original article

Effects of chronic pain on function, depression, and sleep among patients with traumatic spinal cord injury

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BACKGROUND AND OBJECTIVES: The main objectives of this cross-sectional study were (1) to examine chronic pain using the Multidimensional Pain Inventory-Spinal Cord Injury (MPI-SCI) version and (2) to assess the relationship between chronic pain and functional status, depression, and sleep quality among patients with SCI.

DESIGN AND SETTINGS: This was a cross-sectional study of all eligible patients admitted to the Ministry of Health Ankara Diskapi Yildirim Beyazit Education and Research Hospital Physical Therapy and Rehabilitation Clinic between January 2007 and July 2010.

METHODS: Forty-four patients (33 male, 11 female) with traumatic SCI, aged ≥18 years, who had pain continuing for ≥6 months and were hospitalized in the physical therapy and rehabilitation clinic were included in this cross-sectional study. Chronic pain intensity, functional status, depression, and sleep quality were assessed according to the MPI-SCI, Functional Independence Measure (FIM), Hamilton Rating Scale for Depression (HAM-D), and Pittsburg Sleep Quality Index (PSQI), respectively.

RESULTS: A positive correlation was observed between "Pain Severity" (one of the subscales of the MPI-SCI) and HAM-D (r=0.487, *P*=.001) and PSQI (r=0.312, *P*=.039). "Pain Severity" was significantly higher in the "impaired sleep" group (*P*<.05) than in the "normal sleep" group and in the "depression" group (*P*<.05) than in the "no depression" group.

CONCLUSION: We identified a strong interrelationship between SCI-related "Pain Severity" and both depression and sleep quality. Hence, a comprehensive pain examination and management strategies including psychosocial interventions should be given particular consideration to address the critical issue of chronic pain in individuals with SCI.

Traumatic spinal cord injury (SCI) is generally a destructive disorder that negatively influences independence and lifestyle.[1] Pain is a significant problem for many with traumatic SCI.[2] Patients with SCI have described pain as the most difficult medical condition to deal with, more so than the loss of motor or sensory function.[3]

The exact percentage of the SCI population with chronic pain (reports vary from 26% to 96%, with one-third of pain rated as severe) remains unclear, as does the extent to which function and quality of life are affected by pain. As a result, SCI pain has become a favorite topic of study for physiatrists.[4,5] In our country, the prevalence of pain after SCI was reported as 61%.[6]

The persistent nature of pain associated with SCI has been reported to frequently interfere with cognitive, emotional, and physical health and functioning, including sleep, which has been shown to reduce quality of life. It has also been demonstrated that chronic pain is associated with changes in mood, particularly with more depressive symptoms and more perceived stress.[7,8]

Patients with SCI may experience several types of

pain simultaneously, including different mechanisms that complicate the clinical picture.[9] Because pain in this patient population is heterogeneous and may present with more than 1 type, each pain should be evaluated separately and in as much detail as possible.[10] Although a number of assessment instruments have been developed for chronic pain patients in general, they may not be appropriate for use with SCI patients because of some differences based on the injury and physical impairments that may influence the perception of pain.[11] The West Haven Yale Multidimensional Pain Inventory (MPI) is a comprehensive instrument designed to assess a range of self-reported behavioral and psychosocial factors associated with chronic pain syndromes.[12] The MPI has been adapted to SCI and appears to be a reasonable instrument to evaluate the impact of pain in people with SCI and the response of their significant others (the person with whom the patient feels closest) to pain.[11,13]

The main objectives of this cross-sectional study were (1) to examine chronic pain multidimensionally using the MPI-SCI and (2) to assess the relationship between chronic pain and on functional status, depression, and sleep quality among patients with SCI.

METHODS

The sample for this cross-sectional study consisted of 44 patients with traumatic SCI, who were aged ≥18 years, had pain continuing for ≥6 months, and were hospitalized in the physical therapy and rehabilitation clinic. They were admitted to the clinic for further rehabilitation. Patients with head trauma and impaired mental functions that precluded their answering all the questions were excluded from the study.

