

An Evaluation of the Quality of Sleep Before and After Surgical Treatment of Patients with Cervical Disc Herniation

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Objective : It has been reported in recent studies that 50–80% of patients with cervical disc hernia have concomitant sleep disorders. The aim of this study was to evaluate the quality of sleep before and after surgical treatment in patients with cervical disc hernia and to assess the effects on treatment.

Methods : The study included 32 patients performed discectomy and fusion with an intervertebral cage through the right anterior cervical approach. Oswestry Disability Index (ODI), Visual Analog Scale (VAS) and Pittsburgh Sleep Quality Index (PSQI) were applied to all patients preoperatively and at one month postoperatively.

Results : The postoperative PSQI total points and all the PSQI subscale points, the ODI and VAS scores were significantly reduced compared to the preoperative values. A positive correlation was determined between the preoperative ODI points and the PSQI total points and sleep duration, sleep latency and daytime functional loss subscale points. A positive correlation was also found between preoperative ODI points and VAS points. A positive correlation was determined between the preoperative VAS points and the PSQI total points and sleep duration, and sleep latency subscale points. A negative correlation was determined between the postoperative ODI and the daytime functional loss subscale points.

Conclusion : The results of the study showed that in patients with cervical disc hernia, sleep quality and daytime functionality were negatively affected by severity of pain that limited daily activities. Bringing the pain under control with surgical treatment was observed to increase sleep quality. It can be concluded that when planning treatment for these patients, it should be taken into consideration that there could be a sleep disorder in addition to the complaints and symptoms such as pain, hypoesthesia and loss of strength.

Key Words : Cervical · Disc · Herniation · Sleep disorder.

INTRODUCTION

In literature, it was well documented that disorders in sleep

quality could cause to harmful effects on mental and physical well-being by producing the lower concentration and mood changes such as increased depression or anxiety risk. It also

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may provoke the higher occurrence of accidents and falls⁸). On the other hand, it has been well known that chronic pain (such as headaches, fibromyalgia, chronic fatigue syndrome, rheumatoid arthritis, ankylosing spondylitis, osteoarthritis, carpal tunnel syndrome, back pain, etc.) can precipitate the problems with impaired emotional, behavioral, and functional abilities. Furthermore, it may disturb the quality of the sleep by producing the difficulty falling asleep, difficulty staying asleep, early awakening, and interrupted sleep²). Although the nature of the sleep disturbance remains unclear in these patients, it has been thought that good daytime control of pain could lead to better sleep quality and it has been suggested to consider sleep disorders in respect of the general treatment and outcome of the disease⁷).

Eventually, it has been demonstrated that in the general population, one in three individuals may experience neck pain which has developed for various reasons such as fibromyalgia, cervical disc herniation and/or narrowed cervical canal and the annual incidence has been reported as 10% and 24%⁶). This pain occurs following the compression of the motor and sensory pathways of the nerve roots (radiculopathy) and/or of the motor and sensory long pathways in the spinal cord¹⁰). While the primary complaint of these patients is pain, recent studies have started to report that it is accompanied by sleep disorder at a rate of 50–80%. However, a few study which investigated the relationship between cervical pain and sleep disorder has been found in literature^{2,10}). The aim of this study was to evaluate the quality of sleep before and after surgical treatment in patients with cervical disc herniation and to assess the effects on treatment.

MATERIALS AND METHODS

Material

Approval for the study was granted by the Local Ethics Committee (decision no 03/05, dated January 1, 2017). The study was conducted in compliance with the Declaration of Helsinki. The study was conducted between February 2015 and December 2016 in our neurosurgery clinic and informed consent was obtained from all patients. Patients who had complaints of neck and/or arm pain which had not responded to standard analgesic treatment and/or physiotherapy and were accepted for surgical treatment of an advanced level of

cervical disc herniation which originated from one or two intervertebral spaces were included in present study.

