RESEARCH ARTICLE

The relationship between pain and clinical parameters, depression, anxiety and sleep quality in patients with spinal injury

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Abstract

Objective: To examine the frequency of pain in individuals with spinal cord injury, and to assess the relationship of pain with functional status, sleep quality, anxiety and depression levels.

Method: The prospective, cross-sectional study was conducted from March to June 2018 at Istanbul Physical Medicine and Rehabilitation Training and Research Hospital, Istanbul, Turkey, and comprised adult patients of wither gender with spinal cord injury who were in the rehabilitation phase both on outpatient and inpatient basis. Data was collected using a questionnaire exploring demographic and clinical features. The presence of pain was assessed using the Leeds Assessment of Neuropathic Symptoms and Signs scale and, in case pain was found present, it was categorised as neuropathic, nociceptive and mixed type pain types. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index, while the Hospital Anxiety and Depression scale was used to evaluate anxiety and depression levels. Data was analysed using SPSS 20.

Results: Of the 150 patients, 104(69.3%) were males and 46(30.7%) were females. The median age of the sample was 46 (IQR:20.52) years. Neuropathic pain was observed in 61(40.7%) patients, nociceptive in 32(21.3%) and mixed type in 12(8%). Depression was found in 71(47.3%) patients, poor sleep quality in 41(27.3%) and anxiety in 35(23.3%). Sleep, anxiety and depression scores were higher in the presence of neuropathic and nociceptive pain ($p<0.05$).

Conclusion: Pain is a common complication in patients with spinal cord injury. In the presence of pain, sleep quality is worse, and anxiety and depression levels are high.

Keywords: Spinal cord injury, Pain, Sleep quality, Anxiety, Depression. (JPMA 72: 1932; 2022)

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Introduction

Spinal cord injury (SCI) is a severe neurological condition that leads to great socio-economic consequences for the affected individuals and the health system. SCI caused by factors such as traffic accident, sports injury and falling is frequently of traumatic origin.[1,2]

The lifetime expenditure of an SCI patient is $2.35 million in the United States.[1] It can be said that complications have an important share in this expense.[3] For this reason, knowing the complications and underlying mechanisms can decrease healthcare costs and increase the quality of life (QOL) of the patients.

Pain is a common complication in SCI patients. Pain, reported in frequencies ranging 64-82%, affects the prognosis of the patients and also causes a decrease in their QOL.[4] Emotional disorders in patients after SCI are among the other complications. Similar to pain, the presence of depression increases other complications, such as pressure ulcers and urinary tract issues in patients, and has a negative effect on the prognosis of patients.[5] Sleep disorders are more frequently observed in patients with SCI than the general population along with decreased social participation and QOL.[6] Sleep disorders are associated with other SCI complications, and it can be said that the specific complications observed in patients with SCI are related to each other.[7]

The current study was planned to determine the frequency and types of pain, to classify the pain, and to determine the demographic and clinical features related to pain.

Patients and Methods

The prospective, cross-sectional study was conducted from March to June 2018 at Istanbul Physical Medicine and Rehabilitation Training and Research Hospital, Istanbul, Turkey. The medical ethics committee of the university hospital approved the study in accordance with the Declaration of Helsinki protocol No.20181226 and written informed consent was obtained from all patients. The sample size was calculated using post-hoc power analysis through G*Power 3 to test the difference in dependent group frequencies by 2x2 contingency table.[8] Those included were adult patients of either gender in the rehabilitation phase post-SCI of at least 3 months. Those

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with accompanying brain damage, alcohol or substance addiction, body mass index (BMI) >35kg/m^2, those with other neuromuscular disease, asthma, chronic obstructive pulmonary disease (COPD), and those with known depressive disorder and/or psychotic disorder were excluded.

After taking informed consent form the patients, demographic and clinical data was collected using a questionnaire. The presence of pain was assessed using the Leeds Assessment of Neuropathic Symptoms and Signs (LANSS) scale and clinical evaluation. In the presence of pain, it was classified as nociceptive, neuropathic or mix-type. SCI severity was staged using the American Spinal Injury Association (ASIA) scale.[9] The presence of spasm was evaluated using the Penn Spasm Frequency Scale (PSFS). Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and their anxiety and depression levels were evaluated using the respective domains of the Hospital Anxiety and Depression (HAD) scale.

The original LANSS scale[10] has been converted into its Turkish version with due validity and reliability study.[11] It is a 7-item scale answered as yes/no. Its maximum score is 24, and scores >12 indicate the presence of neuropathic pain. In the evaluation of nociceptive pain, a 10-scale visual analogue scale (VAS) was preferred.

