

Influence of sleep disorders on somatic symptoms, mental health, and quality of life in patients with chronic constipation

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Abstract

Background: Sleep disturbance is a common symptom in CC patients, and it is positively related to greater somatic and psychiatric symptoms.

Methods: The participants were 126 adult outpatients with CC. The measures were: constipation—Constipation Scoring System (CSS) and Patient Assessment of Constipation-Symptoms (PAC-SYM); sleep—Pittsburgh Sleep Quality Index (PSQI); anxiety—General Anxiety Disorder-7 (GAD-7); depression—Patient Health Questionnaire-9 (PHQ-9); and QOL—Patient Assessment of Constipation Quality of Life (PAC-QOL) and SF-36. Patients were divided into sleep-disorder and normal-sleep groups by their PSQI scores.

Results: The sleep-disorder group had significantly higher rates of incomplete defecation and blockage and higher CSS scores, PAC-SYM total scores, and PAC-SYM rectal-item scores than the normal-sleep group. GAD-7 and PHQ-9 scores were significantly higher in patients with poor sleep. Furthermore, sleep disorders, depression, and anxiety were all positively correlated with constipation severity. “Worry/anxiety” score of PAC-QOL scale was significantly higher and scores for seven SF-36 subscales were significantly lower in patients with poor sleep. In addition, correlation analyses showed significant negative relations between QOL and constipation, sleep disturbance, anxiety as well as depression. However, multiple regression revealed that PAC-QOL was positively associated with severe constipation and SF-36 was negatively associated with anxiety and depression. But sleep disturbance was not the independent risk factor for QOL of CC patients.

Conclusion: Sleep disorders may worsen the physical- and mental health of CC patients. Sleep disturbance may lower CC patients’ QOL indirectly through the combined effects of anxiety, depression, and constipation.

Abbreviations: CC = chronic constipation, C-IBS = constipation-predominant irritable bowel syndrome, CSS = Constipation Scoring System, FD = functional dyspepsia, FGID = functional gastrointestinal diseases, GAD-7 = General Anxiety Disorder-7, IBS = irritable bowel syndrome, PAC-QOL = Patient Assessment of Constipation Quality of Life, PAC-SYM = Patient Assessment of Constipation-Symptoms, PHQ-9 = Patient Health Questionnaire-9, PSQI = Pittsburgh Sleep Quality Index, QOL = quality of life.

Keywords: anxiety, chronic constipation, depression, quality of life, sleep disorders

1. Introduction

Chronic constipation (CC), which is one of the most common functional gastrointestinal disorders, is characterized by decreased bowel movements and/or difficult defecation. A meta-analysis of worldwide research showed that the total prevalence

rate of constipation ranged from 0.7% to 79%.^[1] An epidemiological survey of CC in 5 Chinese mainland regions reported the morbidity rate of functional constipation was 6% and that the rate of constipation-predominant irritable bowel syndrome (C-IBS) was 1%.^[2] Patients with CC usually have a poor quality of life (QOL) and a heavy social burden.^[3]

Our clinical work has found that CC patients with sleep disorders often complain of more somatic symptoms and emotional disorders than patients with normal sleep. Several studies, to date, have indicated that sleep disorders may increase the risk of gastrointestinal diseases.^[4] Patients with CC tend to have comorbid depression and/or anxiety, compared with healthy populations, and their QOL is severely impaired.^[5] Moreover, chronic sleep disorders are some of the most common risk factors for developing emotional disorders, such as depression and anxiety.^[6]

Sleep plays a very important role in maintaining an individual’s state of health. It has been reported that sleep quality affects the way people view the world and that poor sleep makes people pessimistic. This, in turn, can make them more likely to experience social isolation and lower self-efficacy for self-care, which are predictors of poor health.^[6,7] The aims of our study were to investigate: whether sleep disorders worsen the somatic symptoms and mental health of patients with CC; and the degree to which sleep disorders influence the constipation/health-related QOL of patients with CC and which the independent risk factors for QOL

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are. This study analyzed the sleep quality of CC patients and the relationships among sleep disorders, somatic symptoms, anxiety/depression, and QOL, so that new approaches can be developed to improve CC patients' clinical symptoms and overall QOL.

