ORIGINAL ARTICLE

Clinical correlates of fatigue in spinal cord injury

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Study design: Retrospective chart review.

Objectives: To determine the prevalence of fatigue in an outpatient spinal cord injury population and to examine the clinical variables contributing to that fatigue.

Setting: GF Strong Rehabilitation Centre, Vancouver, British Columbia, Canada.

Methods: Medical charts of 76 individuals admitted to the GF Strong Outpatient SCI Program between December 2004 and December 2005 were reviewed. Data collected included information on clinical characteristics, demographics and Fatigue Severity Scale (FSS) scores. Multivariable analysis was completed to determine the independent association between these variables and fatigue severity.

Results: A total of 57% (95% confidence interval (CI) = 45–67%) of the sample were found to have fatigue severe enough to interfere with function. People that were admitted for medical reasons; had pain, spasticity, incomplete injuries, and/or were on more than one medication with a known side effect of fatigue had significantly higher FSS scores. Multivariable analysis indicated incomplete injury was the only statistically significant predictor of a higher FSS score; pain approached significance ($P=0.07$, CI = -0.09, 2.06). Together these variables account for 18% of the variance in FSS scores in this sample.

Conclusion: Fatigue among individuals with spinal cord injury who are seeking outpatient rehabilitation is very common. The severity of fatigue was greater for individuals with incomplete lesions. Pain was also a potentially important covariate of fatigue. Further research is required to determine what else contributes to fatigue severity beyond these clinical variables as only minimal variance was accounted for in our model.

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Introduction

Fatigue can be defined as an overwhelming sense of tiredness, lack of energy and often a feeling of total exhaustion.¹ It is a common reason to visit a physician,² accounting for 4–9% of complaints in the general population³ and increasing to over 90% among individuals with certain neurological disorders.⁴

Studies have found that there are different types of fatigue such as physical or mental⁵ and that it can be distinguished from other clinical symptoms of disease.¹ It is important to investigate fatigue because it has been shown to have an impact across all domains of function and can negatively affect daily and social activities and quality of life.^{1,6}

Fatigue as a clinical issue has been studied in many diseases and disorders such as multiple sclerosis,^{7–9} Parkinson's disease¹ and stroke.⁶ Studies in Parkinson's and stroke have shown that fatigue can be distinguished from depression both in samples that have and have not controlled for depression.^{1,6}

Fatigue has been reported as an issue for people with spinal cord injury (SCI);^{10–13} however, estimates on the prevalence of fatigue in this population and identification of the variables that explain the presence of fatigue severity are not clearly delineated in the literature. For example, some clinical variables such as chronic pain and sleep disturbance and various demographic factors such as sex, country of residence and age have been found to be associated with fatigue after SCI,^{11,12,14,15} yet little is known about the independent contributions in explaining fatigue among these variables. Although the association between age and fatigue among individuals with SCI has received some attention, the findings have been somewhat conflicting.

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For example, Pentland *et al.*¹³ found that males with SCI reported increased fatigue with increasing age. However, a more recent study by McColl *et al.*¹¹ found that fatigue was reported more in their younger sample (40–65 years) who also had a shorter duration of injury.

The purpose of the present study was to determine the prevalence of fatigue in individuals with SCI who were seeking intervention through an outpatient program and to describe which clinical variables contribute to fatigue as measured using a standardized self-report measure of fatigue severity.

Methods

Sample

The sample of interest for our review of the medical charts consisted of individuals with SCI admitted to the GF Strong Rehabilitation Centre outpatient SCI program between 1 December 2004 and 31 December 2005. GF Strong is a tertiary rehabilitation hospital and the primary spinal cord rehabilitation centre in British Columbia, Canada. We targeted charts from those individuals who completed an admissions questionnaire and the Fatigue Severity Scale (FSS) ($n=108$). Individuals were excluded if the FSS was not completed correctly (i.e., left more than one response blank or responses were unclear) ($n=8$), if the admissions questionnaire was not completed ($n=5$), if the individual had a diagnosis other than an SCI (i.e., spina bifida) ($n=11$), or if their charts were not available for review during the data collection period ($n=8$). The final sample consisted of 70% ($n=76$) of the accessible population. Table 1 describes the sample in detail.

