Spinal Cord (2003) 41, 600–609
 1362-4393/03 $25.00
www.nature.com/sc

Original Article

Types and effectiveness of treatments used by people with chronic pain associated with spinal cord injuries: influence of pain and psychosocial characteristics

EG Widerström-Noga*[,1,2,3] and DC Turk[4]

[1]*The Miami Project to Cure Paralysis, University of Miami, Miami, FL, USA;* [2]*Department of Neurological Surgery, University of Miami, Miami, FL, USA;* [3]*VAMC, Miami, FL, USA;* [4]*Department of Anesthesiology, University of Washington School of Medicine, Seattle, WA, USA*

Study design: Postal survey.
Objectives: Because of the high prevalence and inadequate control of pain following spinal cord injury (SCI), it is important to have information about the factors associated with the use of specific pain therapies. We conducted this study to evaluate the ability of pain characteristics and psychosocial factors to predict the use of treatments.
Setting: The Miami Project to Cure Paralysis (Miami, FL, USA).
Methods: People with SCI ($n=120$) were mailed a packet containing a questionnaire with questions regarding demographic factors, pain characteristics, and pain treatments along with a copy of the Multidimensional Pain Inventory.
Results: A total of 59% of the respondents had been prescribed treatment or self-initiated efforts to treat pain over the previous 18-month period. The most common treatments used by this sample were massage (26.6%), opioids (22.5%) and nonsteroidal anti-inflammatory drugs (NSAIDs) (20%). The most effective treatments overall were 'physical therapies' with 50% receiving these treatments indicating that their pain was 'considerably reduced' or that they were 'pain free.' Opioids and anticonvulsants were perceived to be the most effective pharmacological agents prescribed (33.3 and 23.8% reporting their pain was considerably better or eliminated, respectively). People using prescription medication reported significantly greater pain severity, more widespread pain, more descriptive adjectives, more evoked pain, greater difficulty in dealing with pain, and more interference and decreased activity levels due to pain, compared to people not using prescription medication. A combination of greater difficulty in dealing with pain, intense pain, presence of evoked pain, and higher level of perceived support from significant others was predictive of taking prescription medication.
Conclusion: People taking prescription medication reported significantly more intense pain with neuropathic characteristics that significantly affected daily life and routine activities. A substantial percentage of individuals with pain related to SCI did not obtain significant pain relief from prescription medications. None of the factors assessed predicted the use of nonprescription treatments. The results of this study confirm the inadequacy of available modalities to manage chronic pain related to SCI.
Spinal Cord (2003) **41,** 600–609. doi:10.1038/sj.sc.3101511

Keywords: neuropathic pain; prediction; nonpharmacological treatment; opioids; anticonvulsants; self-management

Introduction

Recent surveys indicate that people with spinal cord injuries (SCIs) frequently experience moderate to severe pain long after they sustained their injuries.[1–3] Persistent pain following SCI interferes with important daily activities including sleep[4–6] and creates additional difficulties for people who are already dealing with a multitude of consequences secondary to their SCI. The presence of persistent pain in persons with SCI makes it

*Correspondence: EG Widerström-Noga, The Miami Project to Cure Paralysis, School of Medicine, University of Miami, Lois Pope Life Center (R-48), 1095 NW, 14th Terrace, Miami, FL 33136, USA

more difficult for them to achieve an optimal quality of life following their injury.[7,8]

A wide range of pharmacological and nonpharmacological treatments have been used to control pain following SCI. Treatment, however, is often inadequate.[9] One explanation for the failure of reasonable pain control is that the mechanisms causing and sustaining pain are not well understood.[10–12] People with SCI may experience one or more types of pain simultaneously. These different pains include nociceptive pain, such as musculoskeletal pain in the back, neck and shoulders, or neuropathic pain at or below the level of injury.

Over time, pain, from whatever cause, may be amplified and maintained by psychological as well as pathophysiological mechanisms.[13–15] Therefore, both sets of factors should be considered in the design of an integrated strategy to manage pain.

Several authors[16,17] have attempted to define the various pain types experienced by people with SCI based on verbal descriptions of pain and combinations of characteristics that are typically related to specific types of pain. For example, in the recently developed taxonomy of SCI pain, 'burning,' 'shooting', or 'electric' pain below the level of injury in an area with sensory abnormality is purported to be indicative of neuropathic pain.[16,17]

Several studies suggest that abnormal sensations may indicate specific mechanisms important for treatment decisions.[18–21] Sensory changes may be *quantitative* (threshold changes such as hypoesthesia or hyperesthesia) or *qualitative* (such as allodynia, dysesthesia, or paresthesia).[22,23] Responses to sensory testing may be important for defining a specific type of pain and thus serve as a basis for prescribing pain treatment. For example, if the etiological mechanism appears to be neuropathic, the first line of treatment might be anticonvulsant medication. Alternatively, other types of medications that have been shown to be effective with pain associated with other neuropathic pain disorders (eg, postherpetic neuralgia, diabetic neuropathy[24]) could be prescribed. On the other hand, if pain appears to be nociceptive, alternative pharmacological and nonpharmacological treatments that have proven effectiveness alone or in combination for nociceptive pain might be recommended (eg, physical therapy, opioids, psychological approaches). When more than one type of pain is present, a combination of treatments to target the different mechanisms would be most appropriate.

