Prognostic Importance of Sleep Quality in Patients With Heart Failure

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Background Poor sleep quality is common and is associated with poor quality of life and health status in patients with heart failure. However, few investigators have focused on the impact of impaired sleep quality on survival in heart failure.
Objective To examine whether self-reported sleep quality is associated with prognosis in patients with heart failure.
Methods The study sample consisted of 204 patients with heart failure. Sleep quality was measured with the Pittsburgh Sleep Quality Index. Poor sleepers were defined as patients with scores greater than 5 on the index. Patients were followed up for a median of 364 days to determine cardiac events (a composite of cardiac death, hospitalizations, or emergency department visits for cardiac reasons). Multivariable Cox proportional hazard regression was used to examine whether poor sleepers were at a higher risk than good sleepers for shorter cardiac event–free survival after covariates were adjusted for.
Results Of 204 patients, 129 (63%) reported poor sleep quality. Poor sleepers were 2.5 times more likely to have a shorter cardiac event–free survival (95% CI, 1.164-5.556) than were good sleepers after covariates were controlled for.
Conclusions Impaired sleep quality was prevalent in patients with heart failure and was associated with poor cardiac event–free survival. Clinicians should assess and manage sleep quality in patients with heart failure to improve outcomes. (*American Journal of Critical Care.* 2016;25:516-525)

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More than 5 million adults in the United States have heart failure and experience frequent hospitalizations,[1] poor quality of life, and multiple signs and symptoms.[1-4] Sleep disturbance is a common finding among patients with heart failure,[2-4] and up to 94% of patients with heart failure experienced sleep disturbance, from occasionally to almost constantly.[4] In a study in which patients with heart failure were followed up for 1 year after discharge from the hospital, Johansson et al[5] found that sleep disturbance was persistent in 30% of the patients who reported sleep problems at discharge and that sleep disturbance newly occurred in 14% of patients who did not report sleep problems at discharge. Several factors contributing to sleep disturbance in patients with heart failure have been identified, including nocturnal dyspnea, comorbid conditions (eg, chronic obstructive pulmonary disease), sleep-disordered breathing, and medications (eg, β-blockers).[6]

Sleep is a basic human need and has profound effects on brain development, restoration of body and brain function, cognitive function, and psychological status.[7] Poor sleep is adversely related to psychological states, physical functioning, and quality of life.[7] Sleep disturbance, such as chronic sleep deprivation and deviant sleep patterns, contributes to the development and progression of cardiovascular disease[8,9] by changing immune and inflammatory responses and increasing unhealthy behaviors (eg, overeating).[10,11] Patients with heart failure report that they experience poor physical and psychological functioning due to sleep problems.[6,12-14] Because poor sleep contributes to excessive daytime sleepiness and cognitive dysfunction, poor sleepers are unable to effectively perform self-care.[15,16] Therefore, sleep problems commonly experienced by patients with heart failure should receive attention to prevent poor outcomes.

Although the duration of sleep is important, the self-reported quality of sleep, a subjective appraisal by individuals of several aspects of sleep (eg, restfulness and depth), is also vital.[7,12] Among patients with heart failure, as many as 96% have impaired quality of sleep as indicated by self-reports.[17-21] Heart failure patients with poor quality of sleep have impaired quality of life and higher levels of depressive symptoms.[12,13,17,19,20] Aside from the marked impact of sleep quality on quality of life and emotional states in patients with heart failure, its effect on prognosis has not been well described, although the relationship between the quality of sleep and prognosis has been reported in other populations of patients.[22-24]

Disturbed sleep is common among patients with heart failure.

Therefore, the purpose of this study was to examine whether self-reported sleep quality is associated with prognosis in patients with heart failure. The specific aims were to describe components of self-reported sleep quality and to examine the relationship between self-reported sleep quality and cardiac event–free survival among patients with heart failure.