Protocol

A retrospective chart review was performed using a chart extraction form designed by the investigators. If variables of interest were not available in the subjects' charts, the data were considered missing and the individual was excluded from analysis. All applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research.

Measurement

The variables collected included: demographic information (i.e., age, sex and marital status), medical history and injury characteristics (i.e., duration, mechanism, level, completeness and type of injury). The reason for referral to the outpatient program was collected based on the subjects' response on the outpatient questionnaire. This variable was categorized into medical management, social (i.e., psychosocial adjustment or recreation issues), functional reasons (i.e., assistance with activities of daily living) and equipment needs. The response categories for the reason for referral variables were binary (yes/no) in nature. Presence and impact of pain, and presence of spasticity was also collected using the subjects' yes–no response on the questionnaire. Medications with known side effects of fatigue were also

Table 1 Sample demographics and injury characteristics ($n=76$)

	Mean (s.d.)	Range
Age (years)	43.88 (12.97)	20–83
Age at injury (years)	31.20 (14.26)	0–82
Duration of injury (years)	12.68 (12.15)	0.08–40
	n	%
Sex		
Male	49	64.5
Female	27	35.5
Age (years)		
20–39	29	38.2
40–59	41	53.9
60–90	6	7.9
Duration (years)		
0–10	41	53.9
11–20	12	15.8
21–30	14	18.4
31–40	9	11.8
Injury level		
Cervical	37	48.7
Thoracic	29	38.2
Lumbo-sacral	9	12.0
Not reported	1	1.3
Completeness		
Complete	33	43.4
Incomplete	42	55.3
Injury etiology		
Traumatic	62	81.6
Non-traumatic	13	17.1
Not reported	1	1.3

Abbreviation: s.d., standard deviation.

collected. These included: baclofen, all benzodiazepines, tizanidine, all opioids, gabapentin, amitriptyline and nortriptyline. Information on current mobility aid use, living situation, employment and attendant care needs was collected.

Information regarding fatigue was captured using the nine-item FSS,⁷ which measures the impact of fatigue on different elements of daily life.^{1,5,8,16,17} The items are measured using a seven-point Likert scale ranging from one (strongly disagree) to seven (strongly agree). The items were summed and a mean score was calculated. Higher scores indicate a higher severity of fatigue.¹ A score of greater than four out of seven has been used to indicate severe fatigue.^{1,16} A recent study of the FSS in the SCI population suggested that reliability (Cronbach's $\alpha=0.90$; intraclass correlation coefficient=0.84) was evident. Moreover, support for validity through the assessment of hypothesized relationships with measures of depression, vitality and a visual analogue measure of fatigue was demonstrated (Anton *et al.*, submitted 2006).

Analysis

Summary statistics such as means, standard deviations and proportions were calculated to describe the sample. To

Table 2 Mean scores and s.d.'s for the total and individual FSS items

	Mean score	s.d.
FSS 1 My motivation is lower when I am fatigued	5.08	1.90
FSS 2 Exercise brings on my fatigue	3.74	1.88
FSS 3 I am easily fatigued	3.99	1.96
FSS 4 Fatigue interferes with my physical functioning	4.68	2.03
FSS 5 Fatigue causes frequent problems for me	3.63	2.13
FSS 6 My fatigue prevents sustained physical functioning	3.97	2.21
FSS 7 Fatigue interferes with carrying out certain duties and responsibilities	3.93	2.17
FSS 8 Fatigue is among my three most disabling symptoms	3.64	2.27
FSS 9 Fatigue interferes with my work, family or social life	3.95	2.34
Overall average FSS score ($n=76$)	4.07	1.78

Abbreviations: FSS, Fatigue Severity Scale; s.d., standard deviation.

indicate the prevalence of fatigue severity, the mean scores, 95% confidence intervals and the percent over the fatigue cut score of over 4 were calculated.