Although the rationale for mechanism-based treatment seems reasonable, other factors appear to play an important role in both prescribed and self-initiated treatments. Preliminary data indicate that how patients present to physicians will influence the pain management interventions they receive.[25,26] Moreover, people's decisions about the use of self-initiated efforts to control symptoms are also likely to be influenced by their attitudes and beliefs.[27] Little is known about the use of both prescribed and self-initiated pain management interventions by people who have pain secondary to SCIs. Because of the refractory nature of pain related to SCI, information about what factors influence a person's choice to seek treatment or to self-initiate treatment and the type of treatment used, may be helpful for implementing improved treatment approaches.

The participants in this study consisted of a group of people with SCIs who had experienced persistent pain for many years since their injury. We were interested in determining what types of pain treatments were used long after the initial SCI. Furthermore, we wished to determine the role that pain characteristics and psychosocial and behavioral factors play in use of any prescription or nonprescription treatments.

Methods

Participants

People with SCI included in the database of the Miami Project to Cure Paralysis were mailed a postal survey. Specifically, people ($n = 258$) with SCI, who were over 18 years of age, had been injured more than 18 months prior to the date of the survey, and who had reported the presence of chronic pain or nonpainful sensations in a previous study[28] were invited to participate. The participants completed a comprehensive pain history that included detailed descriptions of their present pain.[29] This set of materials also included: (1) a list of prescribed and self-initiated interventions used in the last 18 months; (2) a numerical scale rating difficulty in dealing with chronic pain; (3) body maps on which to indicate locations of pain; (4) questions about the presence of evoked pain; (5) a list of pain descriptive adjectives; (6) numerical pain intensity rating scales; and (7) a copy of the multidimensional pain inventory (MPI)-SCI.[30,31]

Responses to the initial mailing were received from 136 of the original 258 (52%) invited to participate. Additional attempts were made by telephone to contact those who did not respond to the initial mailing. These efforts resulted in another eight agreeing to participate. We determined that 75 people included in the initial mailing had invalid telephone numbers or had moved, leaving no forwarding address or telephone number. Of the 184 who were contacted, 24 indicated that they did not currently experience persistent pain but only nonpainful abnormal sensations. Since the focus of the present study was treatments for *current pain*, these people were excluded from the study. The final sample consisted of 120 people (75.5% of those who could be contacted and who met the inclusion criteria).

Sociodemographic data and characteristics of injury

Demographic information and injury characteristics obtained from the questionnaire included: current age, sex, age at time of injury, time postinjury, and level of injury (cervical, below cervical). Participants were also asked to provide information concerning sociodemographic factors such as marital status, highest level of

education and employments status. Marital status was defined as 'Single' if the response was 'single,' 'divorced/separated,' or 'widowed,' and 'Married.' Level of education was collapsed into two classes: 'Higher level of education' included 'advanced degree,' 'bachelors degree,' or 'associate degree' and 'Lower level of education' included 'pre-high school,' 'high school,' or 'trade school.' The classification 'Employed or studying' included 'full time,' 'part time,' 'student,' or 'self-employed,' and defined as 'Not employed or studying' when indicating 'unemployed,' 'retired,' or 'home-maker.' These data are summarized in Table 1.

Intensity of pain Pain intensity was assessed using numerical rating scales (NRS),[32] ranging from 0 (no pain) to 10 (most intense pain imaginable). Participants were asked to rate the intensity of their *present* pain when *most* intense and when *least* intense. These two ratings were combined to calculate the average pain intensity.

Location of pain Participants were asked to indicate on body maps (outline figures depicting frontal and dorsal views) the areas corresponding to the pain they were *presently* experiencing. The body maps were divided into 45 sections, previously described by Margolis *et al*,[33] but was combined into eight principal regions: (1) head; (2) neck and shoulders; (3) hands and arms; (4) frontal torso and genitals; (5) back; (6) buttocks; (7) thighs; and (8) legs and feet.

Quality of pain Participants were provided a list of 24 adjectives and asked to circle the words that 'best described the pain they were *presently* experiencing.' The words listed were based on interviews with people with SCI and published studies.[34–36] In a previous study,[3] we determined that *burning* and *aching* were the most frequently used descriptors reported by people with pain associated with SCIs. *Burning* pain in an area of sensory deficit is usually associated with neuropathic pain,[10,37,38] whereas *aching* located in an area above the level of injury is often related to nociceptive musculoskeletal pain.[39,40]

Allodynia Allodynia (ie, pain in response to a stimulus that would normally not provoke pain, such as light touch) or hyperalgesia (ie, an exaggerated response to a painful stimulus) is often associated with neuropathic pain.[18] Participants were asked to report whether any areas on their body only hurt or hurt more when the particular area was exposed to something that would normally not be painful, such as a breeze or light touch. These responses were used as surrogate measures indicating the presence of allodynia.

Table 1 Demographic information for all participants ($n=120$)

Demographics	*All subjects (n=120)*	*Received treatment (n=71)*	*Received no treatment (n=49)*[a]
Age (mean±SD)	40.6±12.1	40.0±11.4	41.6±13.1
Age at injury (mean±SD)	32.4±11.5	32.4±11.2	32.3±12.0
Time since injury (years) (mean±SD)	9.8±5.2	9.1±4.8	10.8±5.7
Sex			
Men (*n*, %)	94 (78.3)	54 (76.1)	41 (86.7)
Women (*n*, %)	26 (21.7)	17 (23.9)	8 (16.3)
Level of injury			
Cervical (*n*, %)	62 (51.7)	39 (51.7)	23 (46.9)
Below cervical (*n*, %)	58 (48.3)	32 (45.1)	26 (53.1)
Marital status			
Married (*n*, %)	50 (42.0)	28 (40.0)	22 (44.9)
Single (*n*, %)	69 (58.0)	42 (60.0)	27 (55.1)
Level of education			
High level (*n*, %)	78 (65.0)	50 (70.4)	28 (57.1)
Low level (*n*, %)	42 (35.0)	21 (29.6)	21 (42.9)
Employment status			
Working or studying (*n*, %)	51 (42.9)	31 (43.7)	20 (41.7)
Not working or studying (*n*, %)	68 (57.1)	40 (56.3)	28 (58.3)

