ORIGINAL ARTICLE

Impact of Associated Conditions Resulting From Spinal Cord Injury on Health Status and Quality of Life in People With Traumatic Central Cord Syndrome

Vanessa K. Noonan, MSc, PT, Jacek A. Kopec, MD, PhD, Hongbin Zhang, MSc, Marcel F. Dvorak, MD, FRCSC

ABSTRACT. Noonan VK, Kopec JA, Zhang H, Dvorak MF. Impact of associated conditions resulting from spinal cord injury on health status and quality of life in people with traumatic central cord syndrome. Arch Phys Med Rehabil 2008;89:1074-82.

Objective: To determine the effect of associated spinal cord injury (SCI) conditions on the health status and quality of life (QOL) in people with traumatic central cord syndrome.

Design: Cross-sectional design.

Setting: Community-based.

Participants: Subjects (N=70) with traumatic central cord syndrome who were a minimum of 2 years postinjury.

Interventions: Not applicable.

Main Outcome Measures: Presence of associated SCI conditions (neuropathic pain, spasticity, bowel, bladder, and/or sexual dysfunction, decreased motor function); health status (36-Item Short-Form Health Survey [SF-36], symptom satisfaction); and QOL.

Results: The SF-36 physical component score (PCS) was lower in subjects who reported problems with bowel, bladder, and/or sexual function (−6.9; 95% confidence interval [CI], −11.6 to −2.2). The PCS was decreased in subjects with a lower motor score and this relationship was negatively affected by spasticity and being less educated. The SF-36 mental component score was negatively affected by neuropathic pain and a lower motor score. Neuropathic pain and a lower motor score were both associated with subjects being dissatisfied with their symptoms. Subjects who had a higher motor score were more likely to have a higher QOL (odds ratio, 1.7; 95% CI, 1.1 to 2.7).

Conclusions: The associated SCI conditions bowel, bladder, and/or sexual dysfunction, neuropathic pain, decreased motor function, and spasticity negatively affect the health status of persons with traumatic central cord syndrome. Diminished motor recovery was the only associated SCI condition to impact QOL. By developing a conceptual model and adjusting for confounders, an estimate for each associated SCI condition's effect on patient outcomes was obtained. Our results indicate the importance of treating or ameliorating associated SCI conditions in order to maximize physical and mental functioning.

Key Words: Bladder; Health status; Muscle spasticity; Pain; Rehabilitation; Quality of life; Sexual dysfunction, physiological; Spinal cord injuries.

WITH ADVANCES IN MEDICINE and technology people with spinal cord injury (SCI) are now living longer and are sustaining less severe injuries.[1] This has resulted in a growing interest in the long-term outcomes of people with incomplete SCI, such as traumatic central cord syndrome.[2] Initial studies on traumatic central cord syndrome focused on understanding the natural history and assessed motor recovery using earlier versions of the International Standards for Neurological Classification of Spinal Cord Injury.[3,4] Studies by Anderson,[5] Estores,[6] and Widerstrom-Noga[7] and colleagues indicate that the priorities for people with SCI include addressing problems such as pain, bowel, bladder, and sexual function in addition to improving motor function. To ensure that research on the long-term outcomes is relevant, the sequelae of the SCI must be described and their impact on a person's health status and quality of life (QOL) must be assessed.

Damage to the spinal cord can affect the body's systems and functions. In reporting these changes following SCI, the literature has used the terms *medical complications*, *secondary impairments*, and *secondary conditions* interchangeably to describe both aspects of the injury as well as secondary health issues that often develop following the injury.[8-12] The lack of standardization in terminology can impede communication and so, in order to advance our understanding of disability, these terms need to be clearly defined.[13] Turk proposed a framework where a primary health condition refers to the disease or injury, for example, SCI. The term *associated conditions* describes aspects of the primary health condition that are seen as part of the pathology.[13] For example, sustaining an injury to the spinal cord may result in neurogenic bowel and bladder function, varying degrees of motor paralysis and sensory dysfunction and spasticity. Finally, secondary conditions are related to the primary health condition, where the primary health condition is a risk factor for developing these subsequent secondary conditions. Secondary conditions are often preventable and the likelihood that a person will develop them depends on a variety factors ranging from personal factors (eg, age) to social or physical environmental factors (eg, access to health care services).[13] In SCI, examples of secondary condition include developing pressure ulcers or musculoskeletal pain due to upper-extremity overuse.

To understand the disablement process and target interventions, information about the disability (primary, associated, and secondary conditions) and influencing factors such as personal

From the Division of Spine, Departments of Orthopaedics (Noonan, Dvorak), Health Care and Epidemiology (Noonan, Kopec), and Statistics (Zhang), University of British Columbia, Vancouver, BC, Canada; and Arthritis Research Centre of Canada, Vancouver, BC, Canada (Kopec).

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Reprint requests to Vanessa K. Noonan, MSc, PT, #276-828 West 10th Ave, Vancouver, BC V5Z 1L8, Canada, e-mail: *Vanessa.Noonan@vch.ca.*

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factors and time since injury must be identified and measured. Only after this has been accomplished will it be possible to determine the relationship between aspects of the disability and their impact on outcomes such as health status or QOL. To date, some studies report data on individual factors and studies should consider multiple factors.

