

## Original Article

# Health related management plans improve sleep disorders of patients with chronic liver disease

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**Abstract:** Backgrounds: Sleep disorders (SDs) are commonly occurred in patients with chronic liver disease (CLD) and always bring with uncomfortable experience. Lavender hot-bathing, foot-soaking, or progressive relaxation have been widely used to provide comfortable feeling for CLD patients and promote their sleep quality. Aims: Thus, the aim of present study is to investigate effective intervention from above mentioned in the managements of SD and promote sleep quality for CLD patients. Methods: This study was conducted in People's Liberation Army No. 302 Hospital. A total of 317 subjects joined in our research. Initially, 197 CLD patients were enrolled and divided randomly into four groups for receiving lavender hot-bathing and foot-soaking, progressive relaxation, or the combination of both methods, and controls. After that, all of enrolled subjects were given sleep state questionnaires to assess their sleep qualities and other associated factors. Self-rating scores of sleep (SRSS) was used to assess sleep disorder. Furthermore, another cohort with 120 CLD patients were also investigated for further confirming related findings. Results: The SRSS scores were significantly higher in the patients with CLD (62.94%) than those of domestic common model and internal medicine inpatients. However, all three methods of intervention were effectively decreased SRSS scores. The four mostly influencing factors of sleep states were short sleep, difficulty falling asleep, staying asleep and early morning awakening. Besides, age was identified as one of associating with sleep states. 44.67% of patients suffered from polyuria, abdominal distention or itch of skin. And those factors contributed to major risk factors of sleep disorder. Furthermore, sleep states also influenced by environmental interference (37.06%). Conclusion: The health managements of health education could reduce risk factors and implement intervention strategies, effectively decreased occurrence of sleep disorder related symptoms.

**Keywords:** Sleep disorders, chronic liver disease, self-rating scores of sleep

## Introduction

Sleep-related complaints and disturbances are increasingly recognized in the setting of chronic liver disease (CLD). That has recently been shown to be an important prognostic factor in patients with variety of CLD. This includes the association of sleep disturbance with chronic hepatitis B, hepatitis C, autoimmune hepatitis, drug-induced liver disease, alcoholic liver disease, liver cirrhosis and primary biliary cirrhosis [1, 2]. More recently, a number of systemic symptoms have been recognized that can occur at any point in the process of CLD, and which were associated with functional impairment and reduced quality of life [3]. The most characteristic of these risk factors for CLD were endotoxin, hormone, psychological disorders, family

or social pressures, all of them have the potential result of sleep disorders [4-6]. On the other hand, sleep disorders caused poor prognosis in CLD patients and increasing their financial burdens [7]. We undertook a prospective study to investigate sleep states in CLD patients and screen effective interventions in the managements of sleep disorders. All of the intervention methods included lavender hot-bathing and foot-soaking, progressive relaxation, the combination of two methods.

## Materials and methods

### *Patient selection*

The subjects enrolled in this study were outpatients or healthy volunteers. Internal medical

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**Table 1.** Patients' demographics

Variables		Number (%)
Age (years)	< 20	9 (4.57)
	20~39	67 (34.01)
	40~59	97 (49.24)
	≥ 60	24 (12.18)
Diagnosis	Chronic Hepatitis B	84 (42.6)
	Cirrhosis	88 (44.67)
	Hepatic carcinoma	17 (8.63)
	Chronic Hepatitis C	8 (4.06)
Treatment duration (years)	< 1	70 (35.53)
	1~5	69 (35.03)
	6~10	30 (15.23)
	> 10	28 (14.21)
Education levels	Primary school or below	19 (9.64)
	Middle/high school	107 (54.32)
	Undergraduate	68 (34.52)
	Graduate	3 (1.52)
Professions	Farmer	23 (11.67)
	Worker	61 (30.96)
	Student	14 (7.11)
	Self-employed	16 (8.12)
	Employed	48 (24.37)
	Government officers	35 (17.77)

inpatients (n = 300), normal subjects (n = 13 273) and CLD patients (197) were enrolled from September, 2005 to May, 2006 in the People's Liberation Army No. 302 Hospital. In the cohorts of CLD, there were 169 males (85.8%) and 28 females (14.2%); with a mean age of  $43.87 \pm 13.31$  years, ranged from 15 to 76 years. The average histories of liver diseases were 4.97 years, ranged from 0.5 to 40 years. The basic demographics of CLD patients were listed in **Table 1**. Then, they were randomly divided into four groups for different management interventions, lavender hot-bathing and foot-soaking (lavender group, n = 29), progressive relaxation training (n = 29), combination group (combining two strategies, n = 31) and controls (n = 31). Assessments conducted at baseline (before interventions), one and two weeks after interventions. According to their responses, the patients were classified as the ones with low-risk sleep states, the ones with high-risk sleep states and the ones suffering from a sleep disorder. Subsequent health-related management plans were then performed.