The HAD scale, developed in 1983,[12] has anxiety (HAD-A) and depression (HAD-D) subscales. Of the 14 items, 7(50%) each assess depression and anxiety. Each question is answered on a 4-point Likert scale 0-3. Scores 11 and above indicate the risk of depression or anxiety. Low scores show low risk for depression and anxiety.[13] The Turkish validity and reliability study of the has already been done.[14]

The PSQI[15] consists of 19 items evaluating 7 components of sleep. Each item is scored 0-3. High scores indicate poor sleep quality. The validity and reliability of the Turkish version has also been done.[16]

Data was analysed using SPSS 20. The appropriateness of variables to normal distribution was examined using visual (histogram and probability plots) and analytical methods (Kolmogrov Smirnov, Shapiro-Wilk test). Descriptive statistics were expressed as mean and standard deviation, median and interquartile range (IQR)), and frequencies and percentages, as appropriate. Normally distributed numerical variables were analysed using t test, and non-normally distributed data was analysed using Mann Whitney U test. Chi-square analysis was used to compare nominal data. Spearman test was preferred in the correlation analysis. P<0.05 were considered statistically significant.

Results

Of the 150 patients, 104 (69.3%) were males and 46 (30.7%) were females. The median age of the sample was 46 (IQR:20.52) years. Pain was detected in The anatomical injury level of the patients was cervical in 37 (25.5%), thoracic 83 (57.2%) and lumbar 25 (17.2%). Besides, 54 (36.2%) of the patients were ASIA-A, 22 (14.2%) were ASIA-B, 35 (23.5%) were ASIA-C, and 38 (25.5%) were ASIA-D. ASIA-B category was significantly different between those who had pain and those who did not have pain (Table-1).

Table-1: Relationship between presence of pain and injury level.

		Pain (-) n=69 n(%)	Pain (+) n=81 n(%)	p
Neurological level	C1-4	5 (41.7)	7 (58.3)	0.73
	C5-8	13 (61.9)	8 (38.1)	0.12
	T1-5	13 (44.8)	16 (55.2)	0.85
	T6-12	28 (48.3)	30 (51.7)	0.70
	L1-5	10 (34.5)	19 (65.5)	0.15
ASIA Level	ASIA A	26 (48.1)	28 (51.9)	0.73
	ASIA B	16 (72.7)	6 (27.3)	0.007
	ASIA C	14 (40.0)	21 (60.0)	0.39
	ASIA D	13 (34.2)	25 (65.8)	0.08

*Chi-square test. ASIA: American Spinal Injury Association.

Table-2: Relationship of pain with functional status, spasm, anxiety, depression and sleep quality.

		Pain (-) n=69 n(%)	Pain (+) n=81 n(%)	p
Functional level *	No balance of sitting	4 (36.4)	7 (63.6)	0.13
	There is a balance of sitting	10 (58.8)	7 (41.2)	
	Wheelchair	8 (80.0)	2 (20.0)	
	Therapeutic ambulation	25 (50.0)	25 (50.0)	
	Indoor ambulation	7 (30.4)	16 (69.6)	
	Kanedian and AFO	8 (42.1)	11 (57.9)	
	Community ambulation	7 (35.0)	13 (65.0)	
Tonus*	Flask	14 (56.0)	11 (44.0)	0.36
	Normal	17 (38.6)	27 (61.4)	
	Increased	38 (46.9)	43 (53.1)	
PSFS*	(+)	16 (44.4)	20 (55.6)	0.73
	Light	8 (40.0)	12 (60.0)	0.72
	Middle	6 (54.5)	5 (45.5)	
	Heavy	2 (40.0)	3 (60.0)	
PQSI (mean ± SD)**		2.7 ± 2.1	5.9 ± 3.6	<0.001
HAD-A (mean ± SD)**		3.4 ± 3.5	6.8 ± 4.7	<0.001
HAD-D (mean ± SD)**		5.7 ± 4.6	7.8 ± 4.0	0.002

*Chi-square test. **Mann Whitney U test. AFO: Ankle-foot orthosis, PSFS: Penn Spasm Frequency Scale, PQSI: Pittsburgh Sleep Quality Index, HAD-A: Hospital Anxiety and Depression Scale-Anxiety, HAD-D: Hospital Anxiety and Depression Scale-Depression.

Table-3: Relationship of neuropathic pain with functional status, spasm, anxiety, depression and sleep quality.

