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ORIGINAL RESEARCH

International Retrospective Comparison of Inpatient Rehabilitation for Patients With Spinal Cord Dysfunction Epidemiology and Clinical Outcomes

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Abstract

Objective: To describe and compare epidemiologic characteristics of patients with spinal cord dysfunction admitted to spinal rehabilitation units (SRUs) in 9 countries (Australia, Canada, Italy, India, Ireland, The Netherlands, Switzerland, United Kingdom, and United States).

Design: Retrospective multicenter open-cohort case series.

Setting: SRUs.

Participants: Patients (N=956) with initial onset of spinal cord dysfunction consecutively admitted between January 1, 2008, and December 31, 2010. Median age on admission was 59 years (interquartile range [IQR], 46−70), and 60.8% of patients were men.

Interventions: Not applicable.

Main Outcome Measures: Demographic characteristics (eg, age, sex), time frame over which clinical symptoms of spinal cord dysfunction developed, etiology, length of stay in hospital, level of lesion and American Spinal Injury Association Impairment Scale (AIS) grade, discharge destination, and inpatient mortality.

Results: The time frame of onset of spinal cord dysfunction symptoms was as follows: ≤1 day (28.5%); ≤1 week (13.8%); >1 week but ≤1 month (10.5%), and >1 month (47.2%). Most common etiologies were degenerative conditions (30.8%), malignant tumors (16.2%), ischemia (10.9%), benign tumors (8.7%), and bacterial infections (7.1%). Most patients (72.3%) had paraplegia. The AIS grade on SRU admission was grade A in 14%, grade B in 6.5%, grade C in 24%, grade D in 52.4%, grade E in 0.2%, and missing in 2.9%. AIS grade significantly improved by discharge ($z=-10.1$, $P<.0001$). Median length of stay in the SRU was 46.5 days (IQR, 17−89.5). Most (80.5%) patients were discharged home. Differences between countries were found for most variables.

Conclusions: This international study of spinal cord dysfunction showed substantial variation of etiology, demographic, and clinical characteristics across countries. Further research, including multiple centers per country, are needed to separate country effects from center effects.

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Rehabilitation of people with spinal cord dysfunction a term preferred to nontraumatic spinal cord injury (SCI) because injury and nontraumatic are oxymoronic,[1] has gained more attention in recent years.[2-7] It is believed that in many developed countries spinal cord dysfunction has become more common than traumatic SCI.[8,9] Patients with spinal cord dysfunction are typically of older age compared with those with traumatic SCI, have a more even sex distribution, and are most likely to have incomplete paraplegia.[2-7]

Most spinal cord dysfunction rehabilitation reports are from single centers and involve relatively small numbers of patients. Comparisons between studies are limited by a number of factors,[5,10] including different inclusion criteria, definitions of etiology, outcome measures, approaches to analysis, and time periods over which the studies were conducted. Previous reports have stressed the need for international studies on the impact of patient and disease characteristics and differences in health care provision for patients with spinal cord dysfunction on rehabilitation outcomes in this group.[5,11]

The overall aim of this project was to perform an international study comparing the outcomes for patients with spinal cord dysfunction admitted to spinal rehabilitation units (SRUs) in different countries. The specific objective of this article was to present patients' key demographic and spinal cord dysfunction characteristics at admission and discharge from SRUs. The outcomes by etiology will be reported in a subsequent publication.

Methods

Setting and study design

A retrospective open-cohort case series was conducted of patients with spinal cord dysfunction who were consecutively admitted for initial inpatient rehabilitation in an SRU between January 1, 2008, and December 31, 2010. This was an international study, with 1 SRU in each of 9 countries participating (Australia, Canada, India, Ireland, Italy, The Netherlands, Switzerland, United Kingdom, United States). Details of the organization of rehabilitation services and perceived barriers to admission and discharge within the International Spinal Cord Rehabilitation study group, including criteria for the inclusion of the participating SRU in this study group, have been recently reported.[12,13]

Participants

The study inclusion criteria were as follows: aged ≥18 years old at admission to the SRU, spinal cord dysfunction and the first rehabilitation admission after the onset of spinal cord dysfunction Patients with a diagnosis of Guillain-Barré syndrome, multiple sclerosis, spina bifida, Friedreich ataxia, or conversion syndrome were excluded.

Data collection

Demographic and clinical data collection included date of birth or age on admission to the SRU, sex, date of onset of spinal cord dysfunction symptoms, date of admission to acute hospital, date of admission to and discharge from the SRU, discharge destination, cause of spinal cord dysfunction level of spinal cord dysfunction (paraplegia vs tetraplegia), American Spinal Injury Association Impairment Scale (AIS) grade[14] on admission and discharge from the SRU, and death while in the SRU.

The classification of the spinal cord dysfunction etiology and time frame over which the presenting clinical symptoms developed were recorded, based on the International Non-traumatic SCI Data Sets.[15]

The classification of etiology was made according to the second or third level of detail used in the data sets,[15] with the higher level of detail used when available. In this classification system, musculoskeletal causes (eg, cervical stenosis) are categorized as degenerative. Because of the small number of cases in our sample from some of the categories in the data sets classification, some case categories were collapsed to facilitate statistical analyses.[15] All infectious causes were collapsed into an infection group. The hemorrhagic and other nonischemic vascular causes were collapsed into a vascular-other group, and all remaining cases were combined into another group.

In many cases of spinal cord dysfunction the time frame of the onset of neurologic damage is not instantaneous as typically is the case with traumatic SCI. Some causes of spinal cord dysfunction can have an onset of symptoms over minutes (eg, ischemia), hours (eg, tumor), days (eg, infection), or weeks to months (eg, degeneration). The time frame of spinal cord dysfunction symptom onset was recorded as acute (≤1d), subacute (≤1wk), prolonged (>1wk but ≤1mo), or lengthy (>1mo).

The classification of discharge destination used the categories from the International Core Data Set,[16] but with the additional separation of hospital into acute hospital and no return to rehabilitation and other rehabilitation hospital for ongoing inpatient therapy. We recorded whether the patient was transferred to an acute care unit for elective or emergency treatment during the course of their rehabilitation admission and the duration of these interruptions.[17] These readmissions were considered to be a continuation of an initial admission and not a separate admission if patients returned to the SRU. In these cases, the total number of days out of the unit was recorded and subtracted from the rehabilitation length of stay (LOS).

Potential participants were identified through medical records or databases of discharges of the participating SRUs. The medical files were reviewed by the investigator from each participating SRU or a research assistant under the supervision of the investigator, to confirm that the patient met the eligibility criteria.

The relevant information was recorded on a standardized data collection form and subsequently entered into a local database that included a site code and participant number. A separate local project log contained the identifying patient details to allow rechecking of the data. The database for the project data had conditional formatting applied to fields to help minimize the chance of an error occurring during data entry (eg, age <18y, date of admission outside the study admission date inclusion criteria). At all sites the investigator monitored the data collection and entry processes.

The completed database from each site was reviewed by both the principal investigator (P.W.N.) and a research assistant to check for any inconsistencies in data. If any such inconsistencies were identified, the contributing site was contacted to recheck relevant item(s). The databases from all sites were merged into a central database for analysis.

List of abbreviations:

AIS	**American Spinal Injury Association Impairment Scale**
IQR	**interquartile range**
LOS	**length of stay**
SCI	**spinal cord injury**
SRU	**spinal rehabilitation unit**