[a]Bonferroni adjusted *t*-tests and χ^2 showed no significant differences between persons who had received treatments within the 18-month period and those who did not receive treatment

The MPI The MPI is a 60-item (56 scored) self-report questionnaire[30] designed to assess the impact of pain and adaptation to chronic pain. The MPI has excellent psychometric properties[41,42] and the factor structure has been confirmed in several studies.[43,44] In addition, it is sensitive to change[45,46] and is predictive of long-term pain following an acute injury.[47]

Based on our previous research,[31] we determined that a somewhat modified version of the MPI (MPI-SCI) was appropriate for use with people who experience pain associated with their SCI. Specifically, we found that it was necessary to delete several items related to work and significant other responses to improve the fit of the factor structure. In addition, the section on 'general activities' was supplemented with items pertaining to decreased activity levels due to pain as distinct from restrictions of activity due to other aspects of the SCI.

Difficulty in dealing with pain Participants were asked to rate how difficult they found it to *deal with their chronic pain* on an NRS scale from 0 to 10 (0 = not hard at all, 10 = extremely hard). This measure was used in a previous study of SCI.[28]

Pain treatments

A total of 17 treatments identified during interviews and in previous studies[9,28] (ie, heat therapy, ice therapy, massage therapy, ultrasound, transcutaneous electrical nerve stimulation (TENS), acupuncture, other physical therapy, occupational therapy, nerve blocks, surgery, trigger point injections, chiropractic manipulation, psychotherapy, hypnosis, meditation, and herbal medicine) were listed in the questionnaire. They could also add additional treatments to the list. Participants were asked to indicate the treatments that they had received for their pain 'in the last 18-month period.'

Participants were provided with a list that included various analgesic agents in the following categories: opioids, anticonvulsants, antidepressants, antispasticity medication, sedatives, acetaminophen, aspirin, and nonsteroidal anti-inflammatory drugs (NSAIDs). They were asked to indicate whether they had been taking any of the prescribed medication or used nonprescription pain medication 'during the past 18 months.' They could also add additional medications to the list.

Participants were also asked to rate the *perceived effectiveness* (ie, whether each treatment made their pain *worse*, *had no effect*, *slightly better*, *considerably better*, or *disappear*) of all pain treatments they had tried. Pharmacological and nonpharmacological treatments were combined into several categories (Figure 1). If they had used more than one treatment from a category, the highest rating was used to indicate the effectiveness of that category.

Statistical methods

χ^2 and two-tailed Student's *t*-tests, with the Bonferroni correction to adjust for multiple comparisons, were used to assess univariate relations. We conducted a logistical regression analysis (stepwise procedure) to predict the use of prescription medication. The logistical regression is a type of multiple regression analysis based on maximum likelihood and is used when the dependent variable is dichotomous. The automatic forward stepwise procedure begins with no variables in the model, and at each step the most significant variable is entered. At each step, the procedure examines the variables included for entry and removal until all variables in the model fulfil the criteria for retention. The odds of an event occurring are the ratio of the probability of it happening to the probability of it not happening (odds ratio (OR) value). The OR value may be complemented with a 95% confidence interval (CI), indicating the range of numeric values in which we can be confident that 95% of the population value estimated will be found. Results were considered significant when $P<0.05$.

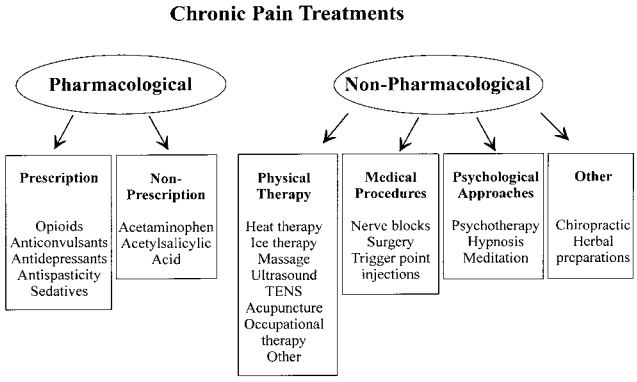

Figure 1 Types of pain treatments used by persons with SCI

Results

In all, 71 (59.2%) of the participants were currently or had in the last 18 months used pharmacological (prescription or nonprescription) or nonpharmacological treatment (NPhT) to control their pain (Table 2). Of this sample, 29 (24.2%) indicated that they had used treatments from one of these three categories, 24 (20%) two, and 18 (15.0%) people had received all three types of treatments during this period. Pain medication (PM) had been prescribed for 48 (40.0% of the sample), 36 (30.0%) had used nonprescription medication (NPM), and 47 (39.2%) had used NPhT, that may have been recommended or self-initiated. The pharmacological class used by the largest proportion of participants was opioids (22.5%) followed by NSAIDS (20%), whereas the most common NPhT was massage (26.7%).

