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Original Article

Relationship between sleep disorder and subjective feelings of recovery in convalescent stroke patients

Shuhei Koeda, OTR, PhD,[1] Koshi Sumigawa, OTR, PhD,[1] Yuji Koike, OTR, MS,[1] Chihiro Sato, OTR, MS,[2] Hiroto Imai, OTR,[2] Eri Osanai, OTR,[2] Tomoki Shimizu, OTR,[3] Yuko Muto, OTR,[4] Akiyo Harigae, OTR,[5] Akihiro Mizunashi, OTR,[6] Takao Osanai, OTR, PhD[1]

[1]Hirosaki University Graduate School of Health Sciences, Hirosaki, Aomori, Japan
[2]Hirosaki Stroke Rehabilitation Center, Hirosaki, Aomori, Japan
[3]Fuefuki Central Hospital, Fuefuki, Yamanashi, Japan
[4]Aomori Rosai Hospital, Hachinohe, Aomori, Japan
[5]Hirosaki University of Health and Welfare, Hirosaki, Aomori, Japan
[6]Rehabilipark Hanamoyou, General Health Services Facility, Ishinomaki, Miyagi, Japan

ABSTRACT

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Objective: Sleep disorder occurs at a high frequency in stroke patients and can disrupt the progress of rehabilitation. Here, we investigated stroke patients' recognition of their improvement (i.e. their subjective feelings of recovery). We also explored ways of preventing and treating sleep disorder in these stroke patients by determining the relationship between subjective feelings of recovery and sleep disorder.

Methods: The study subjects were 42 patients who had been hospitalized in a kaifukuki (convalescent) rehabilitation ward for stroke. Subjects were scored on a Visual Analog Scale (VAS) for subjective feelings of recovery and on the Pittsburgh Sleep Quality Index (PSQI) as an indicator of sleep disorder.

Results: A significant negative correlation was found in the relationship between subjective feelings of recovery and PSQI score. PSQI scores in the group with Low subjective feelings of recovery (VAS < 35%) were significantly higher than those in the group with High subjective feelings of recovery (VAS ≥ 35%). Sleep disorder in the former group was severe. Subjective feelings of recovery were significantly positively correlated with the stage of recovery from motor paralysis and with Activities of Daily Living (ADL) ability. However, the PSQI score was not correlated with either of these latter two measures.

Conclusions: We speculated that a decrease in subjective feelings of recovery caused by motor paralysis and a decline in ADL abilities in patients with VAS scores lower than 35% led to impairment of the sleep state. These results suggest that evaluation of subjective feelings of recovery is an effective predictor of sleep disorder in stroke patients.

Key words: stroke, sleep disorder, subjective feelings of recovery, rehabilitation

Introduction

Sleep disorder is a complication occurring in 25−78% of stroke patients [1, 2]. As the incidence of common sleep disorder is around 20%, this incidence in stroke patients is very high [3−5]. Sleep disorder causes daytime sleepiness and non-participation in rehabilitation exercises, thus disturbing effective rehabilitation [6, 7]. Therefore, paying attention to sleep disorder in stroke patients is very important for achieving early return home and into society.

Physiological factors (time zone changes, hospitalizations), psychological factors (schizophrenia, depression), pharmacological factors (medication, alcohol intake), physical factors (respiratory disease, sleep apnea syndrome), and psychological stress (anxiety due to a disease) have been shown to be associated with sleep disorders [8, 9]. The incidence of sleep disorder is higher in stroke patients than in the general population because of hospitalization and medication, along with the depression and anxiety that

Correspondence: Shuhei Koeda, OTR, PhD
Hirosaki University Graduate School of Health Sciences,
66−1 Hon-cho, Hirosaki, Aomori 036−8564, Japan.
E-mail: ot_koeda@cc.hirosaki-u.ac.jp
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can occur after discharge in response to motor paralysis and a decrease in Activities of Daily Living (ADL) ability.