In the following five months, 120 patients with chronic liver disease were further enrolled and

determined. There were 106 males (88.3%) and 14 females (11.7%). The mean age was  $43.83 \pm 12.01$  years, range from 15 to 72 years. The mean time of CLD history was 7.6 years, ranged from 0.1 to 30 years. The demographics of those patients were summarized in **Table 2**.

Internal medical inpatients were enrolled according to the criteria that patients had stable condition without following symptoms serious pain, bloating, skin itching or discomfort, serious complications or other chronic diseases. The blood ammonia (BLA) was less than 40  $\mu\text{mol/L}$  and did not suffer from long-term (> 2 years) history of insomnia, the sleep scores was  $\geq 23$  points. All enrolled subjects did not receive any other clinical interventions or treatments. There were no more than three people in the same inpatient unit. Research Committee approved this study, and all subjects written informed consent.

### *Evaluation methods*

The sleep questionnaire used in this study were included sleep condition self-rating scale (self-rating scale of sleep, SRSS), the detail information as described in reference [8]. A SRSS score  $\geq 23$  points was considered to have sleep problems. Another important part of surveying factors that affected sleep were designed in questionnaire, it mainly consist following aspects, comfort level change, outside influence, psychological factors, family and social factors, economic factors, effects of symptoms, sleep rhythm disorders and environment changes. There were total of 200 questionnaires, 197 valid questionnaires were returned with an efficiency rate of 98.5%.

### *Treatment plans*

The patients in lavender group: under the assistances of nurse, patients were treated with lavender warm sponge bath and footbath every night for two weeks. About 5 g lavender dried flowers were soaked in water for body massage at the temperature 36~39°C, or footbath at 40~45°C for 10~15 min. The patients in relax

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**Table 2.** The demographics of the 120 patients for further analysis

Variables		Number (%)
Age (years)	< 20	2 (1.7)
	20~39	39 (32.5)
	40~59	67 (55.8)
	≥ 60	12 (10)
Diagnosis	Chronic Hepatitis B	49 (40.8)
	Cirrhosis	56 (46.7)
	Hepatic carcinoma	5 (4.2)
	Chronic Hepatitis C	7 (5.8)
Treatment duration (years)	< 1	3 (2.5)
	1~5	12 (10)
	6~10	62 (51.7)
	> 10	44 (36.7)
Education levels	Primary school or below	2 (1.6)
	Middle school/high school	9 (7.5)
	Undergraduate	35 (29.2)
	Graduate	3 (2.5)
Professions	Farmer	21 (17.5)
	Worker	19 (15.8)
	Student	2 (1.7)
	Self-employed	39 (32.5)
	Employed Government officers	67 (55.8)

was  $26.38 \pm 7.80$ , significantly different in comparing with normal subjects ( $22.14 \pm 5.48$ ) or internal medical inpatients ( $24.40 \pm 4.25$ ) ( $P < 0.01$ ). There were 124 patients (62.9%) with SRSS scores  $\geq 23$  points. There was no significant difference of mean scores between male ( $26.01 \pm 7.83$ ) and female ( $28.61 \pm 7.36$ ) ( $P = 0.086$ ). We next determined the SRSS of patients with different age, mean values for teenage (< 20 years), youth (20 to 39 years), middle-aged (40 to 59 years) and elderly ( $\geq 60$  years) patients were  $22.11 \pm 7.39$ ,  $24.96 \pm 7.12$ ,  $27.87 \pm 8.07$ , and  $25.83 \pm 7.74$ , respectively.

### *Risk factors of sleep disorders during hospitalization*

group, 30 minutes before sleep, patients were treated with relaxation training according to 'progressive neuromuscular relaxation training' by trained nurses for two weeks. The combined treatments were that patients treated with both methods mentioned above for two weeks. The patients who randomly divided as controls were conducted by a nurse without teaching them relaxation or administer treatment.

### *Statistical analysis*

Results are expressed as means  $\pm$  Standard Error of Mean (SEM). Statistical analysis was performed by SPSS statistical package version 17.0 (SPSS Inc., Chicago, IL). Statistical significance in contingency tables was evaluated by  $\chi^2$  and Fisher's exact test. Unpaired Student's t test, one-way ANOVA, and Mann-Whitney rank sum test were used for comparisons of continuous variables. Correlations between of variables were analyzed by non-parametric Spearman's correlation. A  $P$  value less than 0.05 was considered with significance.