Methods

Design

We conducted a secondary analysis of data from a longitudinal, observational study to examine the relationship between self-reported sleep quality and prognosis in patients with heart failure. A total of 204 patients who had data on the variables of interest, such as self-reported sleep quality and cardiac events, were included in this analysis.

Sample

Patients with heart failure were recruited from heart failure clinics affiliated with a university-based

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medical center and community hospitals in the United States. Providers referred potential participants to researchers. Patients were eligible to enroll if they had a physician-confirmed diagnosis of heart failure with either reduced left ventricular ejection fraction or preserved left ventricular ejection fraction, were older than 21 years, were on a stable medication regimen, and read and spoke English. Patients were excluded if they had a recent myocardial infarction; heart failure associated with valvular heart disease, pregnancy, or inflammatory processes (eg, myocarditis); coexisting serious illnesses (eg, renal failure); referral for heart transplant; or obvious cognitive impairment that precluded providing informed consent.

Measurements of Variables

Sleep Quality. The Pittsburgh Sleep Quality Index (PSQI)[25] was used to assess self-reported sleep quality. The PSQI is a 19-item, self-reported measure of sleep quality during the preceding month that consists of 7 components: (1) sleep quality, (2) sleep onset latency, (3) sleep duration, (4) habitual sleep efficiency (ratio of hours spent asleep to hours spent in bed), (5) overall sleep disturbances (eg, nocturia, orthopnea, and pain), (6) use of sleeping medications, and (7) daytime dysfunction ("trouble staying awake while engaging in social activity" and "problem of keeping up enough enthusiasm to get things done"). Each subscale is weighted equally on a 0 to 3 scale. Global scores of the PSQI are obtained by summing the scores of the 7 components (ranges, 0-21); higher scores indicate worse sleep quality. A PSQI global score of greater than 5 was used to define a poor sleeper.[25]

The outcome of this study was the composite end point of "time to first cardiac event."

Depressive Symptoms. The Beck Depression Inventory-II[26] was used to assess depressive symptoms. The inventory consists of 21 items to measure intensity of depressive symptoms indicated by self-report. Each item is rated with a 4-point Likert scale (0-3), and total scores can range from 0 to 63, with higher scores indicating more severe depressive symptoms. Depressive symptoms were categorized as absent (0-12), mild (13-19), moderate (20-28), or severe (≥29).

Demographic and Clinical Variables. Information on age, sex, living arrangement, cause of heart failure, New York Heart Association (NYHA) functional class, left ventricular ejection fraction, and prescribed medications were collected via interviews with patients and review of medical records by trained research nurses. A structured interview was used by research nurses to determine NYHA functional class. Height and weight were measured by using professional grade stadiometers and calibrated scales. Body mass index was calculated as weight in kilograms divided by height in meters squared.

Cardiac Event–Free Survival. The outcome of this study was the composite end point of time to first cardiac event, which is composed of a visit to an emergency department or hospitalization for heart failure or other cardiac-related reasons and cardiac-related mortality during a median of 364 days (interquartile range, 225-389 days). Research nurses made a monthly call to patients and the patients' family members to ask about visits to the emergency department, hospitalizations, or death. This information was confirmed via medical records, the hospital administrative record database, or death certificates.

Procedures

The study was approved by the appropriate institutional review board, and all participants gave signed, written informed consent. Baseline data collection occurred at the clinical research development and operations centers at each medical center where patients were recruited. Patients completed the PSQI to assess sleep quality, answered questions on depressive symptoms, and provided sociodemographic information. Research nurses assessed height, weight, and NYHA functional class during this visit. After baseline data collection, research nurses followed up patients and patients' family members monthly by telephone to collect information on cardiac events (eg, cardiac-related hospitalizations).