In previous research into sleep disorder in stroke patients, Leppävuori et al. [10] reported that stroke patients with insomnia had high levels of anxiety because of a decline in ADL ability and poor family relationships. Ebrahim et al. [11] reported that most patients' complaints of insomnia were caused by anxiety over their decline in walking ability in the early stages after stroke. Previous research has shown that the anxiety caused by the sequelae of stroke greatly influences sleep disorder. In the rehabilitation of stroke patients the therapist evaluates mainly walking and ADL ability. However, there are as yet no clearly defined methods for evaluating anxiety due to dysfunction and decline in ADL ability. To provide effective rehabilitation of stroke patients it is essential to reduce the risk of sleep disorder. Therefore, we need to clarify the relationship between sleep disorder and signs of psychological stress (e.g. anxiety disorder) due to stroke symptoms.

Psychological stress in stroke patients is related to their physical disability, and improving physical disability reduces anxiety [12]. Ueki et al. [13] reported that acquiring feelings of recovery from physical disability is more important than the severity of the physical disability (e.g. motor paralysis) in terms of the improvement of mental health problems such as anxiety. Therefore, we hypothesized that stroke patients' levels of psychological stress, as manifested by their degree of anxiety, might reflect their subjective feelings of recovery. In other words, we hypothesized that patients who felt that "My disease has not been cured" would have high levels of anxiety, whereas those that felt that "My disease is already cured" would have low levels of anxiety, or none.

Here, we used subjective feelings of recovery as an index of psychological stress, as manifested by anxiety, in stroke patients. We also investigated the relationship between subjective feelings of recovery and sleep disorder. In addition, we investigated the relationship between these scales and dysfunction and disability. Our overall aim was to find a way of preventing and treating sleep disorder in stroke patients.

Methods

1. Subjects

The study subjects were 42 patients who had been hospitalized in a kaifukuki (convalescent) rehabilitation ward for stroke and agreed to participate in the study. The subjects met four criteria: first attack; no communication dysfunction due to aphasia or other disorders; ability to understand questions, with no cognitive dysfunction; and no higher brain dysfunction such as unilateral spatial neglect.

Before the study started, we obtained the subjects' consent and agreement to cooperate. We explained that they could choose to withdraw from the study, that they would not be identified, and that any personal details associated with the study would be known only to members of the research group. Subjects who agreed to participate were interviewed by rehabilitation staff not involved with them and filled in questionnaires in private. A therapist not involved with the subjects helped them to use a pen or maintain their posture as necessary. The investigations were performed within 10 days after each subject had been moved to the kaifukuki rehabilitation ward.

This study was approved by The Committee of Medical Ethics of Hirosaki University Graduate School of Medicine, Hirosaki, Japan (approval number 2012-133) and the Ethical Review Board of Reimeikyo Hirosaki Stroke Rehabilitation Center.

2. Measurements

2–1. Subjective feelings of recovery

We used a Visual Analog Scale (VAS) to investigate subjective feelings of recovery. The VAS used a 100-mm line with "never cured" written at the left end and "completely cured" written at the right end, in reference to preliminary research (Fig. 1) [14]. Subjects placed a mark at the position that they felt reflected the current level of their self-assessment of their recovery status in response to the question "What is your current self-assessment of your level of recovery since your stroke?" We measured the distance from the left edge to the mark placed by the patient to evaluate the patient's self-assessment of their recovery status, and then converted the measured distance to a percentage.

2–2. Sleep disorder

To investigate sleep disorder we used the Pittsburgh Sleep Quality Index (PSQI) [15]. The PSQI contains quantitative and qualitative information about sleep and has proven to be reliable and valid. It is used to evaluate sleep disorder in stroke patients because it contains simple questions that are easy to answer [16–18]. The PSQI consists of 7 factors, namely sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and daytime dysfunction. The questionnaire consists of 18 items, and the total score of the 18 items is the

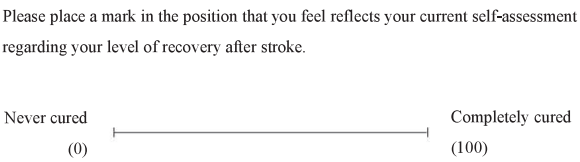

Figure 1. Scale used to assess subjective feelings of recovery.