Patients were excluded from the study if they had been diagnosed with sleep disorder previously and had a history of medication for that. Furthermore, patients were excluded if they were using antidepressant or antipsychotic drugs. Moreover, they were excluded if they had a systemic disease that could affect sleep quality such as chronic obstructive pulmonary disease, heart failure or obstructive sleep apnea syndrome or if the disc herniation was from more than two intervertebral spaces.

Method

The age and gender was recorded for each patient included in this study. A record was also made of the levels of the intervertebral disc hernia (as one or two intervertebral disc spaces) and of the localisation of the herniated disc in the spinal canal (as midline location or foramen location).

Through the right anterior cervical approach, total discectomy and fusion with an intervertebral cage was performed to one or two intervertebral disc space of all patients. Postoperatively, standard analgesic drugs were administered and the patients were discharged the following day with a rigid cervical collar if there was no complication. Oswestry Disability Index (ODI), visual analog scale (VAS) and the Pittsburgh Sleep Quality Index (PSQI) were performed to all patients preoperatively and at the 1st month postoperatively.

ODI

This index is applied to determine the disability level of patient who suffers from the pain. It consists of 10 items called “severity of pain”, “personal care”, “rising”, “walking”, “sitting”, “standing”, “social life”, “sleep”, “travelling”, and “degree of pain”. Each item is scored from 0 to 5. If the total point of the patient increases, it is considered that the disability level of the patient increases^{3,5}).

VAS

This scale is used to evaluate the severity of pain in patient, with the lowest point of 0 as no pain and the highest points of 10 as intolerable pain^{4,9}).

PSQI

This index is used to investigate the sleep quality level of the patient and to demonstrate any sleep disturbance during the

previous month. It consists of 19 items and seven subscales called “sleep time”, “sleep disturbances”, “sleep latency”, “day-time functionality loss”, “habitual sleep efficiency”, “subjective sleep quality” and “use of sleeping medication”. Each item is scored between 0–3 points. If total point increases, it is accepted that sleep quality level and sleep disturbance increases¹⁾.

Statistical analysis

Descriptive statistics were stated as median, minimum-maximum, standard deviation and frequency distribution. Conformity of continuous variables to normality and homogeneity was examined by using the Kolmogorov-Smirnov and the Levene tests. In the comparison of age between the genders, the Student’s t-test was applied. Mann Whitney U test was performed to determine the effects of the level and location of herniated disc to the ODI, VAS, and PSQI points. The Wilcoxon Signed Rank test was applied to compare the preoperative and postoperative values of all scales. The correlations between the scale points were evaluated with the Spearman’s Correlation test. A value of $p < 0.05$ was accepted as statistically significant.

RESULTS

A total of 32 patients (female=21, male=11) with a mean age of 47.56 ± 9.81 years were evaluated in this study. The mean age of fe-

male patients was 46.71 ± 10.62 years and of males, 49.18 ± 8.28 years, with no statistically significant difference determined between the genders ($t=0.669, p=0.508$). No complication secondary to the surgical treatment was seen in any patient.

The Total PSQI points and all PSQI subscale points were decreased in the postoperative period compared to the values obtained preoperatively ($Z=-4.950, p < 0.001$). The postoperative ODI ($Z=-4.939, p < 0.001$) and VAS ($Z=-4.957, p < 0.001$) scores were also significantly decreased compared to the preoperative values (Table 1, Fig. 1). When the change in preoper-