		Neuropathic Pain (-) n=89 n(%)	Neuropathic Pain (+) n=61 n(%)	p
Functional level *	No balance of sitting	5 (45.5)	6 (54.5)	0.29
	There is a balance of sitting	11 (64.7)	6 (35.3)	
	Wheelchair	8 (80.0)	2 (20.0)	
	Therapeutic ambule	31 (62.0)	19 (38.0)	
	Indoor ambule	9 (39.1)	14 (60.9)	
	Kanedian and AFO	12 (63.2)	7 (36.8)	
	Community ambule	13 (65.0)	7 (35.0)	
Tonus*	Flask	15 (60.0)	10 (40.0)	0.93
	Normal	27 (61.4)	17 (38.6)	
	Increased	47 (58.0)	34 (42.0)	
PSFS*	(+)	18 (50.0)	18 (50.0)	0.19
	Light	10 (50.0)	10 (50.0)	0.86
	Middle	6 (54.5)	5 (45.5)	
	Heavy	2 (40.0)	3 (60.0)	
PQSI (mean ± SD)**		3.2 ± 2.6	6.4 ± 3.6	<0.001
HAD-A (mean ± SD)**		4.3 ± 4.5	6.5 ± 4.3	<0.001
HAD-D (mean ± SD)**		6.1 ± 4.5	7.9 ± 4.1	0.01

*Chi-square test. AFO: Ankle-foot orthosis, PSFS: Penn Spasm Frequency Scale, PQSI: Pittsburgh Sleep Quality Index, HAD-A: Hospital Anxiety and Depression Scale-Anxiety, HAD-D: Hospital Anxiety and Depression Scale-Depression.

Table-4: Relationship of nociceptive pain with functional status, spasm, anxiety, depression and sleep quality.

		Nociceptive Pain (-) n=118 n(%)	Nociceptive Pain (+) n=32 n(%)	p
Functional level *	No balance of sitting	9 (81.8)	2 (18.2)	0.14
	There is a balance of sitting	12 (70.6)	5 (29.4)	
	Wheelchair	10 (100)	0	
	Therapeutic ambule	43 (86.0)	7 (14.0)	
	Indoor ambule	18 (78.3)	5 (21.7)	
	Kanedian and AFO	14 (73.7)	5 (26.3)	
	Community ambule	12 (60.0)	8 (40.0)	
Tonus*	Flask	21 (84.0)	4 (16.0)	0.27
	Normal	31 (70.5)	13 (29.5)	
	Increased	66 (81.5)	15 (18.5)	
PSFS*	(+)	29 (80.6)	7 (19.4)	0.75
	Light	15 (75.0)	5 (25.0)	0.11
	Middle	11 (100)	0	
	Heavy	3 (60.0)	2 (40.0)	
PUKI (mean ± SD)**		4.0 ± 3.2	6.1 ± 3.8	0.004
HAD-A (mean ± SD)**		4.4 ± 3.8	8.4 ± 5.5	<0.001
HAD-D (mean ± SD)**		6.3 ± 4.4	8.7 ± 4.0	0.004

*Chi-sqare test. **Mann Whitney U test. AFO: Ankle-foot orthosis, PSFS: Penn Spasm Frequency Scale, PQSI: Pittsburgh Sleep Quality Index, HAD-A: Hospital Anxiety and Depression Scale-Anxiety, HAD-D: Hospital Anxiety and Depression Scale-Depression.

Table-5: LANSS scale and its correlation with demographic and clinical characteristics.

		LANSS	PUKI	HAD-A	HAD-D
Age	Rho	-0.130	0.027	-0.012	-0.113
	p	0.24	0.74	0.88	0.16
Education Period	Rho	-0.005	-0.072	0.015	0.066
	p	0.96	0.38	0.85	0.42
BMI	Rho	-0.003	0.008	0.111	-0.052
	p	0.98	0.91	0.17	0.52
Inpatient treatment period	Rho	0.208	0.077	0.040	0.112
	p	0.09	0.41	0.66	0.22
Disease duration	Rho	-0.068	-0.081	0.071	0.059
	p	0.54	0.32	0.38	0.47
LANSS	Rho	-	0.142	-0.032	0.049
	p	-	0.20	0.77	0.66
PQSI	Rho	0.142	-	0.556	0.435
	p	0.20	-	<0.001	<0.001
HAD-A	Rho	-0.032	0.556	-	0.668
	p	0.77	<0.001	-	<0.001
HAD-D	Rho	0.049	0.435	0.668	-
	p	0.66	<0.001	<0.001	-

*Spearman correlation analysis, Rho; correlation coefficient.
LANSS: Leeds Assessment of Neuropathic Symptoms and Signs scale, BMI: Body mass index, PQSI: Pittsburgh Sleep Quality Index, HAD-A: Hospital Anxiety and Depression Scale-Anxiety, HAD-D: Hospital Anxiety and Depression Scale-Depression.