2. Materials and methods

2.1. Participants

We recruited outpatients who visited the Department of Gastroenterology at the First Affiliated Hospital of Nanjing Medical University between January 2014 and June 2015. CC includes primary and secondary causes and our aim is to investigate the effects of sleep disorders on primary CC, so adult patients who met the Rome III criteria for constipation^[8,9] were included, unless explicitly excluded. Patients who met the following criteria were excluded: patients with structural diseases that were diagnosed by colonoscopy and/or barium enema; patients who had abdominal surgery; patients older than 45 years of age who had severe hematochezia, anemia, emaciation, or an abdominal mass, or a medical history of colorectal polyps or tumors; patients with cardiovascular, endocrine, or neuromuscular disease; and patients who were taking drugs that could affect defecation or sleep quality, such as antidepressants, spasmolytics, or opioids.

Our study was approved by the Ethics Committee of the First Affiliated Hospital of Nanjing Medical University (2016-SRFA-064), and informed consent was obtained from all of the participants.

3. Methods

3.1. Questionnaires

The questionnaires used in our study included instruments collecting information about demographic characteristics and constipation symptoms, the Pittsburgh Sleep Quality Index (PSQI), the Constipation Scoring System (CSS) scale, the Patient Assessment of Constipation-Symptoms (PAC-SYM) scale, the Patient Assessment of Constipation Quality of Life (PAC-QOL) scale, the General Anxiety Disorder-7 (GAD-7) scale, the Patient Health Questionnaire-9 (PHQ-9) for depression, and the SF-36. All the scales were directly translated from English versions to Chinese ones and their efficiency were all validated.

3.2. Constipation symptoms

Patients with CC were asked about common symptoms of constipation, including abdominal pain, abdominal distension, difficult defecation, incomplete defecation, hard stool, blockage, decreased bowel movements, decreased quantity of stool, and prolonged defecation. If a symptom occurred more than 25% of the time, it was recognized as a symptom of constipation.^[8] We used the CSS scale to evaluate the severity of constipation. Higher CSS scores indicated more severe constipation.^[10] The PAS-SYM^[11] was used to measure patients' subjective feelings about constipation related to "abdominal symptoms," "rectal symptoms," and "defecation symptoms." Higher scores indicated more severe constipation.

3.3. PSQI

The PSQI was used to evaluate the sleep quality of patients with CC.^[12] This scale consists of 18 self-report items that are divided

into 7 dimensions, including subjective sleep quality, time to fall asleep, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The score on each dimension ranges from 0 to 3, with higher total scores indicating lower sleep quality.

3.4. GAD-7 and PHQ-9

Anxiety and depression were measured with the GAD-7 and PHQ-9, respectively.^[13] The GAD-7 and PHQ-9 are commonly used self-report tools to evaluate the severity of anxiety and depression. Their liability and validity have been well established.^[14,15] Patients whose scores are greater than 4 on the GAD-7 or the PHQ-9 are recognized as suffering from anxiety or depression, respectively.

3.5. PAC-QOL

The PAC-QOL specifically assesses the QOL of patients diagnosed with constipation.^[16] It contains 28 items that are divided into 4 subscales, including physical discomfort, psychosocial discomfort, worry/anxiety, and satisfaction. A higher total score indicates poorer QOL related to constipation.

3.6. SF-36

The SF-36 measures 8 dimensions of health: physical functioning, role limitations due to physical health, pain, general health, vitality, social functioning, role limitations due to emotional problems, and emotional well-being.^[17] Higher scores indicate better health-related QOL.

3.7. Sleep groups

The patients were divided into 2 groups according to their PSQI total scores. Patients with a score equal to or greater than 5 were classified as having a sleep disorder^[12]; patients with a score less than 5 were classified as having normal sleep.