Interestingly, a substantial minority (40.8%) indicated that they had neither been prescribed nor made any effort to use self-initiated treatments to control their pain. The perceived effectiveness of the treatments used is shown in Table 3. Four classes of drugs (opioids, anticonvulsants, NSAIDs, and sedatives) were endorsed

as making pain 'considerably better' to 'disappear' for at least 20% of those currently or previously taking them. Antidepressants were least likely to improve pain substantially with 66.6% reporting no beneficial effect and 6.6% noting that they felt these medications made their pain worse. It is important to note that even opioids and anticonvulsants had little or no effect on pain severity in over 66% of the people who had received prescriptions for these classes of medication. Of the 120 subjects, 40 had tried physical therapy and 50.0% of them rated the effect as making pain 'considerably better' or 'disappear.' There were no significant differences on any of the demographic variables (ie, age, sex) between those who had had treatment for pain compared to people who reported no treatment during this period (Table 1).

Pain intensity

Pain severity was significantly ($P=0.001$) higher for people who had used treatments (3.9 ± 1.3) compared to those who did not use treatments during this period (3.0 ± 1.6, $t=-3.328$, df $=88.0$). Average intensity of pain was significantly higher in those prescribed PM (6.3 ± 1.7) than in people not using PM (5.5 ± 2.0, $t=-2.332$, df $=105.3$, $P=0.022$). In contrast, pain intensity did not predict use of NPhT or NPM.

Table 2 Frequency of treatments and medications used by at least 10% of participants

Treatment	*%*	*Medication*	*%*
Massage	26.7	Opioids	22.5
Heat therapy	16.7	NSAIDs	20.0
Other physiotherapy	15.0	Acetaminophen	18.3
Ice therapy	13.3	Anticonvulsants	17.5
Medication	10.0	Antispasticity medication	16.7
		Sedatives	15.0
		Antidepressants	12.5

NSAIDS = nonsteroidal anti-inflammatory drugs

Pain location(s)

People who had used PM also reported significantly more painful areas (4.1 ± 1.6) than people who had not taken prescription medication (NoPM) (3.1 ± 1.6, $t=-3.379$, df $=101.7$, $P=0.001$). People who had used NPhT or NPM did not report pain in a greater number of painful areas, compared to people who had not received these therapies. Since use of PM was related to numbers of areas indicated on the pain drawing, we conducted an additional analysis to determine whether specific areas were more common in people who had used PM. The analysis (Table 4) revealed that the proportion of people indicating the presence of pain the frontal/genital area, was significantly ($P<0.000$) larger in the PM group (68.8%) compared to NoPM (29.4%).

Quality of pain

People who had used PM described their pains with significantly more descriptive adjectives (7.4 ± 4.7) as compared to NoPM (5.4 ± 4.8, $t=-2.181$, df $=103.4$, $P=0.031$). There were no significant differences in the number of verbal descriptors used by people who had used NPhT or NPM compared with those who were not using these therapies. The most commonly used descriptors by the sample were 'burning,' 'aching,' and 'sharp.' Taking PM was not related to endorsement of any specific descriptors.

Self-reported allodynia and hyperalgesia

Persons who had used PM reported the presence of allodynia or hyperalgesia significantly ($P=0.009$) more often (65.2%) than those who had not taken PM (40.3%). Since the most significant pain area associated with use of PM was the frontal aspect of the torso and genital area, we examined the relation between evoked

Table 3 Perceived effectiveness of treatments

Treatments or procedures	*Worse (%)*	*No effect (%)*	*Slightly better (%)*	*Considerably better (%)*	*Pain free (%)*
Physical therapy ($n=40$)		7.5	42.5	47.5	2.5
Medical ($n=8$)	8.3	41.7	8.3	33.3	8.3
Psychological ($n=13$)		23.1	61.5	15.4	
Other ($n=12$)	7.7	84.6	7.7		
Opioids ($n=27$)		18.5	48.1	22.2	11.1
Anticonvulsants ($n=21$)		33.3	42.9	19.0	4.8
Antidepressants ($n=15$)	6.6	66.7	13.3	13.3	
NSAIDs ($n=24$)		29.2	50.0	20.8	
Antispasticity (n = 20)		45.0	40.0	15.0	
Sedatives ($n=18$)	5.6	16.7	55.6	22.2	
Acetylsalicylic acid ($n=11$)		54.6	36.4	9.1	
Acetaminophen ($n=22$)		36.4	45.4	18.2	

NSAIDS = Nonsteroidal anti-inflammatory drugs

pain in this area and using prescription medication. Although 37.0% of those who had used PM had evoked pain in the frontal torso and genital region, only 14.7% of those not using PM reported allodynia in this area ($\chi^2 = 7.516$, df = 1, $P = 0.006$).

Difficulty in dealing with pain

People who had used PM rated their pain as significantly more difficult to deal with (7.3 ± 2.2) than those who were not using PM (5.1 ± 2.8, $t = -4.506$, df = 106.2, $P < 0.000$). Even though people using NPhT or NPM also rated their difficulty in dealing with pain higher compared to those not using these treatments, these differences did not reach statistical significance (Table 5).

