

Competent Care for Persons with Spinal Cord Injury and Dysfunction in Acute Inpatient Rehabilitation

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Introduction

The purpose of this paper is to describe the resources necessary to provide **competent care** to persons with spinal cord injury or dysfunction (SCI/D) during their **initial acute rehabilitation admission**. It is not the purpose of this paper to specify standards of care. Clinical guidelines and standards of care that reflect evidence based best practices have already been published and are available from various professional organizations.¹⁻¹⁴ This paper will provide a brief description of the essential elements of a SCI Program and the various discipline areas contributing to it, and will refer, as appropriate for additional details, to the previously published standards of care.

This paper focuses primarily on the initial inpatient rehabilitation phase of care. Although inpatient rehabilitation admissions have become shorter in duration, they are the critical first stage of the rehabilitation care continuum.

Rationale

Prior to 1980 rehabilitation for persons with SCI occurred primarily in specialized centers that included Veterans Affairs (VA) hospitals and those designated by the National Institutes for Disability and Rehabilitation Research as SCI Model Systems of Care. These centers became recognized as expert providers of state of the art clinical care, education, and research focusing on SCI/D. The health care environment of the 1980s, during which rehabilitation was exempt from the diagnosis based prospective payment system that changed the delivery of acute medical care, saw a proliferation of rehabilitation hospitals and rehabilitation units within hospitals throughout the United States. These new hospitals and units often admitted patients requiring spinal cord injury rehabilitation, though they may have lacked the full spectrum of services that have been shown by the SCI Model Systems of Care to produce the most optimal outcomes.

In 2001 the national rehabilitation environment became more complex with implementation of the government Prospective Payment System for Medical Rehabilitation which initially specified that 75% (now amended to 60%) of patients admitted to an acute rehabilitation hospital had to fall within one of thirteen core diagnostic categories in order for a hospital to receive reimbursement from the Centers for Medicare and Medicaid Services (CMS). Because spinal cord injury/dysfunction (SCI/D) was identified as one of these core categories, many hospitals chose to admit these patients in order to maintain compliance with the “60% rule,” whereas previously they may have referred them to a rehabilitation hospital with expertise in SCI/D. Since then, hospitalization for acute rehabilitation has become more limited and patient care services have shifted to subacute rehabilitation and outpatient settings. According to the National Spinal Cord Injury Statistical Center (NSCISC), the median hospital days in the acute care setting declined from 24 days in 1973-1979 to 12 days in 2005-2008. During this same period, the days spent in the acute rehabilitation phase showed a similar dramatic decline from 98 days to 38 days.¹⁵

These accumulated changes over the past thirty years have created confusion and time pressures for health care professionals and consumers trying to make the best possible choices regarding where to receive rehabilitation services in today’s health care market.

An Interdisciplinary Team Approach

Spinal cord injury care involves much more than treating just the medical and physiologic consequences of the injury. Comprehensive rehabilitation services must include a highly specialized interdisciplinary approach that addresses medical, physiologic, functional, psychological, and social issues. All interdisciplinary team members must be able to recognize the unique needs of this population and implement interventions to maximize patient outcomes. Team members should understand the International Standards for Neurological Classification of Spinal Cord Injury (ISNCSCI) as well as the relationship of these standards to prognosis for recovery and anticipated functional outcomes.^{14, 16-18} They should be knowledgeable about and strive to prevent the costly medical complications that are common in persons with SCI/D and their impact on activities of daily living (ADL) and functional mobility. It is important to appreciate the psychosocial impact of SCI/D and to be able to address issues of adjustment. The team must be able to implement complex discharge plans and arrange for life-long follow up and health promotion. Providers must be able to educate and train patients and their caregivers, utilizing efficient methods to facilitate learning during today's limited lengths of stay. Further, providers should be able to adapt their educational style to the learning abilities and cultural identities of those they are teaching. Practitioners in every discipline should be licensed and/or certified as required by the state or national organization to meet and maintain ethical and statutory requirements.

Communication and collaboration among team members are crucial for successful rehabilitation of the patient with SCI/D. For example, as a 24-hour service, nursing staff work with and observe the patient throughout the entire day. As a result, they add value to the rehabilitation process by helping and encouraging the patient to transfer the skills learned in therapy sessions to their daily routine. Equally important is the feedback that nursing staff members provide to their teammates regarding the patient's ability to carry over these skills during evening and night hours. Nursing staff often have interactions with family members that are of great value to other team members, allowing all members of the team to adjust their treatment goals and strategies as necessary.

The patient and family/support system are the central members of the interdisciplinary team and all decisions concerning care are made in collaboration with them. There are a variety of ways to communicate and collaborate ranging from one-on-one sessions, rounds, educational sessions, team meetings, family conferences, and group sessions.

In addition to staying current with advances in neurorecovery following SCI/D, team members should keep abreast of advances in spinal cord injury care in each of their respective disciplines so that the entire program can benefit through the adaptation of care advances.

Medical Services

Traumatic SCI is often associated with a variety of concomitant injuries. Further, persons sustaining SCI become immediately vulnerable to a wide array of significant multisystem medical complications such as pneumonia, deep vein thrombosis and pressure ulceration. It has

been reported that the frequency of medical complications in SCI is inversely proportional to the quality of care available at the treatment facility.¹⁹ It is critical, therefore, that the physician directing care for the newly injured person possess expertise in identifying associated injuries. Further, the physician directing the rehabilitation program must develop treatment plans to prevent common medical complications, promptly diagnose them if they occur, and treat them expeditiously. The physician must also be skilled at performing neurological assessment of the injured person using the ISNCSCI¹⁴ and must possess the knowledge to accurately prognosticate the likely neurologic and functional outcomes based on this assessment. The physician can then direct an appropriate multidisciplinary treatment plan that will address the medical, functional, psychosocial, vocational and avocational needs of the injured person. A physician treating persons with SCI/D should be experienced at directing a multidisciplinary team that places the patient in an active role as part of the treatment team.