PSQI score, which has a maximum of 21 points. A high score means that the sleep disorder is severe. The cut-off is 6 points: subjects with scores of 6 points or more are considered to have sleep disorder [15, 19].

2–3. Other

To further characterize the subjects, we obtained their age, gender, type of stroke, side of paralysis, time since stroke, and complications from their clinical records. To characterize the symptoms associated with the subjects' strokes, we measured the Brunnstrom recovery stage (Br. stage) [20] as an index of motor paralysis and the Functional Independence Measure (FIM) [21] as an index of ADL ability. These indexes are commonly used to evaluate rehabilitation in stroke patients, and they are also used to indicate the severity of movement disability and assess ADL ability in these patients [22].

3. Statistical analysis

To assess the relationship between subjective feelings of recovery and PSQI score we used Spearman's rank correlation coefficient. After determining VAS values for subjective feelings of recovery, we used Fisher's exact test to determine whether a PSQI value of 6 points or more was associated with a particular VAS value.

A PSQI cutoff value of 6 points was equivalent to 35% on the VAS (see Results), as determined by the regression of subjective feelings of recovery against PSQI. We classified the subjects into two groups according to the VAS of their subjective feelings of recovery, namely a group with Low feelings of recovery (VAS < 35%) and a group with High feelings of recovery (VAS ≥ 35%). We then compared the PSQI scores between the two groups by using an unpaired *t*-test.

When a significant difference was found in the PSQI scores between the two groups, we extracted the component items of the PSQI that were associated with this difference. Fisher's exact test was used for this examination.

Furthermore, we examined the relationships between VAS of subjective feelings of recovery or PSQI score and Br. stage of the upper extremity, fingers, and lower extremity and FIM score; we used Spearman's rank correlation coefficient to determine the types of dysfunction and disability that influenced subjective feelings of recovery and sleep disorder.

SPSS Statistics 19.0 for Windows (SPSS Japan, Tokyo, Japan) was used for all statistical tests. The significance level was set at $p < 0.05$ for all statistical tests.

Results

1. Relationship between subjective feelings of recovery and PSQI score

We examined the relationship between subjective feelings of recovery and PSQI score (Fig. 2). There was a significant negative correlation between the two values ($r = -0.38$, $p < 0.05$). Of the 15 subjects with VAS < 35%, 11 had PSQI scores of 6 or more. In contrast, of the 27 subjects with VAS ≥ 35%, only 8 had PSQI scores of 6 or more. Therefore, a PSQI cutoff of 6 points was equivalent to a cutoff of 35% in the VAS, and patients with VAS values < 35% had Low subjective feelings of recovery and a high rate of sleep disorder.

2. Clinical characteristics of subjects

We examined the clinical characteristics of subjects in the Low (VAS 0–34.9%) and High (VAS 35.0–100%) feelings of recovery groups (Table 1). There were 15 subjects (9 males and 6 females) with Low feelings of recovery and 27 (15 males and 12 females) with High feelings of recovery. Comparison of the two groups in terms of clinical characteristics revealed that those in the High group had significantly higher FIM scores than those in the Low group, and those in the High group also had higher ADL ability ($p < 0.05$). There was significantly more left-sided paralysis in the Low group ($p < 0.01$) and significantly more right-sided paralysis ($p < 0.01$) in the High group. Other items did not differ between the groups.

3. Comparison of PSQI scores among groups with Low and High feelings of recovery

We compared PSQI scores among the groups with Low and High feelings of recovery (Fig. 3). PSQI scores were significantly higher in the Low group than in the High group, and sleep disorder in the Low group was severe ($p < 0.01$).

4. Comparison of component items of the PSQI

We compared the component items of the PSQI

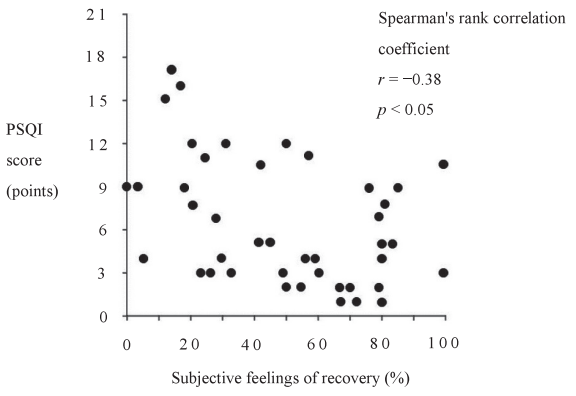

Figure 2. Scatter diagram of correlation between PSQI score and subjective feelings of recovery.