Given the number of variables collected in the study, we used bivariate analyses to determine if variables should be considered in multivariable analyses. Pearson's product moment correlations were used for continuous level variables, and *t*-tests were used for binary level variables. All statistically significant ($P<0.05$) variables were then eligible to be included in a backward regression analysis. The backward approach was used with standard entry of $P<0.05$ and exit $P<0.1$. This liberal approach was used as we were attempting to develop a model that would be more inclusive so that important variables were not excluded when prospective studies are conducted.¹⁸ All statistical analyses were completed using SPSS version 14.

Results

Sample and injury characteristics

The average age of the primarily male (65%) sample was 43.8 (s.d.=12.9) years and the majority (82%) had their SCI related to traumatic etiology. Participants had been injured for a mean of 12.7 (s.d.=12.2) years and the mean age at time of injury was 31.2 (s.d.=14.2) years. There were no statistical differences based on age and duration of injury between those who were included and excluded for the study. Table 1 describes the sample and injury characteristics in detail.

Fatigue severity scale

The mean FSS score for the sample was 4.1 (s.d.=1.8), with 57% of the sample scoring greater than 4. The mean fatigue severity for the group was highest for the item related to alteration in motivation. Table 2 outlines the mean scores for each of the nine FSS items.

Clinical variables and FSS scores

Medical reason for admission, completeness of injury, presence of pain, presence of spasticity and number of medications were the binary variables that were found to

Table 3 Group differences in variables with statistically different FSS scores

(n)	Mean (s.d.)	t	P	95% CI
<i>Lesion</i>				
Complete (33)	3.55 (1.66)			
Incomplete (42)	4.48 (1.81)	-2.29	0.025	-1.74, -0.12
<i>Pain</i>				
Yes (62)	4.34 (1.74)			
No (14)	2.86 (1.51)	2.95	0.004	0.48, 2.48
<i>Spasticity</i>				
Yes (32)	4.75 (1.74)			
No (41)	3.61 (1.66)	2.85	0.006	0.34, 1.94
<i>Medical reason for referral</i>				
Yes (37)	4.54 (1.52)			
No (39)	3.62 (1.91)	2.33	0.023	0.13, 1.72
<i>Medication use^a</i>				
≤1 medication (43)	3.63 (1.73)			
2+ medications (33)	4.64 (1.71)	-2.53	0.014	-1.80, -0.21

Abbreviations: CI, confidence interval; FSS, Fatigue Severity Scale; s.d., standard deviation.

^aReported use of number of medications with possible side effects of fatigue.

have significant group differences on FSS scores. Table 3 shows significant group differences in detail.

The final regression model using variables that were statistically important at the bivariate level revealed that two factors independently predicted fatigue severity. Completeness of injury was the variable that reached significance ($P<0.05$), whereas presence of pain approached significance ($P=0.07$). Together, these variables accounted for 18% of the variance in FSS scores in this sample (Table 4).

Discussion

Our study indicates a majority of our sample was severely fatigued based on their scores on the FSS. This finding supports the descriptive reports found in the literature^{1,7,10-13} and confirms that fatigue is prevalent and of considerable concern in SCI. In persons already living with neurological impairment due to SCI, the additional impairment of fatigue

Table 4 Parsimonious regression model of clinical predictors of FSS ($n = 76$)

	Unstandardized coefficients		Standardized coefficients <i>Beta</i>	P	95% CI
	<i>B</i>	<i>s.e.</i>			
Complete vs incomplete injury	−0.99	0.42	−0.29	0.020	−1.83, −0.16
Presence of pain	0.99	0.54	0.23	0.071	−0.088, 2.06

Abbreviations: CI, confidence interval; FSS, Fatigue Severity Scale; *s.d.*, standard deviation.
($R^2 = 0.18$).

could further limit activity and restrict participation in work, leisure and social activities.