While the majority of such physicians are specialists in physical medicine and rehabilitation, these skills are not the domain of physicians from any particular field of medicine; rather they are acquired through relevant experience. Such experience may be obtained by working in a clinical environment that regularly treats persons with SCI/D. A more formal route is to complete an accredited fellowship training program in spinal cord injury medicine. There are presently 19 such training programs in the United States. Subspecialty certification in SCI Medicine has been available since 1998 for candidates who have passed a certifying exam administered by the American Board of Physical Medicine and Rehabilitation. While initially open to physicians with a record of clinical treatment of persons with SCI, the only way to gain eligibility for the credentialing examination currently is to complete an accredited SCI Medicine fellowship.

A recent meta-analysis of relevant literature concluded that the most important dimension of rehabilitation for people with SCI is the caliber and vision of the rehabilitation staff.²⁰ The physician is the leader of that competent and visionary team.

Consulting Physicians

Spinal cord injury is often the result of a traumatic insult such as a vehicular accident, fall, act of violence or sports injury. As a result, there are often injuries that accompany the SCI. According to the Model Systems' database, the most common associated injuries include extremity fractures (29.3%), loss of consciousness (28.2%), pneumothorax/hemothorax (17.8%), and traumatic brain injury affecting cognitive or emotional functioning (11.5%). Also, persons with SCI/D are particularly susceptible to complications involving the respiratory, gastrointestinal, urological, cardiovascular, integumentary and musculoskeletal systems. During the inpatient rehabilitation phase of care, it is best to maintain the injured individual in the rehabilitation setting, when possible, and bring in the appropriate medical or surgical specialist if complications arise. The multisystem nature of the condition requires the availability of supportive medical and surgical services during the rehabilitation phase of care.²¹

For example, a pulmonary specialist is of great value in assisting in the weaning of a patient from mechanical ventilation, or in the treatment of pneumonia, particularly if there is a need for therapeutic bronchoscopy. A spine surgeon is an important resource for the follow up of spine

stability. A plastic surgeon makes a valuable contribution when the reconstruction of severe pressure ulcers is required. The availability of a psychiatrist to work with the psychologist and social worker is important when pharmacologic treatment of depression or anxiety is required.

Urological Services

For a spinal cord injury program to provide competent care, urological evaluation and management are required. Maintaining optimal urological health is one of the main priorities in the medical care of an individual with spinal cord injury. Bladder evaluation and management are on-going and often require adjustment, according to the individual needs of each patient. The facility should be able to provide evaluation for, and teaching of, various bladder management programs, as well as education about sexuality and fertility. In order to meet these goals, the spinal cord injury program should be associated with a urologist who is available to consult on a regular basis.

Testing of the upper and lower urinary tracts is required, either at the facility or by making arrangements at another facility. Though there is no clear consensus about which tests should be regularly performed from a screening point of view, the availability of a number of diagnostic studies is desirable. These include renal scans to evaluate kidney function, and abdominal CT scans and ultrasounds to evaluate anatomy. Testing of the lower urinary tracts may include urodynamics to evaluate bladder and sphincter function, cystography to evaluate bladder anatomy and identify vesico-ureteral reflux, and cystoscopy to visually evaluate bladder and sphincter anatomy.

While there is no consensus on the exact timing and choice of testing, many SCI centers recommend a baseline evaluation of the upper tracts during the acute rehabilitation phase, with annual follow up thereafter. Lower tract testing is often initiated when spinal shock subsides and annually thereafter. Additional consultation and testing is performed based on screening test results and as clinically indicated. Results of these diagnostic tests are used to guide prescription of a bladder management plan that optimizes the person's independence.

Medical Support Services

In addition to basic radiology, laboratory, and pharmacy services routinely provided by the hospital, the rehabilitation program caring for patients with SCI/D should have easy access to additional services if not available within the facility. These include CT, MRI, nuclear medicine, ultrasonography and modified barium swallow. Pharmacists with knowledge of pharmacological agents routinely utilized with SCI/D patients, such as anticholinergics and antispasmodics, can be valuable members of the rehabilitation team, providing consultation with physicians and patient education.

Case Management

Case managers coordinate the provision of rehabilitation care. Case managers are usually nurses or social workers but may also be a team member from another discipline. Their role is to

balance the needs of the patient and family, assure quality care and oversee the cost-effective use of health care services and resources.

To assure that a patient with SCI/D receives competent care during an acute rehabilitation admission, the case manager:

- Identifies financial constraints that may impact admission, the provision of rehabilitation services and long term follow-up care.
- Assists the patient and family in understanding the constraints of the private and public insurance programs and in making informed decisions about their rehabilitation program and transition to the community.
- Collaborates with team members to identify a patient's educational, financial, psychosocial and vocational needs and barriers to community discharge. This will involve the development of a plan of care and setting realistic goals within the limits of financial resources.
- Communicates with external payer representatives, service providers, and equipment vendors when necessary.
- Evaluates, monitors and updates the discharge plan.
- Acts as a conduit to the community, ensuring the provision of follow-up medical and therapy care, home care services, transportation services, home modification projects, and training of caregivers.
- Facilitates and assures the delivery of needed durable medical equipment (DME) and supplies.
- Assures through follow-up that the transition from acute rehabilitation to the next setting, e.g., home or skilled nursing facility, is successful.