Statistical Analyses

Sample characteristics of good and poor sleepers were compared by using independent *t* tests or χ^2 analysis as appropriate. Cox proportional hazards regression was used to determine the prognostic effect of self-reported sleep quality on length of cardiac event–free survival. Sleep quality was entered as a continuous variable and as a dichotomous variable (good vs poor sleepers) in Cox proportional hazards regression models. Covariates included in multivariable Cox proportional hazards regression models were age, sex, ethnic background, depressive symptoms, and NYHA class, which are associated with self-reported sleep quality and survival. Kaplan-Meier curves with log-rank tests were constructed. All statistical analyses were done by using SPSS, version 20.0, software (IBM SPSS)

Table 1
Sample characteristics

Characteristic[a]	Total (N = 204)	Good sleeper (n = 75)	Poor sleeper (n = 129)	*P*
Age, mean (SD), y	62 (11.6)	63 (12.9)	61 (10.8)	.30
Sex				.47
Male	135 (66)	52 (69)	83 (64)	
Female	69 (34)	23 (31)	46 (36)	
Living with someone	141 (69)	56 (75)	85 (66)	.19
Ethnic background				.002
White	141 (69)	42 (56)	99 (77)	
Nonwhite	63 (31)	33 (44)	30 (23)	
Level of education				.18
≤ High school	79 (39)	34 (45)	45 (35)	
Smoking status				.08
Never smoked	72 (35)	29 (39)	43 (33)	
Former smoker	81 (40)	34 (45)	47 (36)	
Current or recent (stopped smoking within 1 year) smoker	51 (25)	12 (16)	39 (30)	
Average alcohol use				.68
Never	120 (59)	41 (55)	79 (61)	
Rarely (≤ once per week)	53 (26)	20 (27)	33 (26)	
2-7 drinks per week	19 (9)	8 (11)	11 (9)	
Heavy (≥ 7 per week or ≥ 5 per occasion)	12 (6)	6 (8)	6 (5)	
Body mass index,[b] mean (SD)	30.5 (7.1)	30.4 (7.1)	30.6 (7.2)	.89
Charlson Comorbidity Index, mean (SD)	2.9 (1.7)	2.6 (1.7)	3.0 (1.7)	.07
Depressive symptoms score,[c] mean (SD)	10.1 (8.1)	5.7 (5.1)	12.7 (8.4)	< .001
New York Heart Association class				< .001
I/II	126 (62)	58 (77)	68 (53)	
III/IV	78 (38)	17 (23)	61 (47)	
Ischemic cause of heart failure (n = 202)	87 (43)	26 (35)	61 (47)	.08
Left ventricular ejection fraction, mean (SD), % (n = 196)	34.5 (13.5)	34.4 (13.8)	34.4 (13.4)	> .99
Medications				
ACEI or ARB	171 (84)	63 (84)	108 (84)	.96
β-Blocker (n = 203)	182 (90)	65 (87)	117 (91)	.28
Diuretics	154 (76)	56 (75)	98 (76)	.84
Pittsburgh Sleep Quality Index, mean (SD)	7.8 (4.3)	3.5 (1.3)	10.4 (3.3)	< .001

Abbreviations: ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker.
[a] Values in second, third, and fourth columns are number (percent) unless otherwise noted in this column.
[b] Calculated as weight in kilograms divided by height in meters squared.
[c] Score on Beck Depression Inventory-II.