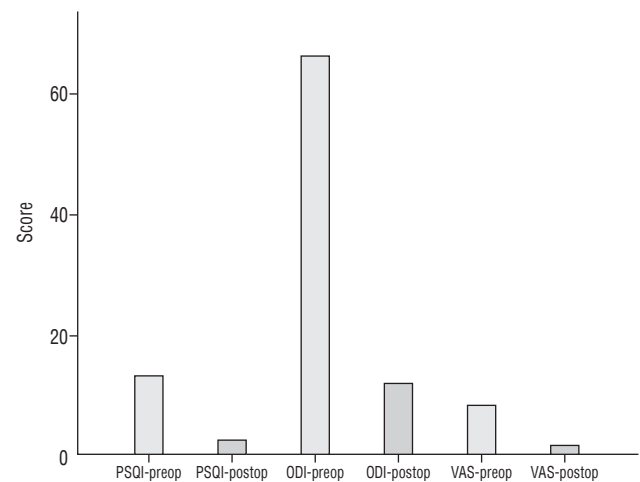


Fig. 1. The postoperative PSQI, ODI and VAS points of the patients were observed to have significantly decreased compared to the preoperative values. PSQI : Pittsburgh Sleep Quality Index, preop : preoperative period, ODI : Oswestry Disability Index, postop : postoperative period, VAS : visual analog scale.

Table 1. The postoperative PSQI and related subscale points of the patients were observed to have significantly decreased compared to the preoperative values

Variable	Preoperative				Postoperative				Z	p-value
	Min	Max	Median	SD	Min	Max	Median	SD		
PSQI	5	17	14	2.685	0	7	2	1.862	-4.950	<0.001
STIME	0	3	2	0.847	0	2	0	0.560	-4.867	<0.001
Sleep disturbances	0	3	1	0.718	0	1	0	0.483	-4.623	<0.001
SLAT	0	3	2	0.995	0	1	0	0.492	-4.687	<0.001
DAYFUN	1	3	3	0.672	0	2	1	0.523	-4.858	<0.001
SEFF	1	3	2	0.693	0	2	0	0.554	-4.864	<0.001
SQUAL	1	3	3	0.619	0	1	0	0.499	-5.027	<0.001
ODI	38	94	66	13.032	4	24	10	5.217	-4.939	<0.001
VAS	6	10	8	0.979	0	5	2	1.170	-4.957	<0.001

The ODI and VAS points were also observed to have significantly decreased postoperatively. Wilcoxon Signed Ranks test, $p < 0.05$. Min : minimum, Max : maximum, SD : standard deviation, PSQI : Pittsburgh Sleep Quality Index, STIME : sleep time, SLAT : sleep latency, DAYFUN : daytime functionality loss, SEFF : habitual sleep efficiency, SQUAL : subjective sleep quality, ODI : Oswestry Disability Index, VAS : visual analog scale

ative and postoperative PSQI, ODI, and VAS scores were examined according to gender, the postoperative PSQI, ODI, and VAS scores were determined to have significantly de-

creased compared to the preoperative values in both gender ($p < 0.05$) (Table 2).

The preoperative daytime functionality loss score in pa-

Table 2. The postoperative PSQI and related subscale points of both male and female patients were observed to have significantly decreased compared to the preoperative values

Variable	Gender	Preoperative				Postoperative				Z	p-value
		Min	Max	Median	SD	Min	Max	Median	SD		
PSQI	Female	5	17	14	2.839	0	7	3	1.982	-4.030	<0.001
	Male	9	16	14	2.412	1	6	2	1.601	-2.940	0.003
STIME	Female	0	3	2	0.910	0	1	0	0.507	-3.999	<0.001
	Male	1	3	2	0.751	0	2	0	0.674	-2.836	0.005
Sleep disturbances	Female	1	3	1	0.740	0	1	0	0.507	-3.745	<0.001
	Male	0	2	1	0.647	0	1	0	0.405	-2.762	0.006
SLAT	Female	0	3	2	0.928	0	1	0	0.512	-3.875	<0.001
	Male	0	3	2	1.136	0	1	0	0.405	-2.701	0.007
DAYFUN	Female	1	3	3	0.676	0	2	1	0.577	-3.974	<0.001
	Male	1	3	2	0.674	0	1	1	0.405	-2.859	0.004
SEFF	Female	1	3	2	0.669	0	2	0	0.590	-3.976	<0.001
	Male	1	3	2	0.751	0	1	0	0.505	-2.873	0.004
SQUAL	Female	1	3	3	0.676	0	1	0	0.512	-4.083	<0.001
	Male	2	3	3	0.405	0	1	0	0.467	-3.017	0.003
ODI	Female	44	94	68	11.500	6	20	12	4.485	-4.018	<0.001
	Male	38	84	62	15.358	4	24	8	6.589	-2.938	0.003
VAS	Female	6	10	9	1.123	0	5	2	1.179	-4.028	<0.001
	Male	7	9	8	0.603	0	4	2	1.206	-2.953	0.003