3.8. Statistical analyses

All data were analyzed using SPSS Version 20.0 (IBM, Armonk, NY). Statistical significance was set at *P*-value less than 0.05 and *P*-value less than 0.01 was regarded as significant difference. Categorical data and ratios were analyzed using the χ^2 test. Between-group differences on continuous variables were analyzed using the *t* test or the rank-sum test, depending on whether the data were normally distributed. Continuous variables were reported as their mean \pm SD if they were normally distributed, or they were reported as their M[Q]. Spearman correlations were used to assess the relationship between QOL and CSS, PSQI, GAD-7, and PHQ-9 scores. Finally, multiple linear regression was used to analyze the influence of sleep, constipation, anxiety, and depression on the QOL variables.

4. Results

4.1. Demographic data

One hundred twenty-six adult outpatients with CC were approached to participate in our study (some patients were lost to follow-up). Among them, 59 patients with CC had sleep disorders and 67 had normal sleep. The ratio of patients with a sleep disorder was 46.83% (59/126). Patients in the sleep-

Table 1
Incidence rate of common constipation symptoms in CC patients.

Symptoms	Sleep disorder (n=59)	Normal sleep (n=67)	χ^2	P
Abdominal pain	11 (18.64%)	15 (22.38%)	0.269	0.604
Abdominal distension	39 (66.10%)	38 (56.72%)	1.163	0.281
Difficult defecation	53 (89.83%)	59 (88.06%)	0.100	0.752
Incomplete defecation	50 (84.75%)	41 (61.19%)	8.674	0.003
Hard stool	36 (61.02%)	52 (77.61%)	4.102	0.043
Decreased number of passage	35 (59.32%)	42 (62.69%)	0.149	0.699
Decreased quantity of stool	48 (81.36%)	49 (73.13%)	1.197	0.274
Prolonged defecation	42 (71.19%)	43 (64.18%)	0.702	0.402
Blockage	43 (72.88%)	37 (55.22%)	4.220	0.040

Data are expressed as number (percentage).
CC=chronic constipation.

Table 2
Severity of constipation and self-rated somatic symptoms of CC patients by sleep.

	Sleep disorder (n=59)	Normal sleep (n=67)	Z/t	P
CSS	19.00 (8.00)	16.00 (8.00)	Z=-2.155	0.031
PAC-SYM				
Abdominal symptoms	1.00 (1.25)	0.75 (1.00)	Z=-1.019	0.308
Rectal symptoms	0.67 (1.33)	0.00 (0.67)	Z=-2.853	0.004
Defecation symptoms	2.80 (0.80)	2.60 (1.40)	Z=-0.971	0.331
Total score	1.68±0.54	1.48±0.55	t=2.025	0.045

Data are expressed as M[Q] or mean±SD.
CC=chronic constipation, CSS=Constipation Scoring System, PAC-SYM=Patient Assessment of Constipation-Symptoms.

disorder group were 52.08±17.15 years-old while patients in the normal sleep group were 50.39±16.51 years-old. The male to female ratio was 1:2.47 in the sleep-disorder group and 1:1.39 in the normal-sleep group. The city to country ratio was 3.92:1 in patients with sleep disturbances and 1.91:1 in patients with good sleep. There was no statistically significance in the demographic characteristics of the 2 groups (all *P*s > 0.05).

4.2. Symptoms of constipation in the sleep disorder and normal sleep groups

4.2.1. Incidence of CC symptoms by sleep group. Patients with sleep disorders were more likely to suffer from incomplete defecation, compared to the patients with normal sleep ($\chi^2=8.674$, *P*=0.003), and the incidence of anal blockage was also higher in the patients with sleep disorders ($\chi^2=4.220$, *P*=0.040)

(Table 1). Significant differences between the 2 groups were not observed for abdominal pain, abdominal distension, difficult defecation, bowel movements, quantity of stool, or prolonged defecation (all *P*s > 0.05).