Table 4 Frequency of areas marked in the pain drawings for people using prescription medication (PM) compared to those who did not (NoPM)

	PM (%)	*NoPM (%)*	*χ^2 (1 df), probability*
Neck/shoulder	33.3	39.7	0.490, NS
Arms/hands	39.6	25.0	2.796, NS
Frontal torso/genitals	68.8	29.4	17.548, $P < 0.000$
Back	75.0	58.8	3.259, NS
Buttock	72.9	48.5	6.899, NS
Thighs	51.5	50.0	0.024. NS
Legs/feet	62.5	51.5	1.389, NS

Table 5 Average ratings for difficulty in dealing with chronic for those using treatments (prescription medication (PM), nonprescription medication (NPM), or nonpharmacological treatment (NPhT)) compared to those not using these treatments

Treatment type	*Had treatment Mean ± SD*	*No treatment Mean ± SD*	t-*Value, df, probability*
PM	7.3 ± 2.2	5.1 ± 2.8	−4.506, 106.2, 0.000
NPM	6.4 ± 2.3	5.8 ± 3.0	−1.053, 76.6, 0.296
NPhT	6.6 ± 2.5	5.6 ± 3.0	−1.881, 103.6, 0.063

Pain impact

The scores from the Pain Severity (PS) and Life Interference (LI) scales of the MPI were compared using *t*-tests and the probability levels were Bonferroni adjusted. The scores were found to be significantly higher for people who had used PM compared to people who had not taken these medications (NoPM) (see Table 6). There were no significant differences between PM and NoPM on the scores from the Life Control, Affective Distress, or Support scales of the MPI. We did not find significant differences on any of the pain impact scores between people who had used NPM or (NPhT) compared to people who had not received these therapies.

Responses from significant others

We also compared the scores from the *perceived responses from significant others scales* ('significant other' was defined as 'the person with whom you feel closest') of the MPI: (1) PM and NoPM; (2) NPM and No NPM; and (3) NPhT and No NPhT. No differences were statistically significant.

Impact on activities

The mean scores from the general activity scale were compared between: (1) PM and NoPM; (2) NPM and No NPM; and (3) NPhT and No NPhT. No differences were statistically significant. However, when people were asked to report how much pain had decreased their activity levels, those who had used PM scored significantly higher (Table 7). Therefore, we performed four *t*-tests (Bonferroni adjusted) to determine which types of activities were significantly decreased due to pain for those who had used PM (Table 8). The only type of activity that was significantly decreased due to pain for persons who had used PM was 'activities away from home.'

Prediction of use of prescription medication

Since persons who had used PM were significantly different on many of the assessed variables, a forward stepwise logistical regression analysis was performed to predict what combination of above factors would be most relevant to the use of PM. Therefore, persons who

Table 6 MPI (Impact) scores for people with chronic pain and SCI who were taking prescription medication (PM) and people not taking this medication (NoPM)

	PM Mean ± SD	*NoPM Mean ± SD*	t-*Value, df, Bonferroni adjusted probability*
Pain Severity	4.1 ± 1.3	3.2 ± 1.5	−3.675, 107.9, 0.002
Life Interference	3.4 ± 1.4	2.5 ± 1.3	−3.657, 97.5, 0.002
Life Control	3.2 ± 1.4	3.4 ± 1.3	−0.769, 91.3, 1.000
Affective Distress	3.0 ± 1.5	2.6 ± 1.2	−1.696, 88.1, 0.467
Support	4.0 ± 1.6	3.5 ± 1.6	−1.521, 92.0, 0.658

MPI = multidimensional pain inventory

Table 7 Average scores for the MPI (general activity scale) and decrease of activity specifically due to pain for those using treatments (prescription medication (PM), nonprescription medication (NPM), or nonpharmacological treatment (NPhT) compared to those not using these treatments

	PM *Mean±SD*	*NoPM* *Mean±SD*	*NPM* *Mean±SD*	*No NPM* *Mean±SD*	*NPhT* *Mean±SD*	*No NPhT* *Mean±SD*
General activity level	1.8±1.0	2.1±1.0	1.8±1.0	2.1±1.0	2.0±1.1	2.1±0.9
Decreased activity due to pain	2.4±1.9	1.5±1.6[a]	1.8±1.8	1.8±1.8	2.0±2.0	1.7±1.6

[a]People on prescription medication reported significantly more decreased activity due to pain than those who did not take prescription medication ($t=2.460$, df = 79.7, $P=0.016$)

Table 8 Average MPI (decreased activity due to pain) scores from people with chronic pain and SCI ($n=120$) who were taking prescription medication (PM) compared to people not using these medications (NoPM)

	PM *Mean± SD*	*NoPM* *Mean± SD*	t-*Value, df, Bonferroni adjusted probability*
Household activities	2.2±1.9	1.4±1.7	−2.351, 90.7, 0.083
Activities away from home	2.7±2.0	1.7±1.8	−2.791, 93.7, 0.025
Outdoor work	2.3±2.3	1.5±1.9	−2.004, 76.0, 0.195
Social activities	2.3±1.9	1.6±1.8	−1.854, 97.9, 0.267

MPI = multidimensional pain inventory

Table 9 Logistical regression analysis (forward stepping procedure) predicting use of prescription medication

Variables	*Odds ratio*	*95% Confidence limits*	*Probability*
Difficulty in dealing with pain	1.957	1.318–2.904	0.001
Average pain intensity	0.465	0.268–0.806	0.006
Self-reported evoked pain	0.564	0.326–0.974	0.040
MPI (support)	1.497	1.026–2.184	0.036
Marital status	1.763	0.986–3.154	0.056

χ^2 (covariates), 30.029 (5 df), $P=0.000$. MPI = multidimensional pain inventory

had had PM in the previous 18-month period versus those who did not have PM treatment in this period was used as the dependent variable. Sex, level of injury, age at injury, marital status, level of education, and employment status, MPI (Impact scales), MPI (Activities), extent to which activities were decreased due to pain, no. of pain areas, no. of verbal descriptors, average pain intensity rating, rating of difficulty in dealing with pain, and self-reported evoked pain, were entered as independent variables (Table 9). The most relevant combination of factors for the use of PM was higher perceived difficulty in dealing with pain, higher average pain intensity, presence of evoked pain, perceived support from significant other and being married.