The ODI and VAS points were also observed to have significantly decreased postoperatively. Wilcoxon Signed Ranks test, $p < 0.05$. Min : minimum, Max : maximum, SD : standard deviation, PSQI : Pittsburgh Sleep Quality Index, STIME : sleep time, SLAT : sleep latency, DAYFUN : daytime functionality loss, SEFF : habitual sleep efficiency, SQUAL : subjective sleep quality, ODI : Oswestry Disability Index, VAS : visual analog scale

Table 3. Daytime functionality loss was significantly impaired in the preoperative period in patients with cervical disc hernia at two levels

Variable	Level		Side	
	Z	p-value	Z	p-value
PSQI 1	-0.266	0.790	-1.626	0.104
STIME 1	-0.504	0.614	-0.047	0.963
SD 1	-1.801	0.072	-0.532	0.595
SLAT 1	-0.080	0.936	-1.135	0.256
DAYFUN 1	-2.615	0.009	-0.824	0.410
SEFF 1	-0.785	0.432	-1.002	0.316
SQUAL 1	-0.929	0.353	-2.452	0.014
ODI 1	-0.775	0.438	-0.458	0.647
VAS 1	-0.912	0.362	-0.275	0.784

In patients with midline location of the disc hernia, the subjective sleep quality was determined to be impaired in the preoperative period. Mann Whitney U-test, $p < 0.05$. PSQI : Pittsburgh Sleep Quality Index, 1 : preoperative period, STIME : sleep time, SD : sleep disturbances, SLAT : sleep latency, DAYFUN : daytime functionality loss, SEFF : habitual sleep efficiency, SQUAL : subjective sleep quality, ODI : Oswestry Disability Index, VAS : visual analog scale

tients with cervical disc hernia at two levels was determined to be significantly impaired ($Z=2.615, p=0.009$). In addition, the preoperative subjective sleep quality score in patients with cervical disc hernia at midline location was determined to be significantly impaired ($Z=2.452, p=0.014$) (Table 3).

Evaluation of preoperative correlations

No statistically significant correlation was determined between the age of the patients and all PSQI, ODI, and VAS scores ($p>0.05$). A positive correlation was determined between the ODI points and the total PSQI points ($r=0.558, p=0.001$). Furthermore, a positive correlation was found between the ODI points and the subscale points of sleep time ($r=0.469, p=0.007$), sleep latency ($r=0.525, p=0.002$) and daytime functionality loss ($r=0.460, p=0.008$) (Table 4). Moreover, a positive correlation was determined between the ODI points and the VAS points ($r=0.430, p=0.014$).

When the relationship between the VAS points and the

PSQI points was examined, a positive correlation was determined between the preoperative VAS points of the patients and the PSQI subscale points of sleep time ($r=0.495, p=0.004$) and sleep latency ($r=0.421, p=0.016$). A positive correlation was also determined between the number of the herniated disc and daytime functionality loss score ($r=0.470, p=0.007$) and between the localisation of the herniated disc and subjective sleep quality score ($r=0.440, p=0.012$).

Evaluations of postoperative correlations

No statistically significant correlation was determined between the age of the patients and all the PSQI scores, the ODI and VAS ($p>0.05$). A negative correlation was determined between the postoperative ODI points and daytime functionality loss score ($r=0.383, p<0.030$). However, there was no significant correlation between the ODI points and the Total PSQI points and the other subscale points ($p>0.05$). Furthermore, no significant correlation was determined between ODI

Table 4. Correlation test results of the scale preoperative points of the patients