Results

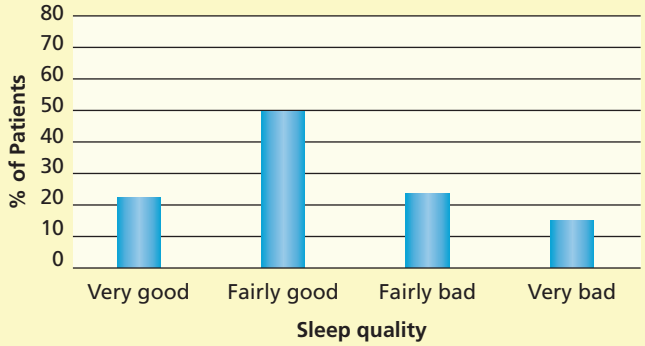
Sample Characteristics

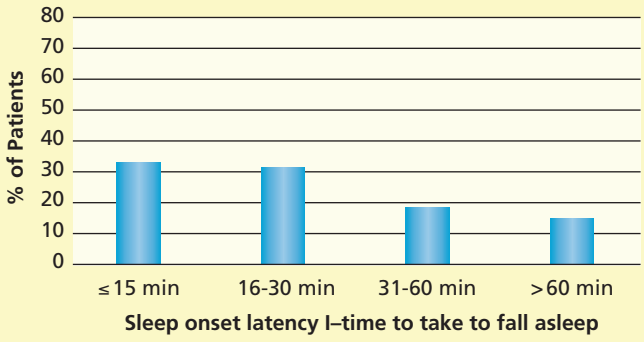
The sample of 204 patients was predominately male and white, and most lived with someone (Table 1). The mean age of the sample was 62 years (range, 35-97 years). The majority of the patients were NYHA functional class I/II and obese class I (mean body mass index, 30.5). One-fourth of the patients were currently smoking or had quit within 1 year before the study enrollment. About 6% of the patients were heavy drinkers.

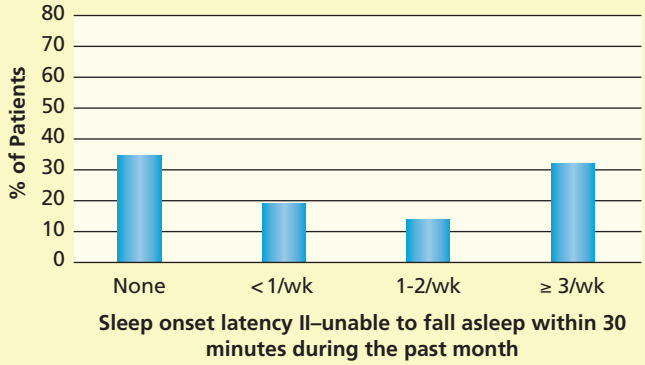
Among the 204 patients, 129 (63%) reported poor sleep quality (PSQI > 5). Compared with poor sleepers, good sleepers were more likely to be nonwhite, less depressed, and NYHA class I/II (Table 1).

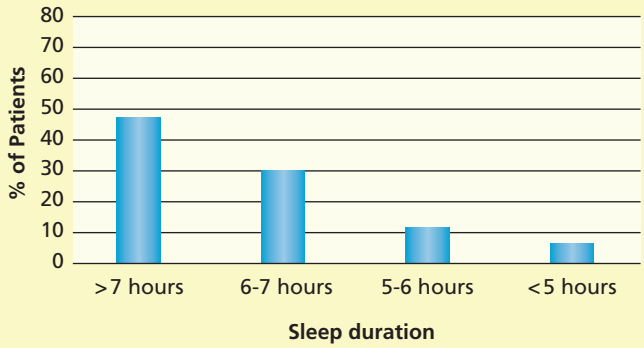
Description of Sleep Quality

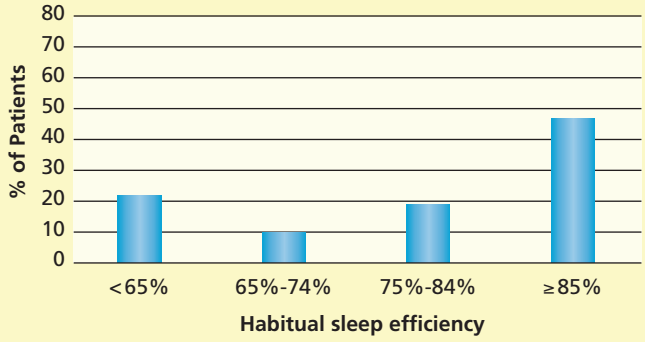
Each component of sleep quality is illustrated in Figure 1. Approximately 29% of the patients reported their overall sleep quality as fairly bad to very bad in response to the question "How would you rate your sleep quality overall during the past month?" Of 71 patients who needed more than 30 minutes to get to sleep, 53 (75%) had experienced difficulty falling asleep 3 or more times a week during the previous month. The majority of patients