## Results

### SRSS

The SRSS scores of 197 CLD patients were shown in **Table 3**. The averaged SRSS score

The risk factors associated with sleep disorders in patients with CLD included clinical symptoms (44.67%), environmental factor (37.06%), psychology (34.01%), economic burden (18.27%), changes of comfort levels and sleep rhythm disorders (15.74%), family and social factors (15.23%). The clinical symptoms during hospitalization were polyuria (20.30%), abdominal distension (16.75%) and pruritus (14.72%). However, there were 51 patients (25.89%) experienced more than above three factors with higher SRSS scores. Thus, CLD patients with more risk factors were mostly likely to suffer from poor sleep quality.

### *The association of SRSS and factors effected patients with CLD*

To more accurately and sensitively monitor short term changes in patients' sleep patterns, the assessment cycle was extended from a week to a month in another cohort with 120 CLD patients. All 360 questionnaires for 120 patients were returned. The intra-class correlation coefficient was  $R = 0.511$ , content validity = 0.831. The assessments were conducted one or two weeks after the interventions.

The SRSS scores among 120 patients with CLD, normal subjects and internal medical inpatients were shown in **Table 5**. SRSS scores

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**Table 3.** The comparison among normal model, internal medical inpatients, and CLD patients

Variable	Normal model (n = 13273)	CLD patients (n = 197)	Internal medical inpatients (n = 300)
Sleep-deprived	2.80 ± 0.87	2.88 ± 1.09	3.01 ± 1.24
Sleep quality	2.33 ± 0.81	2.20 ± 0.83 <sup>*,##</sup>	3.03 ± 1.31
Lack of awareness	2.43 ± 1.07	3.35 ± 1.46 <sup>**,##</sup>	2.82 ± 0.97
Sleep time	2.30 ± 0.63	2.74 ± 0.96 <sup>**</sup>	2.83 ± 1.19
Difficulty in sleeping	1.98 ± 0.99	2.90 ± 1.45 <sup>**</sup>	2.83 ± 0.89
Unstable sleep	2.00 ± 1.01	3.08 ± 1.44 <sup>**</sup>	3.26 ± 1.27
Early awakening	2.00 ± 1.05	3.16 ± 1.42 <sup>**</sup>	3.34 ± 1.17
Nightmare	2.07 ± 1.11	2.67 ± 1.37 <sup>**,##</sup>	2.25 ± 1.36
Medication compliance	1.24 ± 0.64	1.32 ± 0.79 <sup>##</sup>	2.21 ± 0.99
Insomnia	2.96 ± 1.45	2.80 ± 1.38 <sup>##</sup>	3.50 ± 1.32
Total scores	22.14 ± 5.48	26.38 ± 7.80 <sup>**,##</sup>	24.40 ± 4.25

Note. <sup>\*\*</sup> $P < 0.01$ , <sup>\*</sup> $P < 0.05$  in comparing normal model and CLD patients, <sup>##</sup> $P < 0.01$ , in comparing CLD patients with internal medical inpatients.

of CLD patients were significantly different with normal subjects ( $P < 0.05$ ). There were four factors, as following sleep duration, difficulty falling sleep, sleep disturbances and awakening, mostly effected SRSS scores in patients with CLD. Of which had the potential to be used unbiasedly predictor at various stages of sleep. Furthermore, elder patients had less sleep time than that of young patients. And young patients had the lowest scores in the regarding to sleep disturbances and early waking up.

### *Sleep characteristics in patients with chronic liver disease*

The patients with CLD had higher incidence of sleep disorders (62.94%). The incident rates of severity, or moderate to severe sleep disorders (SRSS points 30 to 39 or 40 to 50) were 3 to 15 times higher than those of normal subjects (Table 4). The sleep quality of young CLD patients was superior to middle-aged patients.

### *The managements improved sleep quality in patients with CLD*

The SRSS scores of 120 patients with different interventions were shown in Table 5. Overall, SRSS scores of CLD patients were significantly different at different stages after treatment with three interventions ( $P < 0.001$ ) (Table 6). Specially, lavender significantly improved symptoms in comparing with other interventions. However, two weeks after intervention, the difference in SRSS scores between lavender group and relaxation were comparable.

The association of four risk factors with different interventions was summarized in Table 7. Three interventions had various effects on every stage. There was no difference among three stages for the control group. Though interventions, the total sleep time for CLD patients was improved week by week. Lavender had significantly enlarged sleep time and quality mostly. In a word, three methods of intervention were effectively decreased SRSS scores, and brought benefits for CLD patients.