Study participation was totally voluntary and patients were informed about the nature of the study. The study was approved by the local institutional ethical committee. All procedures were in accordance with the Helsinki Declarations of 1975.

A comprehensive clinical interview was applied consisting of demographic variables (age, age at SCI, gender, marital status) and etiology of SCI. A physical and neurological examination of all patients was carried out. Their neurological level and impairment severity, which was classified using the American Spinal Injury Association (ASIA) classification system, were recorded.[14]

For the pain definition, 6 months was used as the cutoff for indicating "chronic" pain. Patients completed Parts 1 to 2 of the MPI-SCI inventory for pain assessment. The MPI is a self-reported questionnaire based on the cognitive-behavioral perspective designed to assess the impact of and adaptation to chronic pain. It comprises 3 parts: part 1 (pain impact), part 2 (responses by significant others), and part 3 (common activities). The first and second parts measure cognitive, affective, social, and behavioral responses which include: pain severity, life interference, life control, affective distress, support, negative responses from others, solicitous responses from others, and distracting responses from others.[11,13]

Functional status was measured by the patients' scores on the motor and cognitive components of the Functional Independence Measure (FIM).[15,16] It has been widely used to assess the impact of SCI on an individual's activities of daily living and function. The 18 items of the FIM are graded on a 7-point ordinal scale, with a maximum total score of 126. Each FIM item is scored on a scale from 1 (complete dependence) to 7 (independence). FIM was administered using the Turkish version[17] based on the observation of the patients according to the protocol used in inpatient rehabilitation.

Table 1. Mean values for the subscales of the MPI-SCI, FIM, HAM-D, and PSQI.

Variables	Values
MPI-SCI subscales (mean[SD])	
First part	
LI	2.9(1.6)
S	4.5 (1.5)
LC	3.8 (1.1)
PS	4.2 (1.3)
AD	3.4 (1.3)
Second part	
DR	4.4 (1.4)
NR	1.9 (1.6)
SR	3.8 (1.0)
FIM (mean[SD])	
Motor	40.4 (18.8)
Cognitive	34.6 (2.2)
Total	74.8 (19.4)
HAM-D (mean[SD])	
HAM-D n (%)	17.7 (8.0)
No depression	4 (9.1%)
Mild depression	17 (38.6%)
Moderate depression	19 (43.2%)
Severe depression	4 (9.1%)
PSQI (mean[SD])	
PSQI n (%)	7.2 (4.4)
Normal sleep	15 (34.1%)
Impaired sleep	29 (65.9%)

MPI-SCI: Multidimensional pain inventory-spinal cord injury, FIM: functional independence measurement, HAM-D: Hamilton rating scale for depression, PSQI: Pittsburgh sleep quality index.

LI: life interference, S: support, LC: life control, PS: pain severity, AD: affective distress, DR: distracting responses, NR: negative responses, SR: solicitous responses.

For psychosocial status, a screening instrument—the Hamilton Rating Scale for Depression (HAM-D) —was applied by the clinic psychologist.[18] The HAM-D is a standardized interview-based assessment examining the frequency and intensity of depressive symptoms, which yields a total score ranging from 0 to 52, with a high score indicating more frequent and severe symptoms. We defined the presence of a clinically meaningful level of depressive symptoms as a total score greater than 7, with 8 to 15 indicating mild, 16 to 28 indicating moderate, and ≥29 indicating severe depression. The Turkish validity and reliability study of this scale was done by Akdemir et al.[19]

Sleep problems occur frequently in individuals with SCI.[20] The Pittsburg Sleep Quality Index (PSQI) is a self-reported tool to assess quality and patterns of sleep over the last month, which is widely accepted as both valid and reliable.[21] The PSQI measures 7 subscales including: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, and daytime dysfunction. Each subscale is rated from 0 (not in the past month) to 3 points (≥3 times per week). A global sleep quality score is then obtained by summing the 7 components (range, 0-21). A PSQI total score ≥5 indicates poor sleep quality. The Turkish validity and reliability study of this scale was done by Ağargün et al.[22]