Additional resources are available in the literature.²²⁻²⁸

Rehabilitation Nursing

A rehabilitation nurse has specialized training in rehabilitative and restorative principles, works collaboratively with the entire rehabilitation team, and ascribes to a philosophy of care that takes a holistic approach to meeting a patient's functional, emotional, medical, vocational, educational, environmental, and spiritual needs. The nurse assists patients with SCI/D to adapt to an altered lifestyle, designs and implements treatment strategies based on scientific nursing theory and evidence based practice related to self care, and promotes physical, psychosocial and spiritual health.

To provide competent care, nurses working with SCI/D patients must have experience with:

- Neurological assessment and the ISNCSCI classification system
- Bladder and bowel management in upper motor neuron and lower motor neuron SCI/D
- Maintenance of skin integrity
- Autonomic dysreflexia and autonomic instability
- Nutrition
- Circulatory, respiratory, and musculoskeletal complications
- Spasticity and spasticity management

- Self care
- Medications common to SCI/D
- Pain management, in particular neuropathic pain
- Psychosocial issues relevant to patients with SCI/D
- Sexuality and fertility
- Re-integration to, and safety in, the home and community setting
- Appropriate DME (e.g., beds and mattresses) commonly used for SCI/D

A registered nurse with at least two years of practice in rehabilitation nursing can sit for the Certified Rehabilitation Nurse (CRRN) Exam, which validates their expertise in the field. Certification is an indication that the nursing staff and administration are committed to providing excellent care to individuals with SCI/D. It is strongly recommended that nursing staff obtain this certification. As with other disciplines, consistency of staffing is a key to outstanding care, education, and training.

Standards of care and nursing education developed by the Nursing Section of the Academy of Spinal Cord Injury Professionals should be integrated into the program and reflected in nursing policies and procedures.^{13, 29}

Occupational Therapy and Physical Therapy

The skill and expertise of the therapy staff can significantly affect the functional outcome of persons with SCI/D. Continuing education and training beyond basic education programs and exposure to a sufficient volume of patients with SCI/D are imperative for therapists to build and maintain skills and competencies in highly specialized areas. These include the ISNCSCI classification system, expected functional outcomes, respiratory interventions, assessment of mobility, and recommendations for DME and assistive technology. Therapists must be able to break down functional tasks into component parts while working on building the strength, endurance, and flexibility required for the patient to achieve their expected level of function. In addition, therapists must help to minimize the risk of overuse injuries, especially to the upper limbs, by understanding and teaching the appropriate balance of functional repetition, aerobic exercise, stretching and strengthening activities. This will lay the foundation for further skill development, while also preventing functionally limiting complications, such as pressure ulcers, contractures, respiratory complications, and poor posture. Therapists must acknowledge that an optimal outcome may take months or years, and the role of the therapist in the inpatient setting should be to provide fundamental training and education to ensure the patient's safety and health as they transition to an outpatient setting after discharge.

Continuing education may occur through in-house peer programs and mentoring, and outside course work focusing on SCI/D. Professional organizations such as the American Spinal Injury Association (ASIA) and the Academy of Spinal Cord Injury Professionals (ASCIPRO) as well as special interest groups within discipline-specific professional organizations such as the American Physical Therapy Association (APTA) and the American Congress of Rehabilitation Medicine (ACRM) also provide educational resources to therapists.

A rehabilitation unit treating persons with SCI/D must have an adequate number of therapists on staff with the requisite experience and skills to provide patients with the greatest chance for optimum functional outcomes. Experienced therapists can also provide hands on education to their less experienced colleagues. Occupational therapists and physical therapists working with patients with SCI/D must communicate regularly in order to prioritize goals and treatment, avoid duplication, and collaborate on interventions and equipment prescriptions.

To provide competent care, occupational therapists and/or physical therapists working with SCI/D patients on a rehabilitation unit must be proficient in:

- Assessment and documentation of motor and sensory function. Assessment of motor function should include voluntary and involuntary motor activity of all muscle groups throughout the body, not just the key muscles specified by ISNCSCI.
- Identifying functional compensatory strategies and appropriate adaptive equipment that can be utilized for activities of daily living (ADL) skills, such as feeding, grooming, upper and lower body dressing, bathing, and management of the bladder and bowel.
- Instructing in functional and mobility skills for all levels of SCI/D to include transfer training to all surfaces, wheelchair mobility for indoor and outdoor terrain (including advanced wheelchair skills), bed mobility and gait training. This requires a thorough understanding of appropriate DME options and funding parameters.
- Providing recommendations for access into and within the patient's home/school/work environments that are based on that person's individual needs beyond the standard Americans with Disabilities Act or other regulatory guidelines.
- Assessment of, and recommendation for, assistive technology, such as phone, computer and environmental access devices, based on the person's functional level, expected outcome and discharge environment.
- Wheelchair (manual and power), wheelchair seating and mobility device prescription.
- Assessment of upper limb function, focusing on upper limb functional preservation, prevention of overuse throughout all mobility and ADL training, use of adaptive devices (which should be available for training), and pain management related to overuse.
- Assessment of trunk and lower limb function for establishing long term goals in mobility and locomotor training
- Utilizing selective lengthening and shortening of various muscles to enhance a patient's functioning in the absence of active movement; for example, slight shortening of the finger flexors to facilitate tenodesis grasp.
- Utilizing various upper and lower limb orthotic devices to properly protect joints during activities and/or to promote function in the absence of active movement.
- Teaching patients with lower anatomical level of SCI/D or motor incomplete injuries appropriate gait skills. This includes the use of lower extremity bracing and other neurorecovery therapeutic interventions such as functional electrical stimulation (FES).
- Using modalities such as electrical stimulation and/or neuroprostheses to promote independence, wound healing or muscle reeducation/enhancement.
- Preparation of the person with a SCI/D for discharge to home and community environments – directing all care needs, use of external resources and consumer advocacy skills.