Variable		STIME 1	SD 1	SLAT 1	DAYFUN 1	SEFF 1	SQUAL 1	ODI 1	VAS 1	Level	Side
PSQI 1	r	0.639	0.428	0.843	0.328	0.365	0.520	0.558	0.416	0.048	0.292
	p-value	<0.001	0.015	<0.001	0.067	0.040	0.002	0.001	0.018	0.795	0.105
STIME1	r	1.000	0.032	0.541	0.415	-0.192	0.424	0.469	0.495	0.090	-0.008
	p-value	-	0.864	<0.001	0.018	0.293	0.015	0.007	0.004	0.622	0.964
SD1	r		1.000	0.243	-0.265	0.036	0.105	0.065	0.064	-0.324	0.096
	p-value		-	0.179	0.143	0.846	0.568	0.723	0.727	0.071	0.603
SLAT1	r			1.000	0.184	0.211	0.405	0.525	0.421	-0.014	0.204
	p-value			-	0.314	0.246	0.021	0.002	0.016	0.938	0.263
DAYFUN	r				1.000	0.123	0.074	0.460	0.295	0.470	0.148
	p-value				-	0.501	0.687	0.008	0.101	0.007	0.419
SEFF 1	r					1.000	-0.042	0.290	0.048	0.141	0.180
	p-value					-	0.817	0.107	0.795	0.441	0.324
SQUAL 1	r						1.000	0.113	0.126	0.167	0.440
	p-value						-	0.537	0.491	0.361	0.012
ODI 1	r							1.000	0.430	0.139	0.082
	p-value							-	0.014	0.447	0.654
VAS1	r								1.000	0.164	-0.049
	p-value								-	0.370	0.789
LEVEL	r									1.000	0.144
	p-value									-	0.431

Spearman's Correlation test, $p<0.05$. STIME : sleep time, 1: preoperative period, SD : sleep disturbances, SLAT : sleep latency, DAYFUN : daytime functionality loss, SEFF : habitual sleep efficiency, SQUAL : subjective sleep quality, ODI : Oswestry Disability Index, VAS : visual analog scale, PSQI : Pittsburgh Sleep Quality Index

Table 5. Correlation test results of the scale postoperative points of the patients

Variable		STIME 2	SD 2	SLAT 2	DAYFUN 2	SEFF 2	SQUAL 2	ODI 2	VAS 2
PSQI 2	r	0.692	0.0481	0.607	0.365	0.647	0.731	0.122	-0.264
	p-value	<0.001	0.005	<0.001	0.040	<0.001	<0.001	0.505	0.144
STIME 2	r	1.000	0.147	0.430	0.075	0.546	0.297	0.315	-0.094
	p-value	-	0.421	0.014	0.684	0.001	0.098	0.079	0.609
SD 2	r		1.000	0.119	0.120	0.060	0.339	0.130	-0.241
	p-value		-	0.517	0.512	0.744	0.058	0.479	0.184
SLAT 2	r			1.000	-0.067	0.274	0.411	0.346	-0.022
	p-value			-	0.714	0.129	0.020	0.052	0.906
DAYFUN 2	r				1.000	0.038	0.100	-0.383	-0.154
	p-value				-	0.836	0.587	0.030	0.400
SEFF 2	r					1.000	0.482	0.218	-0.131
	p-value					-	0.005	0.231	0.477
SQUAL 2	r						1.000	-0.017	-0.283
	p-value						-	0.925	0.116
ODI 2	r							1.000	0.050
	p-value							-	0.787

Spearman's Correlation test, $p < 0.05$. STIME : sleep time, 2 : postoperative period, SD : sleep disturbances, SLAT : sleep latency, DAYFUN : daytime functionality loss, SEFF : habitual sleep efficiency, SQUAL : subjective sleep quality, ODI : Oswestry Disability Index, VAS : visual analog scale, PSQI : Pittsburgh Sleep Quality Index

points and VAS points or between VAS points and the total PSQI points and the other subscale points ($p > 0.05$) (Table 5).