Based on clinical experience and our review of the literature, we identified variables that might reasonably be associated with fatigue in SCI. We found that having an incomplete injury and the presence of pain were the only two variables that accounted for at least some of the fatigue in individuals with SCI in our sample.

We are not certain why having an incomplete SCI results in more severe fatigue and at first glance this seems counter intuitive. However, it does seem plausible that individuals with incomplete injuries would attempt to complete more activities and rely less on the aid of assistive devices or care attendants. Therefore, the total amount of energy expended in a typical day and the physiological energy cost of specific activities would be greater. For example, Kemp and Thompson¹⁹ discuss that people with incomplete injuries tend to use less efficient means of mobility, which can lead to an increased demand on the musculoskeletal system and result in higher levels of experienced fatigue. Furthermore, it has been suggested that people who are more active in this population are more likely to experience fatigue and the impact of fatigue on their function is greater because they are doing more or have more expected of them.¹¹ In addition, increased energy consumption associated with biomechanically inefficient gait and movement in persons with incomplete SCI could contribute to increased fatigue.

Individuals with pain in our study did have significantly different fatigue scores; however, pain was not a statistically significant predictor of fatigue in the final regression model. Pain was retained in the regression equation because it remained significant at the liberal removal criteria we had for selecting important variables. Because of this we cannot ignore the impact pain might have on fatigue. Attention to this point is especially important considering that Widerstrom-Noga *et al.*¹⁵ found that pain interferes with falling asleep, staying asleep, and participating in activities of daily living (ADL), which all can conceivably contribute to fatigue.

Our study results have implications for clinical practice and rehabilitation. Clinicians must be aware that fatigue is common in persons with incomplete SCI and be sensitive to its potential effects on function. Routine screening for fatigue through a structured history or use of simple fatigue measures like the FSS could identify those patients who are experiencing clinically significant fatigue. Clinicians should also be aware of the potentially treatable causes of fatigue, including mood disorders, sleep disorders, pain, adverse effects of medication commonly used in persons with SCI, anemia and hypothyroidism.

There are a number of limitations to our study. Using a retrospective chart review to collect the data limited our ability to choose how variables were measured and what variables were available for analyses. For example, pain and spasticity were measured using yes–no responses with subjective and potentially unclear wording in the items on the questionnaire used to measure the presence of these variables. In addition, information regarding medication was a simple count of how many prescribed medications people were taking; dosages were not considered.

Relying on chart review also resulted in not being able to consistently capture all potentially relevant data. As a result, we lost some individuals' information and we did not use ASIA impairment scale ratings as a variable, and were forced to use general information on the completeness of the injury. However, when we examined the limited ASIA ratings captured, ASIA D participants had a significantly higher FSS score than ASIA As. Although the differences between the other ASIA groups were not significantly different, it is interesting to note a progressive decrease in FSS score as individuals' injuries become more complete, according to their ASIA rating, suggesting a dose response of fatigue related to completeness of injury. Also, relevant variables such as information regarding individuals' level of assistance and use of mobility aids and other equipment use, and level of depression which has been found to be correlated to fatigue⁶ could not be captured. This is likely a reason why only two variables were retained in our final regression model and why we explained a limited amount of the variance in fatigue. Therefore, we encourage prospective designs be used in future studies of fatigue in the SCI population.

Finally, our study's sample consisted of participants' living in the community who were seeking medical attention. It is possible that our participants represented a small sub-population of individuals with SCI who are experiencing more fatigue. Therefore, the ability to generalize our findings to the larger SCI population is limited. Given the limitations of the current study, future prospective studies are warranted to further understand fatigue in SCI.

Conclusion

Using the FSS, we were able to determine the prevalence of fatigue within our sample of individuals living with SCI in the community. We found that having an incomplete SCI was found to be the only statistically significant variable that contributed to a higher FSS score.

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