It is recommended that at least one OT or PT have certification from the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA)³⁰ as an Assistive Technology Practitioner (ATP). An ATP has specialized training in wheelchair seating and mobility, DME selections, home accessibility recommendations and assistive technology.

Additional resources are available in the literature.^{27, 31, 32, 33}

Speech Language Pathology

The speech and language pathologist (SLP) on the team may play several roles in the care of a person with SCI. Appropriate skill sets are outlined in position statements and guidelines by the American Speech and Hearing Association (ASHA).³⁴⁻³⁷

It is strongly recommended that the speech language pathologist (SLP) working with SCI/D patients who have compromised respiratory support also possesses:

- Advanced knowledge and skills in performing diagnostic dysphagia evaluation (i.e. videofluoroscopy) for swallowing and voice and an understanding of the impact of surgical intervention on swallow and voice function.
- Knowledge of respiratory/pulmonary function in relationship to speech production and swallowing and knowledge of basic pulmonary care.
- Knowledge and clinical skill sets regarding patients with tracheostomies, with and without ventilator dependency. Skill sets need to include knowledge of the various tracheotomy tubes and sizes and their impact on voicing and swallowing as well as the use of voice prostheses in such individuals.
- Knowledge and a clinical skill set focused on alternative and augmentative communication assessment and training. The SLP should have access to various devices and systems to assist in therapeutic trials.

Throughout the treatment program the SLP needs to integrate treatments with the full rehabilitation team and incorporate the skills/guidelines outlined by ASHA for the treatment of individuals and families concerning swallowing and communication.

For those patients with a dual diagnosis of SCI and traumatic brain injury (TBI), the SLP would assess and treat the level of cognitive impairment from the head injury, as per standards of care for persons with brain injury.

Psychosocial Services

Critical to the success of any SCI rehabilitation program is an understanding of the complex psychological and social changes which impact the injured individual and their family. As a result, psychologists and social workers are critically important members of the rehabilitation team. From initial onset, through acute care, inpatient and outpatient rehabilitation and into the community, adaptation to spinal cord injury is a continuous process. The person with SCI, their families, and their extended support systems are constantly accommodating and meeting challenges in their lives.

Psychologists and social workers contribute by providing specialized clinical skills to help the individual achieve optimal, psychological, behavioral, social, vocational, and recreational functioning. Psychologists and social workers provide complementary functions but their roles are not interchangeable. Comprehensive assessments by psychologists and social workers focus on the individual's current coping status and accommodation to the SCI in the context of person, family, and society. Assessments may include, but are not limited to:

- Prior psychological response style to life stressors
- Premorbid psychological status
- Behavioral and psychological response to SCI
- Current mental status, neuropsychological status, and intelligence
- Personality factors
- Ethnic, cultural, and religious factors
- Family and social support networks
- Financial status and resources
- Housing and living arrangements
- Patient and family expectations of treatment
- Recreational interests
- Work history and vocational status
- Educational background
- Identification of barriers to rehabilitation
- Behavioral strengths and weaknesses
- Sexual concerns
- Legal issues
- Substance use and abuse

The psychologist and social worker will also contribute with other team members to the formation of the patient's individual treatment plan. Both psychologists and social workers should have expertise in a variety of psychosocial intervention techniques including but not limited to:

- Behavior management
- Couples counseling
- Family therapy
- Individual psychotherapy
- Problem solving and coping skills training
- Sexual counseling
- Stress management techniques
- Group therapy

At times, psychologists and social workers may also serve as resources to the rehabilitation team through their specialized training and expertise in problem-solving, communication, and interpersonal skills.

Additional resources are available in the literature.³⁸

Therapeutic Recreation

A program providing competent care should include a Therapeutic Recreation (TR) Specialist on the rehabilitation team who has expertise in working with persons with SCI/D. TR uses recreation and leisure activity interventions to guide treatment that enhances the patient's health, function and quality of life. TR specialists facilitate the development, maintenance and expression of a fulfilling leisure lifestyle and optimized community re-entry for persons with SCI/D. In addition, TR specialists use leisure experiences to help achieve therapeutic goals, supplementing those of physical and occupational therapies. After evaluation and goal-setting, the TR Specialist provides programs and services that help eliminate barriers to leisure satisfaction, develop leisure skills and use leisure activities as a way to decrease potential medical complications after discharge and enhance activity and participation in their community. The TR Specialist should have knowledge about:

- Adaptive equipment and how it can be incorporated to promote independence for a person in leisure and recreational activities.
- Community re-integration, including what the person should expect when returning to the community and how to advocate for themselves in accordance with the Americans with Disability Act
- Resources on adapted sports, activities, and support groups specific to the SCI/D population in their area.

Additional resources are available in the literature.^{39, 40}

Pastoral Care

Illness and injury in any form can disrupt the worlds of patients and their families. The chaplain must be able to respond to the emotional, spiritual, and religious aspects of the disruption with empathy and compassion. He or she should provide pastoral care to patients, families, and hospital staff that is respectful of their religious traditions and cultural backgrounds. The chaplain should take a leadership role in the institution in the areas of religious and ethical practice and cultural sensitivity. The pastoral caregiver must actively collaborate with the treatment team and appropriately document pastoral interventions. In addition, the chaplain should be able to address the patient's recurring questions about the meaning of the injury, communicate with the patient's home clergy, and assist with the emotional and physical transition back to church, synagogue, or other house of worship.

Peer Mentoring

Persons who reflect the characteristics of the patient and are living successfully with SCI/D can offer support, encouragement, role modeling and mentoring to newly injured patients and their families and be a useful and valuable resource to the rehabilitation program. The rehabilitation team should have access to trained peer mentors.⁴¹ A family/caregiver peer program will also offer the caregivers a unique form of support and learning different from the treatment team.