4.2.2. Severity of constipation by sleep group. The sleep-disorder and normal-sleep groups differed significantly in their CSS scores (*P*=0.031), with the mean CSS score being higher for the sleep-disorder group (Table 2). The PAC-SYM total scores (*P*=0.045) and ratings of the rectal items (*P*=0.004) also differed significantly between the 2 groups. However, no significant difference was observed for any of the other constipation symptoms.

4.2.3. Self-rated anxiety and depression by sleep group. Scores on the GAD-7 (8.07±4.60 vs 4.63±4.40, Z=-4.420, *P*<0.001) and the PHQ-9 (8.58±4.32 vs 3.36±2.81, Z=-7.377, *P*<0.001) were all significantly higher in the sleep-disorder group than in the normal-sleep group.

4.3. Associations of sleep disorders, anxiety, and depression with CC somatic symptoms

The proportion of patients with anxiety or depression in the sleep-disorder group was 96.6%, which was significantly higher than the 47.8% of patients in the normal-sleep group who had anxiety or depression. As shown in Table 3, the PSQI, GAD-7, and PHQ-9 scores were positively correlated with CSS scores, as well as the PAC-SYM total score and the scores for each PAC-SYM subscale (all *P*s < 0.05).

4.4. QOL of patients with CC by sleep group

4.4.1. Constipation-related QOL. The CC patients with sleep disorders had significantly higher “worry/anxiety” scores

Table 3
Correlations between constipation and self-rated sleep quality, anxiety, and depression.

Constipation	PSQI		GAD-7		PHQ-9	
	r	P	r	P	r	P
CSS	0.425	<0.001	0.326	<0.001	0.293	0.001
PAC-SYM						
Abdominal symptoms	0.189	0.034	0.280	0.001	0.225	0.011
Rectal symptoms	0.301	0.001	0.181	0.042	0.276	0.002
Defecation symptoms	0.270	0.002	0.190	0.033	0.212	0.017
Total score	0.363	<0.001	0.344	<0.001	0.326	<0.001

CSS=Constipation Scoring System, GAD-7=General Anxiety Disorder-7, PAC-SYM=Patient Assessment of Constipation-Symptoms, PHQ-9=Patient Health Questionnaire-9, PSQI=Pittsburgh Sleep Quality Index.

Table 4

Constipation-related QOL of CC patients by sleep.

PAC-QOL	Sleep disorder (n=59)	Normal sleep (n=67)	Z/t	P
Physical discomfort	1.50 (1.00)	1.75 (1.25)	Z=−0.160	0.873
Psychosocial discomfort	1.00 (1.38)	0.88 (1.25)	Z=−1.336	0.182
Worry/anxiety	2.00 (1.09)	1.55 (1.45)	Z=−2.414	0.016
Satisfaction	3.20 (1.60)	3.20 (1.40)	Z=−0.851	0.395
Total score	1.86±0.57	1.68±0.66	t=1.638	0.104

Data are expressed as M[Q] or mean±SD.

CC=chronic constipation, PAC-QOL=Patient Assessment of Constipation Quality of Life, QOL=quality of life.

on the PAC-QOL compared to patients with normal sleep (Z=−2.414, P=0.016) (Table 4). However, no significant difference was found for any of the other items on the PAC-QOL (all Ps>0.05).

4.4.2. Health-related QOL. Scores on 7 dimensions of the SF-36 were significantly lower in the CC patients with poor sleep than that in the patients with normal sleep (all Ps<0.05) (Table 5), indicating poorer general QOL of CC patients in sleep-disorder group. The 7 dimensions were physical functioning, role limitations due to physical health, general health, vitality, social functioning, role limitations due to emotional problems, and emotional well-being.