Discussion

The results of the present study confirm that people with SCIs experience persistent pain long after the injury, despite the availability and use of many treatment options. Interestingly, a substantial proportion (40.8%) of the sample did not indicate the use of any treatments to relieve their pain. People who used treatment interventions for their pain did not differ from those who did not use treatments on any demographic variables. However, as would be expected, people using treatments to control their pain perceived their pain to be significantly more severe.

The results of the present study show that the most common pain medications used by people with SCI were opioids, NSAIDs, and acetaminophen, closely followed by anticonvulsants, antispasticity medication, and sedatives. In another survey of people with SCIs, Warms *et al*[9] reported considerably higher treatment frequencies than we observed in the present study. A possible explanation for the discrepancy is that we asked about the use of treatments in the 'past 18 months,' whereas Warms *et al*[9] asked about whether patients 'ever' used the treatment. The participants in our study had on average sustained their SCI over 9 years prior to the survey. Since most chronic pain starts within 6 months following SCI,[3,38] it is likely that many of the participants had tried various treatment options during the course of their SCI and discontinued them if they were not helpful or had significant adverse effects.

Although opioids are considered to be less effective for relief of neuropathic pain than for nociceptive pain,[48,49] the frequent use of opioids and the perceived usefulness of this drug reported by some participants deserve further investigation. For example, several investigators[24,50] have suggested that specific neurological subgroups of neuropathic pains may respond to opioids. Thus, it is possible that 'opioid responsive' neuropathic pain subgroups may also exist in the SCI chronic pain population. Another explanation might be

that opioids relieved the nociceptive types of pains experienced by our participants and thus may have decreased overall pain severity. Unfortunately, we did not evaluate each type of pain separately and therefore we were unable to examine this hypothesis. Similar to Warms *et al*'s[9] results, massage and physiotherapeutic interventions were the most common NPhT used to relieve pain. Various forms of physiotherapeutic procedures were perceived as providing considerable to complete pain relief in 50% of people using these therapies. Thus, such therapies may have a potential as an adjunct treatment to pain medication for a significant proportion of people even long after they sustained their SCIs.

Future intervention studies with people having SCIs should attempt to differentiate between the separate pain types since the mechanisms underlying these different pains are likely to differ and influence the response to treatment.

The prescription of a specific pain treatment is dependent on a variety of factors related to how patients present to their doctors (ie, how the pain is described and how patients report it to affect their lives).[25] In the present study we assessed aspects related to type of pain and to psychosocial and behavioral impact of chronic pain in order to determine if these were predictive of using PM, NPM, or NPhT. Use of NPM and NPhT was not strongly associated with any of the assessed pain characteristics or to psychosocial and behavioral impact of chronic pain. This finding suggests that these therapies were used to relieve all types of pain and their use was relatively unrelated to any of the psychosocial or behavioral factors assessed.

The use of PM, however, was associated with a number of pain characteristics and to psychosocial and behavioral responses to pain. These results suggest that people who perceive their pain to be more severe and to have a significant impact on their lives, are more likely to be prescribed and to use PM. Furthermore, the results indicate that those who had used PM for their pain experienced significantly more intense pain, reported significantly more areas to be painful, and used significantly more adjectives to describe their pain. In addition, they experienced pain in areas that could either be evoked or aggravated by non-noxious stimuli. Thus, it appears that physicians are responding to both patients' reports of pain severity and related characteristics and reports of the impact of pain on functioning. The importance of the influence of reported impact of pain on prescribing practices, is similar to the findings reported by Turk and Okifuji[26] in heterogeneous chronic pain patients.

Although the reports of evoked pain suggest that the use of PM is associated with having pain with neuropathic features, the high pain intensity, the multiple pain sites, and descriptors also indicate that the presence of multiple types of pain is predictive of use of PM. Both spontaneous and evoked pain in the frontal aspects of the torso and genital area was strongly related to the use of PM, suggesting that pain in this area is particularly bothersome. These types of pain can be either nociceptive or neuropathic. For example, visceral pain may arise due to activation of nociceptors located in visceral organs and transmitted via the autonomic nervous system,[51] even when located below the level of injury. However, genital pain may also be caused by damage to the cauda equina,[17] and thus be neuropathic in origin.

The combination of factors that significantly contributed to predict the use of PM were in descending order: high rating of difficulty in dealing with pain, high average pain intensity, presence of evoked pain, and high perceived support. This suggests that people with SCI who experience intense neuropathic pains have a difficult time coping with them despite the use of PM. We were unable to explore the relations between specific treatments and characteristics of pain and psychosocial variables because the number of people using any specific medication was too small. Future research should investigate these relations as they may be of particular value in treatment planning.

The relation between increased likelihood of using PM and perceiving support by the significant other as high might appear surprising. Although the data are correlational, some investigators have reported that support may have a negative consequence reinforcing pain reports and treatment seeking.[52] Turk *et al*[52] also suggested that responsive partners might encourage more 'illness behavior' in the person experiencing chronic pain. McColl *et al*[53] found that shortly after injury, there was a positive relation between social support and positive coping, whereas later on, this relation was inversed (ie, a high level of perceived social support was negatively associated with coping capability). These results parallel the study by Elliott *et al*[54] who showed that attachment support was predictive of psychosocial impairment in people who had sustained their SCI many years ago.