Other Support Services

Other services offer specialized information and care relative to the needs of the person with SCI/D and contribute to a comprehensive medical and therapeutic program.

Respiratory Care

Major respiratory problems after acute SCI/D include hypoventilation, atelectasis, and secretion management, all due to weakness or paralysis of the musculature needed to breathe and produce a cough.

To provide competent care for SCI/D patients, it is recommended that respiratory therapists familiar with SCI/D be a part of the rehabilitation team, with around the clock availability. When respiratory therapists are not available, the rehabilitation team must be knowledgeable about respiratory function in the patient with SCI/D and proficient in airway management and methods of assisting the patient to mobilize secretions. Interventions include monitoring of oxygen saturation, routine performance of incentive spirometry, assisted cough (“quad cough”), deep breathing techniques, alternative breathing methodologies (e.g., frog breathing), chest physiotherapy, and respiratory treatments. Education of patient and caregivers on pulmonary care and the need for life-long vigilance is critical. Pneumonia and influenza vaccines should be prescribed to persons with SCI/D who have impaired cough.

Patients who are ventilator-dependent should be transferred to a specialized SCI rehabilitation hospital or unit with expertise for such patients. Patients on long term ventilator support have the possibility of returning to the community and a productive life if they have access to specialized equipment, facilities, comprehensive community support and care and, specialized practitioners who have knowledge and experience working with this population.⁴²

Medical Nutrition

A registered dietitian (RD) is an important member of the interdisciplinary team providing care for patients with SCI/D. Acute SCI/D is often associated with severe catabolism and nutritional depletion because of depletion of protein stores. When a patient is in the rehabilitation phase, the RD should conduct a nutrition assessment to develop and implement an individualized therapeutic plan. Evidence suggests that medical nutrition therapy by a RD may result in improved ability to participate in therapies and transition into the community setting and may contribute to improved nutrition-related patient outcomes related to weight control, bowel function, prevention of skin breakdown and pressure ulcer management.⁴³

The nutrition assessment should include but is not limited to:

- Food and nutrition-related history: Energy intake, appropriateness of diet order, beverage intake, fiber intake, medication and herbal supplement use, mealtime behavior, nutrition-related ADLs and instrumental ADLs, physical activity and weight change.

- Biochemical and medical tests and procedures: Swallow study, inflammatory profile, metabolic profile, serum albumin and prealbumin.
- Nutrition-focused physical findings related to the digestive system, cardiovascular-pulmonary system and skin
- Comparative studies: Energy needs, protein needs, ideal body weight, fluid needs, and fiber needs.
- Social history

Additional resources are available in the literature.⁴³

Spasticity management

Spasticity (increased involuntary resistance to quick passive stretch) is a common occurrence after SCI that can have beneficial or deleterious effects on function and comfort. When problematic spasticity develops, it is important to rule out a triggering stimulus below the level of injury to see if removing the trigger will resolve the spasticity. Spasticity management should be discussed by the members of the treatment team led by the SCI physician. The team should identify what aspects of mobility and activities of daily living are facilitated or hampered by spasticity.

Treatment of spasticity is multidimensional. The treatment team should possess the skills and tools to begin to treat problematic spasticity. These tools include the use of physical modalities, bed and wheelchair positioning, tone inhibiting orthotics and casting. The SCI physician should be well versed in the judicious use of systemic anti-spasticity agents including baclofen, tizanidine, benzodiazepenes and dantrolene sodium. The availability of injection therapy to treat focal spasticity with agents such as phenol and botulinum toxin expands the therapeutic repertoire for the patient. The physician should also be able to identify patients who are appropriate candidates for treatment with intrathecal baclofen, particularly when less invasive treatments have been ineffective or poorly tolerated. The physician should either be adept at pump refill, programming and troubleshooting or should identify a local resource to which patients could be referred for this treatment.

Sexuality and Fertility

Education and counseling related to sexuality and fertility following SCI/D should be a part of any program providing competent care. It is recommended that specific members of the team be designated to provide sexuality education as part of the total SCI/D education curriculum. Healthcare professionals must provide education about the effects of SCI/D on sexuality and sexual function with a positive attitude for the future. They should address concerns using a developmental and holistic approach; the focus should be on body image, self-esteem, and gender-specific sexuality issues. Personal beliefs, values and attitudes must be considered and respected when discussing sensitive topics. If formal discussion intimidates the individual, written material or web based resources should be provided. Referral to a urologist or gynecologist familiar with SCI/D may be necessary to address sexuality and fertility options.

Driving

In many instances persons with SCI/D may enhance independent community access through the mobility that driving a personal vehicle can provide. Since driving options vary based on the level of the injury, it is essential that any individual considering a transport vehicle or driving a personal vehicle be evaluated in a comprehensive driver rehabilitation program.

Recommendations will be made based on an assessment of the individual's capacity to operate a motor vehicle, with or without modified controls. Most assessments are followed by training and include state licensure requirements. Staff providing assessments of driving should have, at a minimum, a health professional or traffic safety background and be qualified as Certified Driver Rehabilitation Specialists (CDRS). Occupational therapists can also receive certification through their national organization to provide driving assessments. If not available as part of the institution's SCI/D program, a referral to a driving program should be provided as part of the plan for post-acute care. Additional resources are available in the literature.^{44, 45}

Rehabilitation Engineering, Vocational Rehabilitation, and Technology

Although rehabilitation engineers, vocational rehabilitation counselors, and assistive technology specialists may play a significant role in the SCI/D patient's reintegration to the community, their services may not always be a part of an inpatient rehabilitation program. These professionals should, however, be available for consultation in both the inpatient and outpatient settings. After a person with SCI/D returns to the community, they will have a broader perspective of their environmental needs, at which time working with the assistive technology specialist and rehabilitation engineer will offer enhanced options and solutions. Early contact with vocational counselors, when appropriate, offers information to the individual and family on work support resources and available funding agencies.