Analyses were conducted using SPSS, version 11.5 (SPSS Inc., Chicago, USA). The normality of the distribution of continuous variables was investigated by Shapiro-Wilk test. Descriptive statistics were demonstrated as mean, median, standard deviations, minimum and maximum values for continuous variables, and number of cases or percentage for nominal variables. Comparisons between the groups were performed with Mann-Whitney U test and Kruskal-Wallis test for non-normally distributed variables, and with one-way ANOVA and t test for normally distributed variables. If there was a significant difference in the results, post hoc Tukey or multiple comparison tests were used to determine the conditions caused by this difference. Correlations were tested using a Pearson product-moment correlation coefficient for variables consistent with normal distribution or using a Spearman's rho correlation coefficient for variables that appear to have non-normal distribution. A *P* value less than .05 was considered as statistically significant.

RESULTS

The mean age of patients and age at injury were 33.9 (12.7) years and 30.6 (11.6) years, respectively. Thirty-three (75%) patients were male and 11 (25%) were female. Twenty-three (52.3%) patients were married and 21 (47.7%) were single/divorced.

The distribution of etiological factors of SCI included the following: motor vehicle accident (22, 50%), falls (10, 22.7%), gunshot wound (5, 11.4%), job accident (3, 6.8%), and others (4, 9.2%).

Twenty-eight (63.6%) patients were paraplegic and 18 (36.4%) were tetraplegic. According to the ASIA classification system, 23 (52.3%) patients were

Table 2. Correlation between MPI-SCI subgroups and FIM, HAM-D, and PSQI values.

	FIM		HAM-D		PSQI	
	Correlation	*P*	Correlation	*P*	Correlation	*P*
LI	r=0.000	.999	r=0.341	*.024	rho=0.165	.286
S	rho=-0.166	.281	rho=0.055	.722	rho=0.110	.477
LC	r=0.041	.794	r=-0.048	.758	rho=-0.193	.210
PS	r=-0.077	.621	r=0.487	*.001	rho=0.312	*.039
AD	r=-0.315	*.037	r=0.274	.072	rho=0.282	.064
DR	rho=-0.011	.944	rho=-0.148	.338	rho=-0.116	.455
NR	rho=-0.336	*.026	rho=0.192	.212	rho=0.206	.181
SR	r=-0.229	.134	r=0.238	.119	rho=0.099	.521

MPI-SCI: Multidimensional pain inventory-spinal cord injury, FIM: functional independence measurement, HAM-D: Hamilton rating scale for depression, PSQI: Pittsburgh sleep quality index.

LI: life interference, S: support, LC: life control, PS: pain severity, AD: affective distress, DR: distracting responses, NR: negative responses, SR: solicitous responses.

*P: <.05 statistically significant, r: Pearson's correlation coefficient, rho: Spearman's correlation coefficient.

A, 10 (22.7%) were B, 7 (15.9%) were C, and 4 (9.1%) were D; 23 (52.3%) were complete and 21 (47.7%) incomplete.

Responses by significant others were listed as follows: wife/husband (19, 43.2%), mother (8, 18.2%), father (3, 6.8%), sister/brother (8, 18.2%), daughter/son (3, 6.8%), and others (3, 6.8%). While 40 (90.9%) patients indicated that they lived together with this significant other, 4 (9.1%) lived separately from their significant other.

As the main target was to examine chronic pain multidimensionally in SCI patients, mean values for the subscales of the MPI-SCI are shown in **Table 1**. We also presented the mean values of FIM, HAM-D, and PSQI in **Table 1**. The correlations between the MPI-SCI subgroups and FIM, HAM-D, and PSQI are demonstrated in **Table 2**. There was a positive correlation between "Pain Severity" and HAM-D (r=0.487, *P*=.001) and PSQI (r=0.312, *P*=.039); "Affective Distress" and "Negative Responses" showed a negative correlation with FIM (r=-0.315, *P*=.037 and rho=-0.336, *P*=.019, respectively) (**Table 2**). Because the second objective was to determine the effects of chronic pain on depression and sleep quality, results for associations were given in **Tables 3 and 4**. While depression and sleep quality were categorized, FIM was only assessed for correlation analysis with the FIM total score.