4.5. Correlations between QOL and constipation, sleep disorders, anxiety, and depression

As shown in Table 6, PSQI scores were positively associated with PAC-QOL total scores and “worry/anxiety” scores (both Ps<0.05), which indicated that sleep disorders impaired constipation-related QOL, especially mental state. In addition, sleep disturbance were negatively correlated with all dimensions of SF-36 (all Ps<0.05). From Table 6, we found CSS, GAD-7, and PHQ-9 were all negatively associated with constipation- and health-related QOL in CC patients (all Ps<0.05), suggesting that constipation, anxiety, and depression were all related to impaired QOL in addition to sleep disorders.

Table 5

Health-related QOL of CC patients by sleep.

SF-36	Sleep disorder (n=59)	Normal sleep (n=67)	Z/t	P
Physical functioning	95.00 (10.00)	95.00 (10.00)	Z=−3.140	0.002
Role limitations due to physical health	25.00 (100.00)	100.00 (75.00)	Z=−2.959	0.003
Pain	94.00 (41.50)	100.00 (29.00)	Z=−1.814	0.07
General health	35.15±16.39	51.82±20.23	t=−5.038	<0.001
Vitality	60.00 (35.00)	75.00 (25.00)	Z=−3.700	<0.001
Social functioning	62.50 (37.50)	87.50 (25.00)	Z=−3.328	0.001
Role limitations due to emotional problems	66.67 (100.00)	100.00 (66.67)	Z=−2.193	0.028
Emotional well-being	56.00 (44.00)	76.00 (28.00)	Z=−3.475	0.001

Data are expressed as M[Q] or mean±SD.

CC=chronic constipation, QOL=quality of life.

Table 6

Correlations between QOL and constipation, self-rated sleep quality, anxiety, and depression.

QOL	PSQI		CSS		GAD-7		PHQ-9	
	r	P	r	P	r	P	r	P
Physical discomfort	0.131	0.144	0.321	<0.001	0.257	0.004	0.219	0.014
Psychosocial discomfort	0.148	0.098	0.237	0.008	0.272	0.002	0.309	<0.001
Worry/anxiety	0.309	<0.001	0.321	<0.001	0.553	<0.001	0.455	<0.001
Satisfaction	0.054	0.547	0.416	<0.001	0.123	0.169	0.110	0.219
PAC-QOL total score	0.267	0.002	0.432	<0.001	0.480	<0.001	0.425	<0.001
Physical functioning	−0.284	0.001	−0.227	0.011	−0.217	0.015	−0.314	<0.001
Role limitations due to physical health	−0.303	0.001	−0.162	0.070	−0.429	<0.001	−0.486	<0.001
Pain	−0.293	0.001	−0.277	0.002	−0.268	0.002	−0.234	0.008
General health	−0.474	<0.001	−0.224	0.012	0.366	<0.001	−0.437	<0.001
Vitality	−0.383	<0.001	−0.204	0.022	−0.639	<0.001	−0.646	<0.001
Social functioning	−0.333	<0.001	−0.144	0.107	−0.534	<0.001	−0.518	<0.001
Role limitations due to emotional problems	−0.230	0.010	−0.098	0.277	−0.499	<0.001	−0.429	<0.001
Emotional well-being	−0.341	<0.001	−0.100	0.267	−0.629	<0.001	−0.576	<0.001

CSS=Constipation Scoring System, GAD-7=General Anxiety Disorder-7, PHQ-9=Patient Health Questionnaire-9, PSQI=Pittsburgh Sleep Quality Index, QOL=quality of life.

Table 7
Influence of sleep, constipation, anxiety, and depression on CC patients' QOL (sleep-disorder group).