As technology evolves, so do the opportunities to use it in the rehabilitation of individuals with SCI/D. Many rehabilitation programs have developed specific features focusing on the application of technologies to meet the functional needs of the persons with various levels of motor ability. Although not mandatory for the provision of competent care in a patient's initial rehabilitation admission, the use of some of these technologies may enhance the rehabilitation process. These include:

- Functional electrical stimulation (FES) with applications that enable:
 - Strengthening of upper and lower limb musculature
 - Hand grasp and functional pinch
 - Standing and standing transfers
 - Ambulation
 - Urination via stimulation of anterior sacral nerve roots
 - Ventilator free breathing via stimulation of phrenic nerves or the diaphragm
- Body weight support treadmill systems to facilitate gait training

- SMART wheel to examine manual wheelchair use during propulsion
- Pressure mapping system to identify an optimal seating system or mattress.

Education

Rehabilitation is largely a process of education of the patient and their support system, thus a program must provide educational programs and access to educational resources to the patient and family in order to provide competent rehabilitation services for persons with SCI/D. Educational programs must be individualized to the needs of the person served based on their general health, SCI/D-specific needs, discharge plan, age, learning style, culture, language, beliefs and previous knowledge base. Teaching methods and tools must also be tailored to cognitive impairments and literacy level.

Educational interventions must prepare the person served and their caregivers to manage healthy routines, maintain safety, and solve issues that commonly occur after SCI/D. Knowing when and how to access additional assistance and resources in the community and health care system is a critical component of SCI/D education. Education can be provided verbally, in a web based format or in a written format. Comprehensive patient education manuals are available from some SCI Model Systems and contain information on many topics relative to SCI/D. Topics that should be addressed in the education of persons with SCI/D include, but are not limited to:

- Access to benefits and other support systems, such as education, vocational rehabilitation, medical insurance, Social Security/Disability, and Workers' Compensation
- Autonomic dysreflexia.
- Bladder management.
- Bowel management.
- Cardiovascular effects of SCI and risk factors for cardiovascular disease.
- Consumer advocacy organizations.
- Diabetes prevention.
- Edema management.
- Emergency preparedness.
- Health and wellness.
- Home and community safety.
- Follow-up medical care, including the need for and how to access care.
- Independent living.
- Leisure education
- Life care management.
- Medical nutrition and weight management
- Musculoskeletal issues.
- Pain management.
- Personal assistance services.
- Psychosocial issues.
- Pulmonary care.
- Self-advocacy and consumer competency.

- Sexual counseling and education, including information about reproduction.
- Skin care and prevention and treatment of pressure ulcers.
- Spasticity management.
- Spinal cord injury research, including access to current research.
- Substance use, abuse and dependency.⁴¹

In addition to the education of patients and their support systems, a program that provides competent care should also provide education for other healthcare providers in the acute care hospital and in other care settings in the community. Primary prevention of SCI/D and prevention of complications should be addressed. Standards for accessibility and reasonable accommodations for persons with SCI/D should also be taught.

Administrative/Operational Functions

Effective administrative leadership is essential for the success of any spinal cord injury program. Administrators ensure the rehabilitation program for persons with SCI/D have facilities that are in alignment with regulatory agencies, provide necessary equipment for persons served as well as providing employees the tools necessary to succeed in treating persons with SCI. Administrators are constantly assessing the outcomes of their program and making adjustments as necessary. Continuous process improvement is required to address the ever changing healthcare landscape as well as to make assessments of the quality of services provided. The goal of any program is to provide the person with SCI/D the skills and knowledge to successfully return to their community. To that end, each program should monitor outcome statistics for their patients regarding return to home and community and other functional measures.

The facility in which the rehabilitation program is located must comply with the Americans with Disabilities Act (ADA) and the Architectural Barrier Act (ABA).⁴⁶ These federal mandates require that facilities be accessible to the public and are designed to be accessible to people with disabilities. Accessibility not only includes architectural and environmental barriers, but also barriers related to attitudes, finances, employment, communication, transportation, and community integration. The removal of any or all barriers is necessary for any rehabilitation setting.

Participating in regular program evaluation allows administrators to benchmark outcomes of their programs. It is imperative that inpatient rehabilitation spinal cord injury programs have a robust system to measure their performance in areas of both business and clinical services. At a minimum, results of the delivery of services in areas of effectiveness, efficiency, access and input from the patient and other key stakeholders should be addressed. The measurement of durability of results in these key domains should also be addressed during follow-up and not just at discharge. The spinal cord injury program should be able to demonstrate its long-term, beneficial results for the patient's health and function. Measures that could address this would be avoidance of re-hospitalization, health promotion, improved independence and autonomy, and return to productive activity.

Special Populations

Pediatric and Adolescent Patients with SCI/D

Considerations for pediatric rehabilitation programs are well-documented.⁴⁷⁻⁵³ If a rehabilitation hospital or unit intends to admit pediatric patients with SCI/D, they must:

- Provide the appropriate milieu that includes, in addition to traditional therapies, equal time for play and leisure (e.g., child life, recreation therapy, free time to hang out) and education (formal academics provided by a neighboring public school system). Without exception, inpatient units must approach rehabilitation programs using a developmental model.
- Provide anticipatory guidance regarding future expectations. Predictable secondary complications such as scoliosis occur as a result of paralysis superimposed on the normal musculoskeletal growth in a child and, for this reason, an orthopedic surgeon and orthotist are key personnel on the pediatric rehabilitation team.
- Include parents of children with SCI/D as equal recipients of the rehabilitation process. Great attention must be given to parental reactions, both emotional and physical, to their child's SCI/D. Intervention in the form of support or other medical care must be offered to minimize adverse health conditions that can develop in parents. Often, a parent support group, led by psychology or rehabilitation nursing, is a regular event in the pediatric rehabilitation unit. Family peer mentoring from parents of previously injured children may also be helpful.
- Provide the appropriate physical environment, including appropriately-sized adaptive and durable medical equipment, play equipment, lower hand rails, toilets, sinks, and beds, and high-low tables to accommodate the varying ages of children and adolescents.

