data that can allow an evidence-based approach to rehabilitation and even the lack of clear evidence that stroke rehabilitation enhances recovery. The authors cover assessment, the choice of site for rehabilitation, the process of rehabilitation and ways to measure progress, and considerations for re-entry of stroke patients into the community. Medical management of common, important problems during rehabilitation are covered briefly. An extensive list of assessment instruments is given with descriptions and references. A wide variety of community and governmental resources is also provided.
- Jorgensen HS, Nakayama H, Pedersen PM, et al. Outcome and time course of recovery in stroke: part II: time course of recovery. The Copenhagen Stroke Study. *Arch Phys Med Rehabil.* 1995;76(5):406–412.

This a prospective, community-based study of almost 1200 consecutive patients with acute stroke followed from the time of admission until death or discharge from the rehabilitation unit. Patients were accrued in the regional stroke center for the city of Copenhagen. Systematic evaluation of neurologic and functional deficits was performed weekly on patients in the hospital or rehabilitation unit, and at 6 months post-stroke on survivors. At 6 weeks 80% of patients had reached maximum functional recovery, and 95% by 12 weeks. Time course of functional recovery was related to stroke severity, with very severe strokes taking longer to recover. Even for the most severe group, very few patients improved after 5 months.
- Kramer AM, Kowalsky JC, Lin M, et al. Outcome and utilization differences for older persons with stroke in HMO and fee-for-service systems. *J Am Geriatr Soc.* 2000;48(7):726–734.

This study looked at stroke patients on admission either to a rehabilitation hospital or nursing home, and compared outcomes based on whether the patient was in a health maintenance

organization (HMO) or a "fee-for-service system" (FFS). HMO patients had better social support and more income, and FFS patients were more likely to be blind or have a psychiatric diagnosis. The groups were otherwise comparable. HMO patients had shorter hospital stays and received less physical and speech therapy, fewer visits from physicians, physician assistants and nurse practitioners, and fewer consults, and they were less likely to be seen by a neurologist or a psychiatrist. Following discharge, and after adjustment for several risk factors, HMO patients were found to be about twice as likely to be in a nursing home and about half as likely to be living in the community. Mortality was about the same in the two groups.

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