QOL	PSQI		CSS		GAD-7		PHQ-9	
	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>
Physical discomfort	-0.134	0.308	0.214	0.098	0.158	0.318	0.291	0.069
Psychosocial discomfort	-0.245	0.076	0.132	0.323	0.053	0.745	0.295	0.078
Worry/anxiety	0.000	0.999	0.017	0.894	0.269	0.093	0.227	0.156
Satisfaction	-0.018	0.891	0.420	0.002	0.168	0.288	-0.032	0.841
PAC-QOL total score	0.153	0.214	0.281	0.022	0.250	0.093	0.284	0.059
Physical functioning	-0.126	0.296	-0.234	0.049	0.032	0.827	-0.462	0.002
Role limitations due to physical health	0.016	0.905	0.019	0.886	-0.120	0.467	-0.273	0.104
Pain	-0.208	0.125	-0.149	0.259	-0.058	0.719	-0.273	0.104
General health	-0.148	0.289	0.009	0.950	-0.226	0.180	-0.056	0.738
Vitality	-0.079	0.438	0.177	0.079	-0.290	0.021	-0.480	<0.001
Social functioning	-0.086	0.458	0.185	0.103	-0.344	0.016	-0.318	0.025
Role limitations due to emotional problems	0.059	0.654	0.125	0.329	-0.256	0.108	-0.252	0.115
Emotional well-being	-0.072	0.489	0.246	0.018	-0.420	0.001	-0.335	0.009

CC=chronic constipation, CSS=Constipation Scoring System, GAD-7=General Anxiety Disorder-7, PAC-QOL=Patient Assessment of Constipation Quality of Life, PHQ-9=Patient Health Questionnaire-9, PSQI=Pittsburgh Sleep Quality Index.

4.6. Influence of sleep, constipation, anxiety, and depression on constipation- and health-related QOL

To confirm further which were the independent predictors of QOL in CC patients, multiple linear regression were performed. The influence of sleep, constipation, anxiety, and depression on QOL of CC patients in sleep-disorder group is shown in Table 7. The PAC-QOL total score (*P*=0.022) and “satisfaction” subscale score (*P*=0.002) were positively associated with CSS scores, suggesting that constipation severity was one of the independent risk factors for constipation-related QOL. In addition, scores for GAD-7 and PHQ-9 were negatively associated with some subscales of SF-36 (all *P*s < 0.05), indicating that anxiety and depression were both independent risk factors for some dimensions (“Physical functioning,” “Vitality,” “Social functioning,” and “Emotional well-being”) of health-related QOL. However, no significant association was observed between sleep and QOL (all *P*s > 0.05), showing that sleep disturbance was not the independent risk factor for QOL.

As shown in Table 8, constipation and anxiety may indicate poorer constipation-related QOL in CC patients with normal

sleep (all *P*s < 0.05), while anxiety and depression were both independent risk factors for some subscales (“Vitality,” “Social functioning,” “Role limitations due to emotional problems,” and “Emotional well-being”) of SF-36 (all *P*s < 0.05). Similarly, no significant association was found between sleep and QOL (all *P*s > 0.05).

5. Discussion

A multicenter study^[18] in China, which investigated the mental-health and sleep status of patients with CC, showed that 43.8% of the individuals had a sleep disorder within the past 3 months. Nearly a third of the patients thought constipation was associated with abnormal mood (anxiety or depression) and sleep disorders. That study also found mental and sleep problems increased patients' visits to clinics. Our clinical work revealed that almost half of the CC patients suffered from sleep disorders, and that anxiety and depression were more severe among these patients. CC patients with sleep disorders also had a poorer QOL compared with patients with normal sleep. Previous studies showed that CC patients often exhibited higher scores for

Table 8
Influence of sleep, constipation, anxiety, and depression on CC patients' QOL (normal-sleep group).