DISCUSSION

In this study, chronic pain and its effects on functional status, depression, and sleep quality were assessed in patients with traumatic SCI. It was observed that "Pain Severity" was significantly higher in the "impaired sleep" and "moderate and severe depression" groups.

The findings yielded a correlation between functional status and pain behaviors from others, such that being more functionally dependent was associated with affective distress and negative responses. SCI patients with pain may view their disability more negatively because of the additional negative impact of pain on their lives. Conversely, a more negative view of one's disability may lead to increased anger and restlessness with concomitant increase in pain severity. Loubser and Donovan[23] concluded that chronic pain imposes an additional handicap for a given degree of disability.

While the depression ratio (including mild-moderate-severe depression) was found as approximately 90% in our study, Migliorini et al[24] recorded it as 37% and Krause et al[25] as 19% in SCI patients. Participants who acknowledged having chronic pain had more depressive symptoms, with a mean Center for Epidemiological Studies-Depression Scale score of 10.6 compared to the means of 9.2 and 8.7 reported for the general population.[7,26,27] Study patients having chronic pain with high rates of depression supported the relationship between pain severity and depression. Therefore, this association suggests that the long-term emotional distress experi-

Table 3. Mean scores of MPI-SCI domains among HAM-D groups.

	No Depression+Mild depression (n=21)		Moderate+Severe depression (n=23)		*P*
MPI-SCI	Mean (SD)	Med (Min-Max)	Mean (SD)	Med (Min-Max)	
First part					
LI	2.3 (1.4)	2.7 (0-4.4)	3.7 (1.7)	3.2 (0.4-5.7)	.030[a]
S	4.5 (1.6)	5 (0-6)	4.6 (1.5)	5 (0-6)	.840
LC	4.0 (1.2)	3.7 (1.6-6)	3.7 (1.0)	3.7 (1.6-6)	.484
PS	3.7 (1.4)	3.7 (0.7-6)	4.6 (1.1)	4.7 (2.3-6)	.019[a]
AD	2.9 (0.8)	3 (1.7-4.7)	3.9 (1.5)	4 (0-6)	.020[a]
Second part					
DR	4.6 (1.3)	5 (1.7-6)	4.3 (1.4)	4.7 (0.5-6)	.450
NR	1.5 (1.6)	0 (0-4.3)	2.2 (1.6)	2 (0-5)	.193
SR	3.3 (1.1)	3 (1.4-5.6)	4.2 (0.8)	4.2 (2.8-6)	.003[a]

MPI-SCI: Multidimensional pain inventory-spinal cord injury, LI: life interference, S: support, LC: life control, PS: pain severity, AD: affective distress, DR: distracting responses, NR: negative responses, SR: solicitous responses, SD: standard deviation, Med: median, Min: minimum, Max: maximum.

[a] *P*. <.05 statistically significant.

Table 4. Mean scores of MPI-SCI domains among PSQI groups.

	Normal sleep		Impaired sleep		*P*
MPI-SCI	Mean (SD)	Med (Min-Max)	Mean (SD)	Med (Min-Max)	
First part					
LI	2.3 (1.6)	2.5 (0-4.9)	3.1 (1.5)	3.1 (0.4-5.7)	.105
S	4.5 (1.5)	5 (0-6)	4.6 (1.5)	5 (0-6)	.930
LC	4.0 (1.2)	4 (1.6-6)	3.7 (1.0)	3.7 (1.6-5.6)	.325
PS	3.6 (1.4)	3.6 (0.7-6)	4.5 (1.2)	4.7 (2.3-6)	.031[a]
AD	2.9 (1.3)	3 (0-6)	3.7 (1.3)	3.7 (1.3-6)	.087
Second part					
DR	4.6 (1.3)	4.7 (1.7-6)	4.3 (1.4)	5 (0.5-6)	.358
NR	1.3 (1.6)	0 (0-5)	2.3 (1.6)	2.7 (0-5)	.044[a]
SR	3.6 (1.4)	3.6 (1.4-6)	3.9 (0.8)	4 (1.8-6)	.464

