GUEST EDITORIAL

Restorative Treatment of Persons with Spinal Cord Injury: Current Trends

Never in our history have there been as many people alive with spinal cord injury (SCI) as today, but are they any better off now than a quarter of a century ago? Do they live longer, do they live better? Are their chances of recovery better? Is their quality of life higher?

There is little doubt that well-coordinated and skillfully delivered emergency, medical, and surgical care helps to save lives following catastrophic injuries, such as SCI. Data show that the long-term survival rates for persons with SCI have steadily risen (1) and, for some individuals, these rates now approach normal. As a result, the prevalence of SCI in our society has increased, even as prevention efforts have probably reduced the annual incidence of this condition. But what kind of life do persons with SCI live and how is society responding to their needs?

In the United States, virtually all persons with new SCI receive some form of interdisciplinary medical rehabilitation, first as inpatients, later as outpatients. As early treatment and delivery of

rehabilitation services have become more efficient, inpatient length of stay (LOS) has fallen dramatically, a trend that was noted even before the arrival of managed care health insurance plans. According to data from the National Spinal Cord Injury Statistical Center (NSCISC), the mean LOS from injury to rehabilitation discharge for persons with SCI (tetraplegia and paraplegia) admitted within 24 hours to SCI Model Systems of Care in 1997 was 64 days compared to 138 days.

Kristjan T. Ragnarsson, MD
Lucy G. Moses Professor and Chairman Department of Rehabilitation Medicine,
Mount Sinai School of Medicine,
New York, NY 10029

Despite decreasing LOS, SCI remains a high cost condition with long LOS compared to most other types of trauma and medical conditions. Although managed care health insurance plans theoretically attempt to control healthcare costs by paying only for treatment with proven efficacy and efficient delivery, in reality most such plans control costs by limiting the benefits of the insured person (i.e., they permit shorter LOS and fewer outpatient visits) and by discounting service fees. It is of clinical interest that although LOS for persons with SCI and consequently cost of care have both decreased, it has been observed that mobility and functional skills, as measured by FIM scores at inpatient discharge, have not changed significantly (2). Nonetheless, with shorter inpatient LOS, it becomes more important to provide effective and efficiently delivered outpatient rehabilitation services to ensure that skills learned during inpatient stay are practiced, polished, and spontaneously used; that education of patients and family members is completed; that emotional adjustment to disability is facilitated; and that community reintegration is progressing. It is unfortunate that reimbursement for outpatient rehabilitation services is frequently insufficient to pay for the cost of a comprehensive interdisciplinary program for persons with SCI, but such a program is required to reach these higher goals. As a result, functional skills may not improve sufficiently, education may suffer, psychological problems may not be adequately addressed, and community reintegration may be suboptimal. It has been shown, that as inpatient LOS has diminished, the incidence of pressure sores among outpatients one year after SCI has increased (3), perhaps an indication of inadequate rehabilitation training. It is a widespread opinion among healthcare professionals that early investment in the form of comprehensive rehabilitation will pay dividends later in the form of a decreased number of rehospitalizations and lower cumulative costs over the lifetime of the person with SCI. This is an important consideration for third-party payers with lifelong responsibility for the health and well-being of the person.

Although SCI still results in a lifelong disability for most persons, it does not have to result in ill health. Good health depends on many modifiable factors, which include lifelong access to consistent good medical care, in-depth health education and health promotion, personal commitment on behalf of the person with SCI to

positive long-term health behaviors, etc. Evidence for improving health among persons with SCI is mostly anecdotal, although increasing life expectancy (1) and a reduced number of rehospitalizations (4) may also be forceful indicators. Development of clinical practice guidelines by a consortium of leading professional organizations, which currently is progressing under the aegis of the Paralyzed Veterans of America (PVA), may positively change behaviors of clinicians and improve their practice patterns for the benefit of their patients with SCI. If the stated goals of managed care health insurance plans were truly realized (i.e., to "control health care costs and improve access to and continuity and coordination across a continuum of services"), these would hold great promise (5). Health education has become an integral part of early rehabilitation at all SCI centers, but instructions may not be fully understood and remembered by all participants. Therefore, it is important to provide persons with SCI with continued access to health information in the form of presentations, books, pamphlets, and audio-visual materials. Maintenance of physical fitness through regular exercise programs suited for persons with disability is felt to promote healthy behavior and increase quality of life. A personal decision to be responsible for one's own health by practicing healthy lifestyles, by monitoring one's physical and mental condition, and by seeking early intervention when appropriate, is likely to be of even greater importance for persons with SCI than the population at large, given their narrow margin between health and sickness, and between functional independence and dependence.