QOL	PSQI		CSS		GAD-7		PHQ-9	
	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>	β	<i>P</i>
Physical discomfort	0.288	0.082	0.193	0.255	0.032	0.809	0.109	0.403
Psychosocial discomfort	0.020	0.907	0.166	0.345	0.325	0.021	0.037	0.786
Worry/anxiety	0.010	0.938	0.265	0.047	0.511	<0.001	0.129	0.207
Satisfaction	-0.028	0.870	0.334	0.063	-0.046	0.745	0.234	0.092
PAC-QOL total score	0.083	0.540	0.312	0.029	0.364	0.002	0.140	0.199
Physical functioning	0.015	0.935	-0.139	0.474	0.035	0.820	-0.101	0.502
Role limitations due to physical health	-0.059	0.715	0.010	0.952	-0.202	0.127	-0.379	0.004
Pain	-0.247	0.163	-0.120	0.509	-0.164	0.255	0.172	0.223
General health	-0.264	0.136	0.063	0.727	-0.106	0.458	-0.192	0.174
Vitality	0.114	0.374	-0.068	0.606	-0.327	0.003	-0.524	<0.001
Social functioning	0.085	0.589	-0.109	0.506	-0.326	0.014	-0.290	0.024
Role limitations due to emotional problems	0.002	0.990	0.064	0.683	-0.389	0.002	-0.333	0.008
Emotional well-being	0.067	0.638	0.077	0.596	-0.354	0.003	-0.460	<0.001

CC=chronic constipation, CSS=Constipation Scoring System, GAD-7=General Anxiety Disorder-7, PAC-QOL=Patient Assessment of Constipation Quality of Life, PHQ-9=Patient Health Questionnaire-9, PSQI=Pittsburgh Sleep Quality Index.

obsessive-compulsiveness, psychoticism, and somatization as well as significant impairment of health-related QOL.^[19,20]

Our results showed that almost half of the CC patients were suffering sleep disorders, which was in agreement with the previous findings.^[18] The incidence rates of incomplete defecation and anal blockage were higher in CC patients with sleep disorders than those in the patients with normal sleep. Furthermore, the CSS scores and the PAC-SYM's rectal item scores of these patients were higher than those of the other patients, indicating that the CC patients with sleep problems had more severe constipation symptoms. These results suggest that sleep disorders might aggravate constipation. Previous studies^[21,22] revealed that sleep disorders were common in patients with functional gastrointestinal diseases (FGID), such as IBS and functional dyspepsia (FD). Poor sleep plays an important role in the FGID pathophysiologic process and increases the incidence of gastrointestinal symptoms. An increasing number of studies have demonstrated that having a sleep disorder is a potential risk factor for future somatic diseases.^[23] In addition, poor sleep interacts with somatic symptoms, which creates a vicious cycle that impairs the patient's health. Having a sleep disturbance is a very stressful experience that may induce bowel disorders.^[24,25] Fass et al^[26] found that sleep maintenance disorders can enhance the visceral sensitivity of FGID patients, and increased arousal at night is just the main symptom of CC patients with sleep disorders. Our findings indicate a difference in rectal hypersensitivity-related symptoms was the major difference between the patients in our 2 groups, and the above study results may partially explain our findings. However, it is still necessary to explore the specific neuroendocrine regulatory mechanisms that underlie these findings.

We found that patients with poor sleep tended to have emotional disorders, such as anxiety and depression. The GAD-7 and PHQ-9 scores of patients with sleep disorders were higher than those of the patients with normal sleep. Hence, the results suggest that poor sleep may result in emotional disorders in CC patients, including anxiety and depression, especially as a number of studies have reported that anxiety and depression are closely related to sleep disorders.^[27–29] Willis and Gregory^[28] reported that anxiety was closely associated with sleep disturbance in adolescents and anxiety could increase the incidence of sleep disorders in the future. Clinical studies have shown that about three-quarters of depressed patients report insomnia symptoms and poor sleep quality,^[30] and that persistent sleep abnormalities are associated with an increased risk of relapse and negative treatment outcomes in depression.^[31] Thus, we hypothesize that having a sleep disorder is a risk factor for developing emotional disorders in CC patients.

Furthermore, our study revealed that scores on the CSS and PAC-SYM were both positively correlated with the GAD-7 and PHQ-9, which indicated that the constipation severity of the CC patients in our study were closely related to anxiety and depression. Biomedical and social-psychological theories suggest that the occurrence and development of diseases are associated with patients' psychological status, and that physical health and mental health influence each other. Several studies have found a correlation between psychological status and constipation,^[32–34] but the reason for this association is not clear. Based on our results, we suspect that the 2 disorders may affect each other, in turn, to create a vicious cycle.