## Discussions

The present study showed that lavender, relaxation and combined both of two methods, could significantly reduce SRSS scores in the regarding various degrees of improvements. During the treatment, lavender played the most important roles in improving sleep time and quality. Although interventions by relaxation did not bring with superior response for CLD patients, it relieved sleep disorders symptoms. Besides, the combination of two interventions failed to show better performance than any single methods.

Previously studies had indicated positive effects of lavender and relaxation on treatment with sleep disorders. Fetveit et al. proved that lavender could extend the short-term effect on sleep time, also shown in animal experiments [9]. Our findings were consistent with previous studies that relaxation improved sleep of Alzheimer patient symptoms [10, 11]. We proved that three interventions could significantly reduce SRSS scores of CLD patients.

Previously study has shown that patients with chronic liver disease have high risk of sleep disorders [12]. We categorized symptoms into three factors categories: disease and environment (factor I), psychological status and change in sleep rhythm (factor II), family and social influence (factor III). Nearly one half of patients attending a Liver Clinic complained of unsatisfactory sleep, was slightly greater than that previously reported with quality of life question-

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**Table 4.** SRSS score of 197 CLD patients

Variables	≤ 22	23~	30~	40~
Male (n = 169)	65 (32.99%) [31.3%]	51 (25.89%) [20.4%]	42 (21.32%) [5.3%]	11 (5.58%) [0.3%]
Female (n = 28)	8 (4.06%) [23.1%]	7 (3.55%) [15.2%]	12 (6.09%) [4.3%]	1 (0.51%) [0.2%]
Total (n = 197)	73 (37.06%) [54.4%]	58 (29.44%) [35.6%]	54 (27.41%) [9.6%]	12 (6.09%) [0.4%]

**Table 5.** The comparisons of SRSS scores among patients with CLD, normal subjects and internal medical inpatients

Factors	Normal patients (n = 13273)	CLD patients (n = 197)	Internal medical inpatients (n = 300)
Lack of sleep	2.80.8	2.88 ± 1.09	3.01 ± 1.24
Sleep quality	2.33 ± 0.81	2.20 ± 0.83 <sup>*,##</sup>	3.03 ± 1.31
Awakening inadequate	2.43 ± 1.07	3.35 ± 1.46 <sup>*,##</sup>	2.82 ± 0.97
Sleep time	2.30 ± 0.63	2.74 ± 0.96 <sup>**</sup>	2.83 ± 1.19
Difficulty falling asleep	1.98 ± 0.99	2.90 ± 1.45 <sup>**</sup>	2.83 ± 0.89
Sleep disturbances	2.00 ± 1.01	3.08 ± 1.44 <sup>**</sup>	3.26 ± 1.27
Wake up early	2.00 ± 1.05	3.16 ± 1.42 <sup>**</sup>	3.34 ± 1.17
Nightmares	2.07 ± 1.11	2.67 ± 1.37 <sup>*,##</sup>	2.25 ± 1.36
Medication	1.24 ± 0.64	1.32 ± 0.79 <sup>##</sup>	2.21 ± 0.99
Reactions after insomnia	2.96 ± 1.45	2.80 ± 1.38 <sup>##</sup>	3.50 ± 1.32
Total	22.14 ± 5.48	26.38 ± 7.80 <sup>*,##</sup>	24.40 ± 4.25

<sup>\*\*</sup>*P* < 0.01 or <sup>\*</sup>*P* < 0.05, as compared to normal patients. <sup>##</sup>*P* < 0.01, as compared to internal.

**Table 6.** SRSS scores for different interventions in 120 CLD patients

Group	Case number	Before	1 w <sup>*</sup>	2 w	<i>P</i>
Lavender	29	32.86 ± 4.37	20.48 ± 4.55	20.03 ± 4.08	0.0000
Relaxation	29	34.52 ± 4.41	23.00 ± 5.86	21.10 ± 4.69	0.0000
Combined	31	35.13 ± 4.65	26.29 ± 5.06	23.00 ± 3.93	0.0000
Control	31	34.94 ± 4.00	32.29 ± 5.10	32.74 ± 4.27	0.0530
<i>P</i> value		0.2565	0.0000	0.0000	

Note, <sup>\*</sup>W, week.