Table 1. Clinical characteristics of subjects.

	Low feelings of recovery group (n = 15)	High feelings of recovery group (n = 27)
VAS of subjective feelings of recovery (%)	19.3±9.2	68.5±17.2**
Age (years)	68.1±10.1	64.9±14.1
Male/female	9/6	15/12
Type of stroke: Infarction/hemorrhage/ lacunar/SAH/other	9/6/0/0/0	15/9/1/1/1
Paralysis side:‡ Right/left/bilateral	5/10/0	18/7/2
Time since stroke (days)	30.2±10.2	32.8±18.6
Complications (more than 1 may be present): HT/DM/HL/other	13/7/5/2	21/10/10/7
Br. stage		
Upper extremity	IV (III–V)	V (III–VI)
Fingers	IV (II–VI)	V (IV–VI)
Lower extremity	IV (III–V)	V (IV–VI)
FIM score (points)	87.0±25.6	110.0±19.9**

*p < 0.05, **p < 0.01, ‡p < 0.05.
Student's unpaired t-test was used to compare subjective feelings of recovery, age, time since stroke, and FIM score.
Mann-Whitney's U-test was used to compare Br. stage values.
Fisher's exact test was used to compare gender, type of stroke, paralysis side, and complications.
VAS, visual analog scale; SAH, subarachnoid hemorrhage; HT, hypertension; DM, diabetes mellitus; HL, hyperlipidemia; Br. stage, Brunnstrom stage; FIM, Functional Independence Measure.

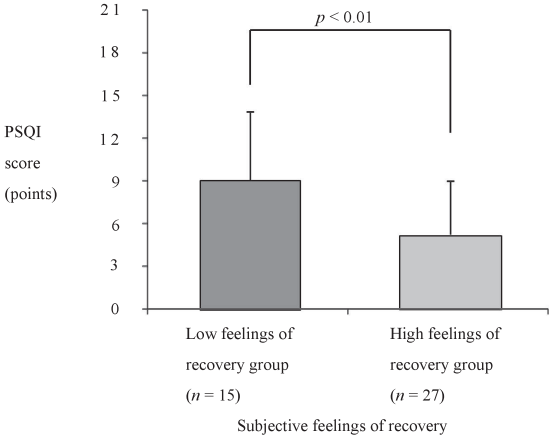

Figure 3. Comparison of PSQI scores between Low and High feelings of recovery groups.

among the two groups (Table 2). Only one item, "Use of sleeping medication" differed significantly between the two groups. Three patients (11%) in the High feelings of recovery group replied "Yes" to use of sleeping medication, whereas 10 (67%) in the Low group replied "Yes" (p < 0.05).

5. Correlations between subjective feelings of recovery or PSQI score and Br. stage or FIM score

We examined the correlations between subjective feelings of recovery or PSQI score and Br. stage or FIM score (Table 3). Subjective feelings of recovery were significantly positively correlated with Br. stage of the upper extremity (r = 0.53, p < 0.01), fingers (r = 0.47, p < 0.01), and lower extremity (r = 0.63, p < 0.01) and with FIM score (r = 0.60, p < 0.01). The PSQI score was not correlated with the Br. stage or FIM score.

Discussion

Sleep disorder is common in stroke patients and disturbs the progress of rehabilitation. Therefore, the therapist engaging in rehabilitation must take care to consider sleep disorder and reduce the risk of it occurring. Here, we used a VAS of subjective feelings of recovery as an index of psychological stress in the form of anxiety [12–14]. We also investigated the relationship between subjective feelings of recovery and sleep disorder. In addition, we investigated the relationship between these scales and dysfunction and disability. Our overall aim was to develop a method

Table 2. Comparison of component items of the PSQI.