Complications were present in 138 (92.0%) patients. The most common complications were neurogenic bladder in 121 (80.7%), pain in 81 (54.0%), neurogenic bowel in 59 (39.3%) and pressure ulcer in 22 (14.7%) patients. Neuropathic pain was observed in 61(40.7%) patients, nociceptive in 32(21.3%) and mixed type in 12(8%). Depression was found in 71(47.3%) patients, poor sleep quality in 41(27.3%) and anxiety in 35(23.3%).

Patients with pain had higher BMI, higher complication rate and higher multiple drug usage rate ($p<0.05$). The PSQI, HAD-A and HAD-D scores were higher in patients with pain than SCI patients without pain (Table-2).

The mean LANSS score of the patients with neuropathic pain was 18.2±4.4. Patients with neuropathic pain had higher BMI, higher complication rate and higher multiple drug usage rate ($p<0.05$). In addition, PSQI, HAD-A and HAD-D scores were higher in SCI patients with neuropathic pain than in patients without pain (Table-3). The presence of neuropathic pain was not associated with ASIA stage and injury level ($p>0.05$).

The mean VAS score of the patients with nociceptive pain was 5.9±2.0. In patients with nociceptive pain, PSQI, HAD-A and HAD-D scores were higher (Table-4).

Neuropathic pain severity assessed by LANSS had a negative correlation with age (Table-5) and the presence of nociceptive pain was not related to the ASIA stage and

injury level (p>0.05).

Discussion

SCI patients experience different types of pain and sensory disorders that occur with different mechanisms. Pain after SCI, as it is difficult to treat, requires the evaluation of not only the pain itself, but also physical, behavioural, psychological and environmental factors that may contribute to the pain mechanism.[17-20]

In the current study, where the frequency of pain was higher in patients with SCI, it was observed that the most frequent pain type was neuropathic, and the least frequent type was nociceptive. Pain is a common complication in patients with SCI.[21-25] In most studies, neuropathic pain was reported to be more frequent in the patients with SCI.[22-26] However, studies have reported the frequency of pain to be higher[27] or lower[28,29] than the findings of the current study. Different methods used for pain assessment as well as ethnicity and geography of the study population may account for the difference.

Various mechanisms have been proposed in the occurrence of pain in patients with SCI. This information, mostly obtained from animal studies,[30,31] indicates that structural neuroplasticity and sprouting of new dendritic fibres are effective in the recovery of SCI, as well as in the formation of pain, spasticity and autonomic dysreflexia. It has been suggested that over-excitable neurons cause neuropathic pain by triggering an exaggerated response to stimuli at the level of injury at the threshold of normal activation or below. Excessive excitability occurs as a result of N-methyl D aspartate and glutamate receptors, sodium and calcium channels, increased glial activation and / or hypofunction of endogenous inhibitory neurons. Pain below the level of injury is thought to occur due to disruption of the relationship between the rapid lateral spinothalamic tract and the slow polysynaptic pathway in the medial spinothalamic tract. It is suggested that late-onset and widespread pain is observed after the injury as a result of the polysynaptic tract dominating the spinothalamic tract. However, some of the mechanisms underlying pain have not been duly illuminated.[32]

The current study found that the pain observed in patients with SCI was associated with poor sleep quality, high anxiety and depression levels. Similar findings were observed in both neuropathic and nociceptive types of pain. Pain can cause negative consequences in many areas. In the current study, sleep and mood disorders were evaluated among these areas and the findings were similar to those reported by earlier studies.[33-36] On the other hand, more complications in patients with pain and more medical treatments as a consequence may indicate that the pain tends to be associated with other complications. Therefore, the presence of other complications and multiple drug usage can be a warning in terms of the presence of pain. However, in complete spinal cord lesions, it may be thought that pain will be less, considering that the conduction of pain will be completely blocked, although pain mechanisms in SCI patients have not been fully elucidated. In the current study, the presence of neuropathic and nociceptive pain may be held responsible for the complex mechanisms underlying the pain independent of the level and severity of SCI. A study[26] stated that the presence of pain is not related to the severity and level of injury. There are other studies reporting similar results.[37]

The current study has some limitations. First, the study was not designed to explore the relationship involving sleep quality, anxiety and depression level. Second, a significant number of patients used medical treatments, such as non-steroidal anti-inflammatory drugs (NSAIDs), gamma-aminobutyric acid (GABA) analogues, and tricyclic antidepressants. These treatments may have caused the frequency of pain and depression to be less common.

Conclusion

Neuropathic pain was associated with impaired sleep quality, anxiety and increased depression levels. Therefore, the treatment of pain should be included as a treatment goal, and the diagnosis and treatment of pain should be done earlier in patients with multiple complications.

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