A considerable amount of literature has been published outlining the prevalence of the associated and secondary conditions following SCI,[14-18] although as mentioned previously these 2 terms are not well distinguished. There is some research that has investigated how the associated and secondary conditions impact health status and QOL. Many of these studies report a relationship between the SCI associated conditions neuropathic pain, motor dysfunction, spasticity, bowel, bladder, and sexual dysfunction and patient outcomes including the 36-Item Short-Form Health Survey (SF-36), the Sickness Impact Profile, and QOL.[10,12,19-21] However, the effects of confounding personal factors such as age, sex, education, and comorbidities have not always been adjusted for when estimating the effect of associated SCI conditions on health status and QOL.[10,12] It has been shown that once factors associated with the SCI and other personal factors described above are controlled for, there is no remaining association between sex and medical complications, contrary to what was reported previously.[8] In determining the relationship between a health condition and patient outcome, personal factors are potential confounders and by adjusting for them, we will be able to obtain a more accurate estimate of the effect.[2,22,23] In addition, time since injury should be considered in the analysis, because it has been reported to influence many of the associated conditions following SCI, as well as health status and QOL,[5,11] and is therefore included as a potential confounder in this study.

The purpose of this study is first of all to propose a conceptual model (fig 1) that includes the primary condition, associated conditions, secondary conditions, and influencing factors and their possible relationships. Using this conceptual model, our goal was to determine the effect of associated SCI conditions (neuropathic pain; spasticity; problems with bowel, bladder, and/or sexual

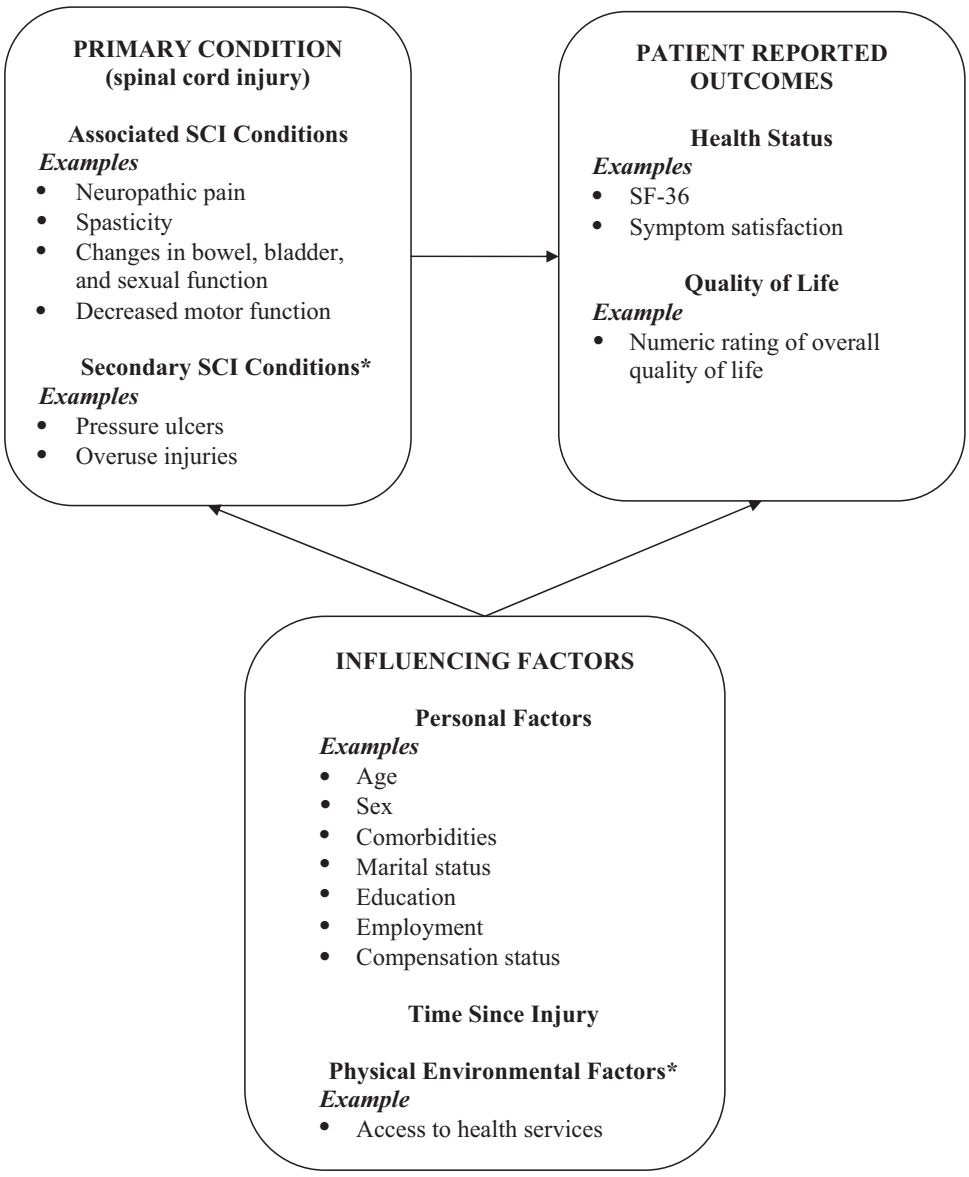

Fig 1. Conceptual model. *Not assessed in this article.