The impaired QOL of patients with CC is closely associated with the severity of constipation.^[35] We found that patients with poor sleep complained of more severe constipation symptoms.

Our results also found that “worry/anxiety” scores on the PAC-QOL were higher and that seven dimensions of the SF-36 were lower among the patients with sleep disturbances than those of the patients with normal sleep. This indicated that the constipation-related and the general health-related QOL of patients with sleep disorders were lower than those of patients with normal sleep. CC patients with sleep disturbances often feel fatigue after sleeping, and they usually suffer from daytime dysfunction, low efficiency of studying or work, and decreased satisfaction with life. In a word, we imply that sleep disorders may aggravate the effects of constipation on the QOL of CC patients.

Moreover, we used multiple linear regression to eliminate the mutual effects among sleep, constipation, anxiety, and depression in our analysis of their influence on the QOL in CC patients. The results indicated that constipation-related QOL was negatively related to the severity of constipation, while health-related QOL was mostly negatively associated with anxiety and depression. However, beyond our expectation, sleep disturbance was not the independent risk factor for neither constipation-related nor health-related QOL. The results of previous studies are in good agreement with our findings. They showed that CC can be burdensome and disruptive to daily living, leading to a reduction in patients' overall QOL.^[5,36] Also, emotional disorders can increase the risk of medical and psychiatric illness, as well as, the risk of economic burdens on patients, which can result in a low QOL.^[37–39] Patients with CC are more concerned about their social functioning and QOL than they are about their total survival time.^[40] Therefore, it is possible that sleep disorders could worsen the QOL of patients with CC indirectly through the interaction of constipation and anxiety/depression.

This study was designed to address clinical therapies for CC by exploring the influence of sleep disorders on the somatic symptoms, mental state, and QOL of patients with CC. We used various scales with high liability and validity to evaluate each variable. The results of our analyses showed that CC patients with poor sleep suffered from more severe constipation, anxiety, and depression, and that their constipation-related and health-related QOL were worse than those of patients with normal sleep. Sleep disorders may aggravate constipation as well as induce emotional disorders, such as anxiety and depression, and constipation and mental symptoms can affect each other, thereby lowering patients' QOL. Anorectal symptoms of the CC patients with sleep disturbance were more notable than those of the control patients, so we hypothesize that sleep disturbances, anxiety and depression may result in dysfunction of the anal sphincter and enhance pelvic floor muscle tone. As a result, anorectal contradictory movements or paresthesia may aggravate constipation symptoms. However, anorectal manometry is still needed to verify the results and explain the relevant mechanisms among these factors.

Although we have come up with some significant results, there are some limitations of our study that should be mentioned. First, this study is a retrospective research project. Instead of objectively examining symptoms by such procedures as anorectal manometry and polysomnography, we used self-report questionnaires to evaluate clinical manifestations and QOL. Hence, recall and self-report bias were difficult to be avoided. Second, the patients included in our study came from a single, third-class hospital, and most of them lived in Eastern China. As a result, the findings of this study may be different from the results of studies in populations from different regions and different levels of hospitals. Third, basic and clinical researches are wanted to

verify the influence of sleep disorders on CC patients' somatic symptoms, mental state, and QOL. Finally, the improvement of constipation symptoms and QOL in CC patients after relieving sleep disturbance and emotional disorders are still needed to follow up as well as be evaluated carefully.

Generally speaking, sleep disorders may worsen physical health as well as mental health, and the interaction of constipation with anxiety and/or depression can further act to lower the QOL in CC patients. Therefore, we recommend that physicians have better to treat sleep disorders to improve the constipation symptoms, mental state, and QOL of CC patients who are suffering poor sleep. Besides regular therapies for constipation, psychological medications or behavioral treatments are in need to treat CC patients with anxiety or depression. In a word, the health state and QOL of CC patients should be evaluated comprehensively before treatment then individualized therapy will be come up with to benefit patients more in the future.

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