MPI-SCI: Multidimensional pain inventory-spinal cord injury, LI: life interference, S: support, LC: life control, PS: pain severity, AD: affective distress, DR: distracting responses, NR: negative responses, SR: solicitous responses, SD: standard deviation, Med: median, Min: minimum, Max: maximum.

[a] *P*: <.05 statistically significant.

enced by these individuals is significantly influenced by the presence of pain.

Pain severity was positively correlated with impaired sleep. Persistent and intense pains associated with SCI[28,29] may profoundly affect the quality of an individual's sleep.[30] Consistent with previous SCI findings,[31,32] our participants reported frequent sleep interference to trouble falling asleep, taking medications to sleep, and waking up, at least sometimes, because of the pain. Jensen et al[20] reported sleep disturbances more frequently in patients with SCI than in healthy people. Because the findings in this study yielded a relationship between pain severity and sleep, it highlights the need to examine this possibility more closely and for other interested investigators to study the effects of sleep treatments on health-related domains in individuals with SCI.

Some limitations to our study are as follows: First, while the sample size of the patients with SCI was not necessarily small, a larger sample would increase confidence in the reliability of the results. Second, the study design was cross-sectional; therefore, the data reflect the respondents' situation at a certain point in time.

In conclusion, in spite of the above-mentioned limitations, this study provides important preliminary support for the utility of behavioral and cognitive-behavioral models in the assessment of chronic pain, which is a complex and serious issue in individuals with SCI. To our best notice, this is the first study displaying chronic pain's impact multidimensionally on functionality, mood, and sleep quality among patients with SCI in our country. Findings emphasize the strong interrelationship between SCI-related pain severity and both depression and impaired sleep. Therefore, this study highlights the need to evaluate each individual with SCI in a comprehensive manner that includes identifying the psychological factors. Health care professionals should give their full attention not only to the clinical examination but also to a pain management strategy by including psychosocial interventions, as an integral part, to address the critical issue of chronic pain in individuals with SCI.