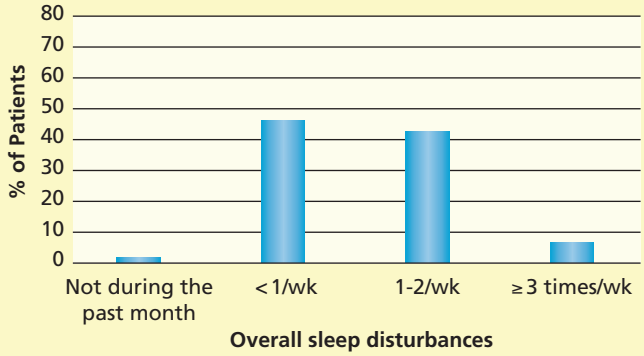


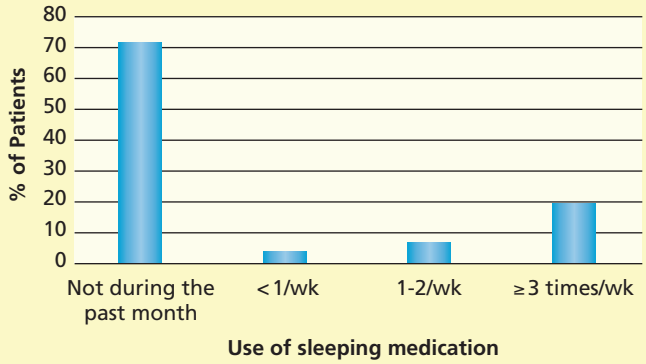


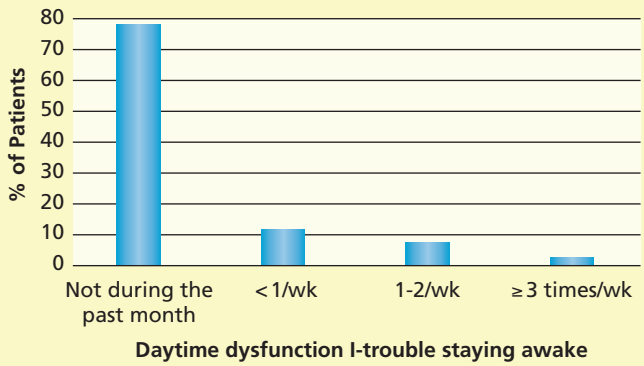












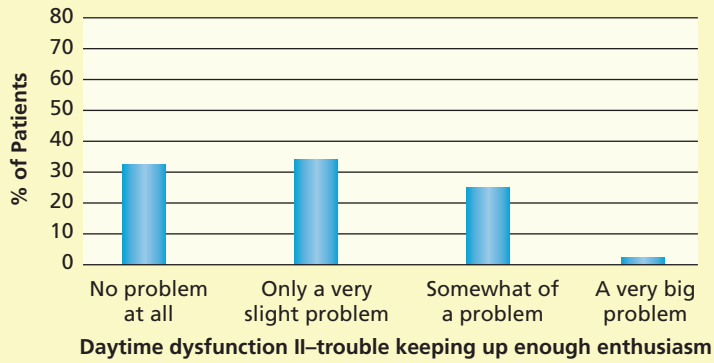


Figure 1 Components of sleep quality (N = 204).