DISCUSSION

Some studies in literature showed a relationship between sleep disorders and chronic spinal pain. These studies suggested that lack of sleep or low quality level of sleep can cause neurobiological changes and decrease the pain threshold. However, the underlying mechanisms of this relationship have not been sufficiently clarified yet^{7,11}. Furthermore, it has been shown that additional clinical disorders such as insomnia, depressive state and anxiety disorder could decrease the pain threshold in many patients suffering from chronic pain. These disorders could lead to more pain being felt and it has been emphasised that by continuing in this vicious cycle, the quality of life of the patient could be reduced^{2,11}.

The results of present study revealed a relationship between pain, the disability status and sleep quality in patients with a cervical disc hernia in the preoperative and postoperative periods. A statistically significant reduction was determined in

the postoperative total PSQI points and all the PSQI subscales points compared to the preoperative values. The ODI and VAS points were also observed to have significantly decreased postoperatively. These findings suggested that the surgical treatment could decrease the pain and disability rates and improve the quality of sleep and sleep disorders. However, disc hernia at multiple levels was observed not to have any effect on the preoperative PSQI, ODI, and VAS points and only daytime functionality loss was significantly impaired in patients with disc hernia at more than one level. The location of the disc hernia in the midline or foramen in the spinal canal did not affect the preoperative PSQI, ODI, and VAS points, but the subjective sleep quality was determined to be significantly impaired in patients with midline location of the disc hernia. However, this study did not contain the control group consisted of the non-operated individuals. Furthermore, the relationship between the severity of the disc herniation and PSQI points did not analyzed in this study, because disc hernia of all patients were seriously protruded to the neural tissue that it had to be removed surgically. On the other hand, the postoperative PSQI, ODI, and VAS points of both males and females were determined to have significantly decreased compared to

the preoperative values when the changes in preoperative and postoperative PSQI, ODI, and VAS points were examined according to gender. There was no significant correlation between gender and sleep quality.

In current study, a positive correlation was determined between preoperative VAS points and the preoperative total PSQI, the sleep time, sleep latency subscale points. Furthermore, there was a positive correlation between preoperative ODI points and the preoperative total PSQI, the sleep time, sleep latency subscale points. From these results, it was thought that as the pain decreased and disability status improved, so sleep latency, sleep time and overall sleep quality increased. Although no correlation was determined between preoperative VAS points and daytime functionality loss, a positive correlation was found between ODI points and daytime functionality loss. When the postoperative results were examined, a positive correlation was determined between ODI points and daytime functionality loss subscale points. The reason for this relationship can be considered to be that ODI does evaluate the pain level as well as various daily activity levels. Indeed, it has been agreed in literature that ODI measures the pain level of an individual as well as it defines disability status and daily activities such as personal care, rising, walking, sitting, standing, social life, sleep and traveling^{3,5}. The postoperative PSQI and VAS points of the patients decreased significantly and the range was seen to be narrowed. This was thought to be the reason that a significant correlation was determined preoperatively but not postoperatively.

At the end of present study, the question arises of “Does pain lead to sleep disorder or does sleep disorder cause pain?”⁷. Although a positive correlation was determined between the pain levels of the patients (VAS scores) and sleep disorders (PSQI points) and disability levels (ODI scores) preoperatively, this relationship was seen to have been eliminated in the postoperative period. From these results it could be said that the pain level and disability level of the patients impaired the sleep quality and if the pain was eliminated, then both the disability level and the sleep disorder were improved prominently. However, with these results it could not be said that sleep disturbance could increase the severity of pain. In addition, this study did not contain any depression scale which could identify the relationship among the pain, sleep disorder and depression, although it has been known that depression could potentiate pain and sleep disturbances². So, further

studies are needed to determine whether sleep disorder triggers the pain.

CONCLUSION

In this study, it was found that severity of pain that restricted daily activities in patients with cervical disc hernia had a negative effect on sleep quality and daytime functionality and that when pain was brought under control surgically, the quality of sleep improved. As a result of this study, when planning treatment for these patients, in addition to major complaints and symptoms such as pain, hypoesthesia/paresthesia and loss of strength, patients should also be questioned about sleep disorders and these should be taken into consideration.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in this study.

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