Since we did not assess different types of pain separately, we are unable to determine whether people were using 'more appropriate' treatments, for example, anticonvulsants for neuropathic pain.[19] In addition, since not all treatments were current but used in the past '18 months,' there is a risk that people both forget treatments that they have used and their effectiveness. Had the treatment been effective and with tolerable side effects, however, we would expect it to be continued. Moreover, Dawson *et al*[55] found there was a fair correspondence between initial and recalled pain information in low-back patients concerning location, frequency and interference with activities over a period of up to 10 years.

In summary, people with SCI continue experience pain of various origins that is usually inadequately relieved by any prescribed or self-initiated treatments many years after injury. Furthermore, similar treatments and medications appear to be used for various types of pain; whereas high pain severity and impact on functioning are more likely to affect the use of prescription medication. Therefore, important areas

for future research include treatment strategies that are tailored to both type of pain as well as psychosocial impact since this may improve treatment outcomes in this population of people.

Acknowledgements

Preparation of this manuscript was supported in part by grants from the VA RR&D (B26566C), The State of Florida, and The Miami Project to Cure Paralysis awarded to the first author and the National Institute of Arthritis and Musculoskeletal and Skin Diseases (AR/AI44724, AR47298) and the National Institute of Child Health and Human Development/National Center for Medical Rehabilitation Research (HD33989) awarded to the second author.

References

1 Finnerup NB *et al*. Pain and dysesthesia in patients with spinal cord injury: a postal survey. *Spinal Cord* 2001; **39:** 256–262.
2 Turner JA, Cardenas DD, Warms CA, Me Clellan CB. Chronic pain associated with spinal cord injuries: a community survey. *Arch Phys Med Rehabil* 2001; **82:** 501–508.
3 Widerström-Noga EG, Felipe-Cuervo E, Yezierski RP. Relationships among clinical characteristics of chronic pain following spinal cord injury. *Arch Phys Med Rehabil* 2001; **82:** 1191–1197.
4 Dalyan M, Cardenas DD, Gerard B. Upper extremity pain after spinal cord injury. *Spinal Cord* 1999; **37:** 191–195.
5 Ravenscroft A, Ahmed YS, Burnside IG. Chronic pain after SCI. A patient survey. *Spinal Cord* 2000; **38:** 611–614.
6 Widerström-Noga EG, Felipe-Cuervo E, Yezierski RP. Chronic pain following spinal cord injury: interference with sleep and activities. *Arch Phys Med Rehabil* 2001; **82:** 1571–1577.
7 Rintala DH *et al*. Chronic pain in a community-based sample of men with spinal cord injury: prevalence, severity, and relationship with impairment, disability, handicap, and subjective well-being. *Arch Phys Med Rehabil* 1998; **79:** 604–614.
8 Westgren N, Levi R. Quality of life and traumatic spinal cord injury. *Arch Phys Med Rehabil* 1998; **79:** 1433–1439.
9 Warms CA, Turner JA, Marshall HM, Cardenas DD. Treatments for chronic pain associated with spinal cord injuries: many are tried, few are helpful. *Clin J Pain* 2002; **18:** 154–163.
10 Ragnarsson KT. Management of pain in persons with spinal cord injury. *J Spinal Cord Med* 1997; **20:** 186–199.
11 Vierck CJ, Siddall P, Yezierski RP. Pain following spinal cord injury: animal models and mechanistic studies. *Pain* 2000; **89:** 1–5.
12 Siddall PJ, Loeser JD. Pain following spinal cord injury. *Spinal Cord* 2001; **39:** 63–73.
13 Summers JD *et al*. Psychosocial factors in chronic spinal cord injury pain. *Pain* 1991; **47:** 183–189.
14 Richards JS. Chronic pain and spinal cord injury: review and comment. *Clin J Pain* 1992; **8:** 119–122.
15 Störmer S *et al*. Chronic pain/dysesthesiae in spinal cord injury patients: results of a multicentre study. *Spinal Cord* 1997; **35:** 446–455.
16 Bryce TN, Ragnarsson KT. Pain after spinal cord injury. *Phys Med Rehabil Clin N Am* 2000; **11:** 157–168.
17 Siddall PJ, Yezierski RP, Loeser JD. Pain following spinal cord injury: clinical features, prevalence, and taxonomy. *Int Assoc Study Pain Newslett* 2000; **3:** 3–7.
18 Eide PK, Jørum E, Stenehjelm AE. Somatosensory findings in patients with spinal cord injury and central dysesthesia pain. *J Neurol Neurosurg Psychiatry* 1996; **60:** 411–415.
19 Jensen TS. Anticonvulsants in neuropathic pain: rationale and clinical evidence. *Eur J Pain* 2002; **6** (Suppl. A)**:** 61–68.
20 Finnerup NB *et al*. Lamotrigine in spinal cord injury pain: a randomized controlled trial. *Pain* 2002; **96:** 375–383.
21 Attal N *et al*. Effects of IV morphine in central pain: a randomized placebo-controlled study. *Neurology* 2002; **58:** 554–563.
22 Boivie J, Leijon G, Johansson I. Central post-stroke pain – a study of the mechanisms through analyses of the sensory abnormalities. *Pain* 1989; **37:** 173–185.
23 Lindblom U. Analysis of abnormal touch, pain, and temperature sensation in patients. In: Boivie J, Hansson P, Lindblom U (eds). *Touch, Temperature, and Pain in Health and Disease: Mechanisms and Assessments*. *Progress in Pain Research and Management*. Vol. 3. IASP Press: Seattle 1994, pp 63–84.
24 Jensen TS, Sindrup SH. Opioids: a way to control central pain? *Neurology* 2002; **58:** 517–518.
25 Turk DC, Okifuji A. Perception of traumatic onset and compensation status impact on pain severity and emotional distress in chronic pain patients. *J Behav Med* 1996; **19:** 435–455.
26 Turk DC, Okifuji A. What factors affect physicians' decisions to prescribe opioid for chronic non-cancer pain patients? *Clin J Pain* 1997; **13:** 330–336.
27 Vincent CA, Furnham A. Why do patients turn to complementary medicine? An empirical study. *Br J Clin Psychol* 1996; **35:** 37–48.
28 Widerström-Noga EG *et al*. Perceived difficulty in dealing with consequences of spinal cord injury. *Arch Phys Med Rehabil* 1999; **80:** 580–586.
29 Widerström-Noga EG, Evaluation of clinical characteristics of pain and psychosocial factors after spinal cord injury (SCI). In: Burchiel KJ, Yezierski RP (eds). *Spinal Cord Injury Pain: Assessment, Mechanisms, Management*. *Progress in Pain Research and Management*. Vol. 23. IASP Press: Seattle 2002, pp 53–82.
30 Kerns RD, Turk DC, Rudy TE. The West Haven–Yale Multidimensional Pain Inventory (WHYMPI). *Pain* 1985; **23:** 345–356.
31 Widerström-Noga E, Duncan R, Felipe-Cuervo E, Turk DC. Assessment of the impact of pain and impairments associated with spinal cord injuries. *Arch Phys Med Rehabil* 2002; **83:** 395–404.
32 Jensen MP, Karoly P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. *Pain* 1986; **27:** 117–126.
33 Margolis RB, Chibnall JT, Tail RC. Test–retest reliability of the pain drawing instrument. *Pain* 1988; **33:** 49–51.
34 Melzack R, Torgerson S. On the language on pain. *Anesthesiology* 1971; **34:** 50–60.
35 Nepomuceno C *et al*. Pain in patients with spinal cord injury. *Arch Phys Med Rehabil* 1979; **60:** 605–609.