Table 2
Comparison of components of sleep quality between good and poor sleepers (N = 204)

Component	No. (%) of patients		*P*
	Good sleeper (n = 75)	Poor sleeper (n = 129)	
Sleep quality			<.001
Very to fairly good (vs fairly to very bad)	74 (99)	72 (56)	
Sleep onset latency I: time to take to fall asleep			<.001
≤30 min (vs >30 min)	69 (92)	64 (50)	
Sleep onset latency II: unable to fall asleep within 30 min during the past month			<.001
<Once per week (vs ≥ once per week)	70 (93)	41 (32)	
Sleep duration ≥6 h (vs <6 h)	72 (96)	85 (66)	<.001
Habitual sleep efficiency ≥85% (vs <85%)	62 (83)	34 (26)	<.001
Overall sleep disturbances <once per week (vs ≥once per week)	60 (80)	30 (23)	<.001
Use of sleeping medications			<.001
Not during the past month	73 (97)	72 (56)	
Daytime dysfunction I: trouble staying awake			
Not during the past month	73 (97)	110 (85)	.007
Daytime dysfunction II: trouble keeping up enough enthusiasm			
Not problem at all (vs only a very slight to very big problem)	68 (91)	68 (53)	<.001

(53%) had habitual sleep efficiency (ie, the proportion of time for actual sleep over the total time spent in bed) of less than 85%. The most common reasons for disturbed sleep, in order, were waking for urination (91%), waking in the middle of the night or early in the morning (90%), snoring or coughing (56%), pain (53%), and breathing problems (44%). A little less than 30% of the patients had taken sleeping medications during the preceding week; of those taking sleeping medications, 70% took them at least 3 times a week. Differences in all components of sleep quality between good and poor sleepers were significant (all $P<.05$) (Table 2).

Cardiac Event–Free Survival

During the follow-up period (a median of 364 days) 2 patients died because of cardiac reasons, and 51 patients had at least 1 of the following cardiac events: cardiac-related visits to the emergency department and cardiac-related hospitalizations.

Sleep Quality as a Continuous Variable. The global scores of the PSQI were independently predictive of cardiac event–free survival after adjustments were made for age, sex, ethnic background, depressive symptoms, and NYHA functional class (hazard ratio, 1.074; 95% CI, 1.001-1.152) (Table 3, Model I). Among covariates entered, female sex (vs male) and NYHA class I/II (vs NYHA III/IV) were associated with a decrease in risk for a cardiac event.

Sleep Quality as a Categorical Variable. When patients were grouped as good and poor sleepers on the basis of PSQI scores, survival time differed significantly between good and poor sleepers (log-rank χ^2 $P=.01$; Figure 2). In the Cox regression model, after adjustments were made for covariates, poor sleepers were 2.5 times more likely to have a shorter length of cardiac event–free survival than were good sleepers (hazard ratio, 2.545; 95% CI, 1.164-5.556; Table 3, Model II). Among covariates included in the Cox regression model, age, female sex, and NYHA functional class were predictive of cardiac event–free survival. Older age was associated

Table 3
Multivariable Cox regression analysis (N=204)

Variable	Hazard ratio	*P*	95% CI
Model I		.001	
Age	1.026	.41	1.001-1.052
Female	0.363	.005	0.180-0.733
White (vs nonwhite)	0.604	.11	0.324-1.126
Depressive symptoms	1.010	.58	0.974-1.048
NYHA class III/IV (vs I/II)	2.008	.02	1.117-3.607
Global scores on the PSQI	1.074	.05	1.001-1.152
Model II		<.001	
Age	1.028	.03	1.002-1.055
Female	0.352	.004	0.175-0.711
White (vs nonwhite)	0.539	.06	0.285-1.019
Depressive symptoms	1.012	.51	0.978-1.046
NYHA class III/IV (vs I/II)	1.903	.03	1.064-3.404
Poor sleeper (vs good sleeper)[a]	2.545	.02	1.164-5.556

Abbreviations: NYHA, New York Heart Association functional class; PSQI, the Pittsburgh Sleep Quality Index.
[a] Poor sleepers had global scores >5 on the PSQI.