SCI/D in the Elderly

The average age of the person sustaining an SCI has increased progressively over the last thirty years. In 1979, the average age was 28.7. This rose to 40.2 years in 2005.¹⁵ From 1980-2007 the percentage of patients older than 70 with SCI/D increased from 4.2 % to 15.4% of the total SCI population.⁵⁴ Elderly persons who sustain SCI should be considered as rehabilitation candidates, and rehabilitation staff providing competent care for persons acquiring SCI/D over the age of 60 must be knowledgeable about the unique set of physiological and psychosocial issues faced by these patients in comparison to their more youthful peers. The inclusion of a geriatrician on the rehabilitation team is strongly recommended.

The normal aging process causes functional decline that may include contributions from osteoporosis, loss of muscle strength and joint flexibility, diminished short term memory, high blood pressure, orthostatic hypotension, decline in respiratory function, changes in bowel function, thinning of skin with loss of elasticity, renal insufficiency and incontinence.⁵⁵ These changes often seen with normal aging are the same secondary complications faced by persons of any age with SCI/D, giving the person who acquires a SCI over the age of 60 a heightened risk of complications. Considering that older persons are more likely to have medical comorbidities and complicated psychosocial profiles (e.g., loss of marital partner, depression, limited social

networks, need for personal and financial assistance, etc.), it is not surprising that the care of older individuals who acquire SCI is more complex. These patients are less likely to regain functional independence^{56, 57} and re-enter the community despite having similar potential for neurological recovery. They also have a significantly greater rate of mortality than younger patients within the first year following onset of SCI, 47% compared to 5%.⁵⁸

The interdisciplinary team working with elderly patients with new SCI/D or with patients who are aging with chronic SCI must be knowledgeable about geriatric care in addition to standard SCI care. They must be highly skilled in managing the multiple health conditions and heightened risk for complications. The team must be able to set achievable functional goals and understand the complex psychosocial issues facing the elderly. The treating team must provide effective counseling and work to resolve complicated discharge issues. The team must provide education and training for patients and families that are both comprehensive and specific to their unique needs.

Bariatric Patients with SCI/D

Among the most challenging patients are those who are obese. With obesity complicating the already highly specialized needs and care, these patients are at increased risk for the common complications of SCI/D, including skin breakdown and deep vein thrombosis. The rehabilitation team must have expertise in preventing and treating these complications in obese patients. To provide competent care to persons with SCI/D and obesity, team members must be able to modify treatment plans and strategies as well as provide for bariatric equipment such as specialty beds, wheelchairs and lifts to ensure the safety of the patient and caregivers. Nurses and therapists must be able to adapt bed mobility, transfers, ADLs, and wheelchair propulsion skills in order for a patient with obesity to achieve their maximum level of independence. Fitting an obese patient with the appropriate DME also requires specialized expertise. For example, if the patient exceeds the weight limit for the pressure mapping system, it will take an experienced clinician to choose a wheelchair cushion and bed mattress to prevent skin breakdown. Assistance from vendors specializing in bariatric equipment may offer help for equipment prescription and provision. Discharge planning is complicated by the need to accommodate the weight and size of bariatric equipment into the patient's home. Experienced staff should consider a home visit or architectural consultation to ensure accessibility, safety, and functional mobility in the home. Additional resources are available in the literature.^{59, 60}

Patients with Spinal Cord Injury with Concomitant Brain Injury (BI)

While the Spinal Cord Injury Model Systems of Care report that 12% of all SCI patients demonstrate clear signs of cognitive dysfunction,⁶¹ other studies report an incidence of dual diagnosis as high as 24%-54%,⁶² as mild BI often goes undetected. The rehabilitation team that serves persons with SCI must be proficient at identifying a person with a concomitant BI as well as adapting the rehabilitation program for such individuals in order to achieve optimal outcomes.

Concomitant BI ought to be suspected in persons who have had a loss of consciousness, abnormal Glasgow Coma Scale score, history of substance abuse, prolonged extrication time, respiratory insufficiency, or in persons who have experienced seizures.⁶³ Clinical signs of

cognitive impairment include agitation, aggression, disinhibition, amnesia and abnormal mental status. Identifying a patient with concomitant BI may be difficult because drug effects may mimic cognitive impairment. Formal testing of neuropsychological function may be hampered by impairment of upper limb function.

Once a concomitant BI is identified, the rehabilitation process becomes more complicated and requires primary treating staff, with the assistance of consulting specialists, to be knowledgeable not only in SCI/D care, but also BI care. Physicians must have the skills to identify and treat post traumatic seizures, agitation and other behavioral alterations, neuroendocrine disorders, hydrocephalus and spasticity related to BI. In addition, physicians must be aware of medications that are commonly used for SCI/D that may have harmful consequences for persons with BI. The antispasticity agents, baclofen and tizanidine, for example, may have a greater likelihood of causing problematic sedation in a person with BI. Conversely, practitioners must also be aware of medications commonly used for BI that may have a deleterious effect for persons with SCI/D.⁶⁴ For example, neurostimulants must be used with caution in persons at risk for autonomic dysreflexia while beta blockers may precipitate problematic hypotension.