**Table 7.** SRSS scores for four associated factors for different interventions

Group	Total sleep time					Difficulty in falling sleep				
	Before	1 w	2 w	H/F	<i>P</i> value	Before	1 w	2 w	H/F	<i>P</i> value
Lavender	3.52	2.38	2.10 <sup>*</sup>	39.79	0.000	4.31	2.48 <sup>**</sup>	2.45	34.75	0.000
Relaxation	3.79	2.69 <sup>**</sup>	2.45	41.55	0.000	4.72	3.10 <sup>**</sup>	2.48 <sup>**</sup>	40.13	0.000
Combined	3.84	2.97 <sup>**</sup>	2.48 <sup>**</sup>	37.68	0.000	4.58	3.29 <sup>**</sup>	2.45 <sup>**</sup>	38.40	0.000
Control	3.61	3.45	3.36	0.84	0.433	4.39	4.26	4.19	0.41	0.815
H/F	4.66	12.98	21.44			1.59	26.67	31.56		
<i>P</i> value	0.198	0.000	0.000			0.661	0.000	0.000		
Lavender	4.45	2.45 <sup>*</sup>	2.45	39.79	0.000	4.21	1.93 <sup>**</sup>	1.93	36.62	
Relaxation	4.35	2.90 <sup>**</sup>	2.41 <sup>*</sup>	41.55	0.000	4.14	2.35 <sup>**</sup>	2.03	28.02	
Combined	4.65	3.39 <sup>**</sup>	3.03	37.68	0.000	4.39	2.94 <sup>**</sup>	2.39	27.51	
Control	4.39	3.68	3.81	0.84	0.117	4.52	3.74	3.81	4.96	0.084
H/F	2.26	7.08	12.03			1.24	10.88	27.99		
<i>P</i> value	0.521	0.000	0.000			0.661	0.000	0.000		

W: weeks.

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naires, however, those studies did not focused on the assessment of sleep [13]. These results were corroborated by the objective parameters provided by clinic test, such as biochemistry parameters and computer tomography, indicating that sleep complaints are not resulted from misperception. Since 2009, we've tried to implement the health-related management programs for patients with chronic liver disease. With the help of sleep questionnaire, the newly admitted patients with CLD (except those with severe complications) were enrolled to assess sleep conditions, sleep disorders (SSRS scores  $\geq 23$ ), SSRS scores ranged from 20 to 22 means classified as class I/II, SSRS scores  $\leq 19$  classified as III. The major purpose of present study was to determine efficacy of health related management plans. The interventions of the plan were health education and prevention, of which had been advocated to treatment with sleep disorder [14, 15].

Recognizing the risk factors associated with sleep disorders, particularly psychological factors, may provide valuables clues for managing sleep and provide more targeted intervention strategies for patients with chronic liver diseases [16, 17]. Through emotional support, such as psychological suggestion, consciousness shift and psychological counseling or other methods to communicate with patients, nurses could help them maintain a good motion [18, 19]. In our study, the education were regular classes on sleep health and health educations. Lecture contents included what is good sleep, how to properly evaluate sleep, maintain a good attitude, use the convenient methods (such as warm water foot bath, a silent language relaxation technique) to achieve satisfactory sleep. Nurses were encouraged to patients report daily sleep latency, total sleep time. If necessary, patients would be guided to have diary records on their sleep, such as the time they wake up every day, their sleep time and wake time including middle awakening, etc. The nurses have the responsibility to help patients correctly evaluate their sleep state. Furthermore, the supports from family and social also play important roles in bringing patients with confidences to conquer diseases.

As one of most important metabolic organ, CLD patients always disrupted with metabolic syndrome and suffer from liver dysfunction [20, 21]. To determine whether different methods could alleviate symptom of sleep disorder, we randomly screen patients who had a high risk

to be treatment with three interventions. We try to minimize risk factors though health education, in specially, type I factors which mostly effect disease. To reduce nocturnal polyuria, patients would be use diuretics to avoid long time asleep morning awake before 5:00, which had been applied in other studies [22, 23]. Moreover, proper dietary water intake and ease bloating [24]. Glycerol (glycerin, 75% alcohol, water (1:3v/v) can reduce itching [25]. Given that, sleep environment of CLD patient would be influenced by environmental factors, such as noise [26]. Therefore, it was necessary to create a peaceful environment for patient to have proper sleep comfortably. Our solutions were consistent with other studies that critically ill patients should be transfer to Intensive Care Unit (ICU). Meanwhile, reasonable treatment should be used cure to the patients. For patients with sleep disorders, appropriate nursing interventions shall be used to reducing risk factors.

In our study, lavender bath with warm sponge and footbath could improve sleep quality. Meanwhile, progressive relaxation had benefit patients with severe difficulties in falling sleep. At same time, it was necessary that nurses help the patients to control their sleep and provide psychological counseling and other relaxation guidance. In conclusion, health management plans, including health education, reducing risk factors and implementing intervention strategies, effectively reduced the symptoms.

### Disclosure of conflict of interest

None.

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