REFERENCES

1. Middleton J, Tran Y, Craig A. Relationship between quality of life and self-efficacy in persons with spinal cord injuries. Arch Phys Med Rehabil 2007;88(12):1643-1648.
2. Dijkers MP, Zanca JM. Factors complicating treatment sessions in spinal cord injury rehabilitation: nature, frequency, and consequences. Arch Phys Med Rehabil 2013 Apr;94(4 Suppl):S115-24.
3. Ravenscroft A, Ahmend YS, Burnside IG. Chronic pain after spinal cord injury. A patient survey. Spinal Cord 2000;38:611-614.
4. Dijkers M, Bryce T, Zanca J. Prevalence of chronic pain after traumatic spinal cord injury: a systematic review. J Rehabil Res Dev 2009;46(1):13-29.
5. Dijkers M. Comparing quantification of pain severity by verbal rating and numeric rating scales. J Spinal Cord Med. 2010;33(3):232-242.
6. Demirel G, Yılmaz H, Gencosmanoglu B, Kesiktas N. Pain following spinal cord injury. Spinal Cord. 1998;36(1):25-28.
7. Rintala D, Loubser PG, Castro J, Hart KA, Fuhrer MJ. 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. McColl MA, Aiken A, McColl A, Sakakibara B, Smith K. Primary care of people with spinal cord injury: scoping review. Can Fam Physician. 2012;58(11):1207-1216.
9. Siddall PJ, Taylor DA, McClelland JM, Rutkowski SB, Cousins MJ. Pain report and the relationship of pain to physical factors in the first 6 months following spinal cord injury. Pain. 1999;81(1-2):187-197.
10. Felix ER, Cruz-Almeida Y, Widerström-Noga EG. Chronic pain after spinal cord injury: what characteristics make some pains more disturbing than others? J Rehabil Res Dev. 2007;44(5):703-715.
11. Widerström-Noga EG, 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(3):395-404.
12. Kerns RD, Turk DC, Rudy TE. The West Haven-Yale Multidimensional Pain Inventory (WHYMPI). Pain. 1985;23(4):345-356.
13. Widerström-Noga EG, Cruz-Almeida Y, Martinez-Arizala A, Turk DC. Internal consistency, stability, and validity of the spinal cord injury version of the Multidimensional Pain Inventory. Arch Phys Med Rehabil. 2006;87(4):5165-23.
14. American Spinal Injury Association. International Standards for Neurological Classification of Spinal Cord Injury. Revised 2000; Atlanta, GA, Reprinted 2008.
15. Keith RA, Granger CV, Hamilton BB, Sherwin FS. The functional independence measure: a new tool for rehabilitation. Adv Clin Rehabil. 1987;1:6-18.
16. Kidd D, Stewart G, Baldry J, Johnson J, Rossiter D, Petruckevitch A, Thompson AJ. The Functional Independence Measure: a comparative validity and reliability study. Disabil Rehabil. 1995;17:10-14.
17. Kucukdeveci AA, Yavuzer G, Elhan AH, Sonel B. Adaptation of the functional independence measure for use in Turkey. Clin Rehabil. 2001;15:311-318.
18. Hamilton M. A rating scale for depression. J Neurol Neurosur Psychiatry. 1960;23:56-62.
19. Akdemir A, Orsel S, Dag I ve ark. Hamilton Depresyon Derecelendirme Olçegi'nin geçerligi, güvenilirligi ve klinikte kullanımı. Psikiyatri Psikoloji Psikofarmakoloji Derg. 1996;4:251-259.
20. Jensen MP, Hirsh AT, Molton IR, Bamer AM. Sleep problems in individuals with spinal cord injury: frequency and age effects. Rehabil Psychol. 2009;54(3):323-331.
21. Buysse DJ, Reynolds CF III, Monk TH, et al. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28:193-213.
22. A?argün MY, Kara H, Anlar O. Pittsburgh Uyku Kalitesi Indeksinin geçerligi ve güvenilirligi. Türk Psikiyatri Derg. 1996;7:107-115.
23. Loubser PG, Donovan WH. Chronic pain associated with spinal cord injury. In: Narayan RK, Wilberger JE, Povlishock JT (eds). Neurotrauma New York: McGraw Hill, 1996, pp. 1311-22.
24. Migliorini C, Tonge B, Taleporos G. Spinal cord injury and mental health. Aust N Z J Psychiatr. 2008 Apr;42(4):309-314.
25. Krause JS, Saunders LL, Reed KS, Coker J, Zhai Y, Johnson E. Comparison of the Patient Health Questionnaire and the Older Adult Health and Mood Questionnaire for self-reported depressive symptoms after spinal cord injury. Rehabil Psychol. 2009;54(4):440-448.
26. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. Appl Psychol Meas. 1977;1:385-401.
27. Sayette RB, Johnston DE. Basic data on depressive symptomatology. Washington (DC): Government Printing Office; 1980.
28. 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(3):154-163.
29. Widerström-Noga EG, Turk DC. Exacerbation of chronic pain following spinal cord injury. J Neurotrauma. 2004;21(10):1384-1395.
30. Morin CM, Gibson D, Wade J. Self-reported sleep and mood disturbance in chronic pain patients. Clin J Pain. 1998;14(4):311-314.
31. Widerström-Noga EG, Felipe-Cuervo E, Yezierski RP. Chronic pain after spinal cord injury: interference with sleep and daily activities. Arch Phys Med Rehabil. 2001;82(11):1571-1577.
32. Biering-Sorensen F, Biering-Sorensen M. Sleep disturbances in the spinal cord injured: an epidemiological questionnaire investigation, including a normal population. Spinal Cord. 2001;39(10):505-513.