The roles of other team members such as the speech language pathologist and neuropsychologist gain importance for patients with a dual diagnosis. The treatment plan must accommodate cognitive dysfunction as well as behavioral change. Visual learning aids, memory books, verbal cueing and repetition of skills may be necessary. Finally, the treatment environment may need to be altered to provide less stimulation to decrease confusion and/or agitation during treatment sessions as well as to provide a safe environment for the patient. Family members must be educated in the skills necessary to manage the care of the injured person while avoiding excess stimulation.⁶¹

Sensory and Motor Incomplete Injuries

The preponderance of literature available on spinal cord injury (SCI) historically reflects standards of care for those persons with a complete SCI. The designation of “incomplete” encompasses a wide variety of clinical presentations of sensory and motor function below the level of the injury that may facilitate function, or offer the opportunity for further neurologic recovery over time. Rehabilitation planning and outcomes relative to independence, self-care, and mobility are based on the degree of neurologic impairment and therefore inpatient rehabilitation programs may vary significantly dependent upon the degree of “incompleteness” of the SCI/D.

Sensory incomplete SCI offers the potential safety of sensory awareness below the level of the injury; depending on the degree of intact sensation, especially if the individual is able to feel temperature, painful and/or tactile sensation which helps protect them from potentially dangerous circumstances such as burns or pressure sores. Motor incomplete SCI/D is characterized by variable voluntary muscle activity below the level of the injury, which may contribute to stability and mobility for functional tasks and signals that other muscles may recover as well. Expectations of functional outcomes for those with motor incomplete injuries are variable and depend upon amount of strength present, the injury pattern (e.g., central cord, Brown-Sequard, anterior cord syndromes), age and medical comorbidities. While rehabilitation programs for

those with complete injuries traditionally rely on compensatory strategies to perform ADLs and mobility skills, the emphasis for those with incomplete injuries is to include neuromuscular facilitation techniques and activity based interventions that enhance the recovery of motor strength and function. This approach requires intensive and repetitive practice of desired tasks and can continue over a prolonged period of time. As healthcare limitations have significantly reduced the inpatient length of stay for persons with SCI/D, there is a need for a continuum of care to be available to those with potential for neurologic recovery.

Continuum of Care

To enable persons with SCI to obtain their optimal level of function, they will almost always require ongoing services after inpatient rehabilitation. The traditional model of moving from the acute hospital to acute rehabilitation to the community has been increasingly modified, with interim stays in alternative settings including Long Term Acute Care (LTAC), subacute rehabilitation, skilled nursing facilities (SNF), and a variety of home based and outpatient therapeutic options. Managing the patient's rehabilitation program through such a continuum of care may save resources while still achieving an optimal level of function.

LTAC facilities are extensions of acute care hospitals, or specialized facilities, that offer interim care for persons with intense medical needs (e.g., respiratory), who are not yet able to tolerate an acute rehabilitation program. Therapy may be limited in this setting, and patients will often move to another setting when discharged from an LTAC. Subacute rehabilitation units may be housed in a SNF or a hospital. These facilities offer rehabilitation services at a much lower intensity than acute rehabilitation and they typically do not offer the specialized rehabilitation services which are often required by this population of patients. SNFs are often part of an extended care facility and offer minimal therapy services, while caring for the less complex patients who have skilled nursing needs, such as wound care.

Upon discharge to the community if an individual with SCI/D has not achieved all the desired functional outcomes as outlined by the *Consortium for Spinal Cord Medicine Clinical Practice Guidelines*¹¹, several options exist for outpatient care. Home care, for home bound individuals, offers skilled nursing and therapies, but is limited by the amount of time allotted and the available equipment and resources in the home. Home care does offer the opportunity for optimizing function in the home environment. The most intensive outpatient programs, called "day rehabilitation programs," offer a full day of coordinated professional services similar to an inpatient rehabilitation program, but are performed on an outpatient basis. Third-party payers may favor this option over inpatient rehabilitation because of lesser expense compared to more costly overnight hospital stays. The most common option for community based outpatient therapy is the traditional single-service therapy provided in the clinic. Outpatient programs allow the person with SCI/D to continue to learn the necessary functional skills while also stressing community re-integration.

When persons with SCI/D are living in the community, they should have access to a system of lifetime follow up care that combines the expertise of spinal cord injury care with primary care medical services. This follow up system should include consideration of medical, functional, nutritional, and psychosocial factors.

Regardless of the venue in which care is delivered, it is the team's responsibility to attempt to ensure a smooth transition through the continuum. Each patient's needs must be considered in order to recommend the appropriate setting along the continuum of care. Ultimately, care for any person with SCI/D should be coordinated by a single practitioner who evaluates the patient at regular intervals, serves as the point of first contact when acute issues arise, and assumes ultimate responsibility for the injured individuals care. The SCI/D physician is ideally suited to assume this role.

Conclusion

A person with SCI/D must have access to competent SCI/D rehabilitation care. Staff in acute care settings must know and be able to recommend where competent rehabilitation care is available and where patients can achieve the best possible health and functional outcomes. Representatives of payer sources should seek competent rehabilitation care in order to prevent expensive complications and achieve appropriate outcomes. The patient in conjunction with family members has the daunting task of making the final determination of which rehabilitation facility to choose. While high-tech equipment and plush environments may look attractive, more important considerations are the skills and experience of the team members and their ability to work together to deliver the crucial components of a program that offers competent care. With their collective expertise, individual members of the team are capable of adapting the rehabilitation process to the unique needs of each patient and family. Even in these days of shortened inpatient rehabilitation stays and limited access to the best programs, patients with SCI can reach their optimal potential and lead productive lives in the community if they are able to access an experienced team of healthcare professionals.

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