Securing quality of life (QOL) and community integration have become very important goals of rehabilitation, although these two terms can neither be defined nor measured precisely. Persons with SCI may simply be judged to have a good QOL if they are subjectively doing all that they want to do. Community integration is related to QOL, but it is a broader term, which at its core addresses social role functioning, such as perceived control of one's life, psychological self reliance, independence in self care, mobility and personal finances, utilization of social resources, and elimination of environmental barriers (including barriers in architecture, personal attitudes, economic incentives, discriminatory practices, etc.). In other words, community reintegration means to enable the person with SCI to become all he or she wants to be.

Research has done much to improve the lives of persons with SCI in terms of compensatory strategies, since cure for the neurological damage has not yet been found. Progress in medical management and rehabilitation engineering obviously does not reverse the paralysis (i.e., alter the pathology and the impairment), but it has done much to improve health and reduce functional limitations. In the basic science research, there are now heard voices of optimism that a partial or complete cure for paralysis can be found. In contrast to previous opinions, that SCI is an incurable condition, basic scientists have during the last decade become increasingly more optimistic that effective therapies can be identified for both acute and chronic SCI. This new optimism has its roots in the late 1980s, when high dose methylprednisolone given within 8 hours of SCI was shown to have a neuro protective effect (6) and later when it was shown that nerve axons within the spinal cord can regenerate under certain circumstances (7).

Although it has long been known that secondary SCI occurs as a result of a cascade of pathological and chemical events within the injured cord immediately following injury, it has only recently been recognized that injury also initiates apoptosis (i.e., a programmed cell death) within the spinal cord. Several known drugs are felt to have neuroprotective effects and be able to limit apoptosis. Some such drugs are already being tested, but others will probably be tried in animal or human experiments in the near future. Currently under evaluation in humans is the GM-1 ganglioside, which is felt to prevent secondary damage and improve recovery of damaged nerve cells after injury, and 4-aminopyridine (4-AP), which is known to increase excitability of demyelinated axons, perhaps by remyelation, and may thus improve function in chronic SCI.

Based on recent findings in the laboratory, there is renewed interest in the regeneration of axons. Schwann cells and different neurotrophins are known to stimulate regeneration of axons, whereas other substances are recognized as growth inhibitors. Implantation of Schwann cells and direct application of neurotrophins is now felt to promote regeneration of axons within the injured spinal cord, although only recently were such regenerated axons reported to be able to grow beyond the bridged gap and reenter the cord (8). It is well known that although axons can regenerate, neurons cannot. Extensive trials are currently underway to investigate new methods to transplant cells into the central nervous system, including fecal cells, from one organism to another, homografts from one part to another within the same organism, and neuronal stem cells (i.e., unspecified cells capable of developing into neurons) with the hope that some of these cells will take and establish connections. All of this activity has caught the attention of the pharmaceutical industry, which is likely to support a number of clinical drug trials in the near future. Clinicians and investigators in the field of SCI would be well-advised to follow these developments closely and consider participation when human trials start.

It has been alluded to in jest that rehabilitation professionals are threatened by research to "cure" SCI, but in my view, such views are both insulting and wrong. First, those who care for persons with SCI have never been satisfied to compensate for their patient's disability by training in self-care techniques and adjustment strategies or by prescribing orthoses, crutches, wheelchairs, and other assistive devices. Rehabilitation professionals completely share the hope of a "cure" with their patients. Second, any therapy leading to a "cure" is likely to increase demands for rehabilitation services, since any potential improvement in neurological function is likely to occur slowly and to be partial, requiring complementation by rehabilitation therapies. Unfortunately, as promising and exciting as scientific developments toward "cure" may be, timetables cannot be set for the progression of science. With rising interest in chemicals capable of improving neurological function, we are likely to see increasing collaboration between basic scientists and clinicians to improve the lives of persons with SCI through new interventions.

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Kristjan T. Ragnarsson, MD

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The Editor

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