		Low feelings of recovery group (n = 15)	High feelings of recovery group (n = 27)
Sleep quality	Good	7(47%)	19(70%)
	Bad	8(53%)	8(30%)
Sleep latency	≤ 30 min	7(47%)	19(70%)
	> 30 min	8(53%)	8(30%)
Sleep duration	≤ 7 h	7(47%)	15(56%)
	> 7 h	8(53%)	12(44%)
Habitual sleep efficiency	< 75%	8(53%)	8(30%)
	≥ 75%	7(47%)	19(70%)
Sleep disturbances	Not during the past month/ Less than once a week and once or twice a week/ 3 or more times a week	13(87%)/ 0(0%)/ 2(13%)	26(96%)/ 0(0%)/ 1(4%)
Use of sleeping medication**	No	5(33%)	24(89%)
	Yes	10(67%)	3(11%)
Daytime dysfunction:			
Having trouble staying awake	No	14(93%)	27(100%)
	Yes	1(7%)	0(0%)
Having problem keeping up enough enthusiasm to get things done	No	12(80%)	24(89%)
	Yes	3(20%)	3(11%)

**$p < 0.01$.
Fisher's exact test was used to compare values.

Table 3. Correlations of subjective feelings of recovery, PSQI score, Br. stage, and FIM score.

	Br. stage			FIM score
	Upper extremity	Fingers	Lower extremity	
Subjective feelings of recovery	0.53**	0.47**	0.63**	0.60**
PSQI score	0.12	0.07	0.05	−0.12

**$p < 0.01$.
Spearman's rank correlation coefficient was used to compare values.
Numbers in the table are correlation coefficients.

for preventing and treating sleep disorder in stroke patients.

We found a significant negative correlation between subjective feelings of recovery and PSQI score. Patients who had a high level of subjective feelings of recovery were less likely to suffer from sleep disorder. Because sleep disorder was relatively common in patients with VAS < 35% in testing for subjective feelings of recovery, we classified the subjects into two VAS groups, namely Low feelings of recovery (VAS < 35%) and High feelings of recovery (VAS ≥ 35%). The Low group had higher PSQI scores than the High group. The Low group also had a severe degree of sleep disorder.

Anxiety caused by decreased ADL ability and walking ability is associated with sleep disorder in stroke patients [10, 11]. We found here that subjective feelings of recovery were significantly positively correlated with Br. stage and FIM score, whereas the PSQI score was not correlated with either item. Thus, we speculated that, in the Low feelings of recovery group, recognition of decreased improvement of the disorder because of motor paralysis and a decline in ADL ability led to anxiety and thus impairment of the sleep state. We therefore suggest that evaluating subjective feelings of recovery is effective for predicting sleep disorder in stroke patients.

Furthermore, we investigated the PSQI component items associated with differences in PSQI score between the Low and High feelings of recovery groups. We found a significant difference only in the use of sleeping medication; there were many users of such medication in the Low group. Sleeping medication improves symptoms such as sleep quality, sleep latency, habitual sleep efficiency, sleep disturbance, and daytime dysfunction [23]. Therefore, it is possible that sleeping medication masked such symptoms in the Low group and thus affected our results. Also, sometimes sleep

medication is prescribed as an anxiolytic [24]; it might therefore have been used to deal with strong psychological stress in the Low feelings of recovery group. Although our results showed that many patients in the Low group took sleeping medication, future studies should examine the characteristics of sleep disorder in this group. This will need to be done in subjects who are not taking sleeping medication.

We found here that Low subjective feelings of recovery are associated with sleep disorder in stroke patients, and that patients with VAS < 35% for subjective feelings of recovery were at increased risk of sleep disorder. Low subjective feelings of recovery resulting from dysfunction and disability likely impair the sleep state. However, in this initial inventory survey, to ensure accuracy we excluded patients with higher brain dysfunction and cognitive dysfunction. Low subjective feelings of recovery in stroke patients are associated with anxiety related to motor paralysis and decreased ADL ability [25, 26]. Therefore, future studies should include these patients with severe brain or cognitive dysfunction. Also, this study was a cross-sectional study; we will need to conduct a longitudinal study in future.

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