36 Davidoff G *et al*. Function-limiting dysesthetic pain syndrome among traumatic spinal cord injured patients: a cross-sectional study. *Pain* 1987; **29:** 39–48.
37 Fenollosa P *et al*. Chronic pain in the spinal cord injured: statistical approach and pharmacological treatment. *Paraplegia* 1993; **31:** 722–729.
38 Siddall PJ *et al*. Pain report and the relationship of pain to physical factors in the first 6 months following injury. *Pain* 1999; **81:** 187–197.
39 Tunks E. Pain in spinal cord injured patients. In: Bloch RF, Basbaum M (eds). *Management of Spinal Cord Injuries*. Williams & Wilkins: Baltimore, MD 1986. pp 180–211.
40 Siddall PJ, Taylor DA, Cousins MJ. Classification of pain following spinal cord injury. *Spinal Cord* 1997; **35:** 69–75.
41 Mikail SF, DuBreuil S, D'Eon JL. A comparative analysis of measures used in the assessment of chronic pain patients. *Psychol Assess* 1993; **5:** 117–120.
42 Bernstein IH, Jaremko ME, Hinkley BS. On the utility of the West-Haven–Yale Multidimensional Pain Inventory. *Spine* 1995; **20:** 956–963.
43 DeGagne TA, Mikail SF, D'Eon JL. Confirmatory factor analysis of a 4-factor model of chronic pain evaluation. *Pain* 1995; **60:** 195–202.
44 Jamison RN, Rudy TE, Penzien DB, Mosley TH. Cognitive-behavioral classifications of chronic pain: replication and extension of empirically derived patient profiles. *Pain* 1994; **57:** 277–292.
45 Flor H, Birbaumer N. Comparison of the efficacy of electromyographic biofeedback cognitive-behavioral therapy and conservative medical interventions in the treatment of chronic musculoskeletal pain. *J Consult Clin Psychol* 1993; **61:** 653–658.
46 Turk DC *et al*. Pain, disability, and physical functioning in subgroups of fibromyalgia patients. *J Rheumatol* 1996; **23:** 1255–1262.
47 Olsson I, Bunketorp O, Carlsson SG, Styf J. Prediction of outcome in whiplash-associated disorders using West Haven–Yale Multidimensional Pain Inventory. *Clin J Pain* 2002; **18:** 238–245.
48 Arner S, Meyerson BA. Lack of analgesic effect of opioids on neuropathic and idiopathic forms of pain. *Pain* 1988; **33:** 11–23.
49 McQuay HJ. Neuropathic pain: evidence matters. *Eur J Pain* 2002; **6** (Suppl. A)**:** 11–18.
50 Yamamoto T *et al*. Pharmacological classification of central post-stroke pain: comparison with the results of chronic motor cortex stimulation therapy. *Pain* 1997; **72:** 5–12.
51 Komisaruk BR, Gerdes CA, Whipple B. "Complete" spinal cord injury does not block perceptual responses to genital self-stimulation in women. *Arch Neurol* 1997; **54:** 1513–1520.
52 Turk DC, Kerns RD, Rosenberg R. Effects of marital interaction on chronic pain and disability: examining the downside of social support. *Rehabil Psychol* 1992; **37:** 259–274.
53 McColl MA, Lei H, Skinner H. Structural relationships between social support and coping. *Soc Sci Med* 1995; **41:** 395–407.
54 Elliott T, Herrick S, Witty T. Problem solving appraisal and the effects of social support among college students and persons with physical disabilities. *J Counsel Psychol* 1992; **39:** 219–226.
55 Dawson EG *et al*. Low back pain recollection versus concurrent accounts: outcome analysis. *Spine* 2002; **27:** 984–993.