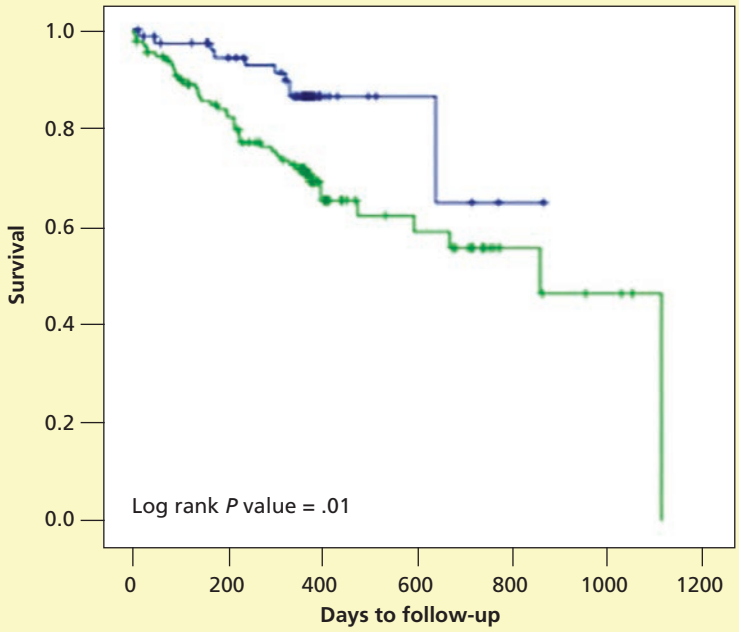


Figure 2 Survival curves between good and poor sleepers. Blue line = good sleepers (scores ≤5 on the Pittsburgh Sleep Quality Index) and green line = poor sleepers (scores > 5 on the Pittsburgh Sleep Quality Index).

with an increased risk for a cardiac event, and female sex and NYHA class I/II were associated with a decreased risk for the cardiac event.

Discussion

The major finding of this study was that self-reported quality of sleep was a significant independent predictor of survival without a cardiac event in patients with heart failure. This result calls clinicians' attention to subjectively reported sleep problems, because more than half of the patients in our study had poor quality of sleep and might be at risk for recurrent visits to the emergency department, hospitalizations, or death.

Self-reported sleep quality was a significant independent predictor of cardiac event–free survival in patients with heart failure.

After controlling for factors associated with survival in heart failure, we found that poor sleepers were 2.5 times more likely to have a cardiac event than were good sleepers. Similar findings were observed in 2 previous studies[5,20] in which self-reported sleep measures were used to examine the relationship between sleep states and prognosis in patients with heart failure. However, these 2 studies[5,20] had some methodological issues. Johansson et al[5] used 1 item of the Center for Epidemiological Studies Depression Scale to assess sleep states (ie, Was your sleep restless?). Because that item is designed to provide data on sleep disturbances in the context of depression, its validity for measuring sleep problems in general is questionable, and the result of the study[5] (significant relationship between sleep problems and mortality) should be interpreted cautiously. Although Wang et al[20] found a significant relationship between poor sleep quality and increased number of hospitalizations, the method used to collect the hospitalization data and the length of time patients were followed up is unclear. Thus, our finding that self-reported sleep quality assessed by using a valid measure and a median follow-up of 364 days adds strong evidence of the adverse effect of poor sleep quality on outcomes in heart failure.

The adverse effect of poor quality of sleep on prognosis has been reported not only for patients with heart failure but also for other populations of patients, such as nonfragile older adults and patients with chronic illness.[8,22,23,27] However, the reason sleep quality is associated with prognosis remains unclear. One potential mechanism is the impact of sleep quality on the engagement of patients with heart failure in self-care.[6,28] Sufficient sleep is important in memory consolidation, so the finding that patients with poor sleep quality experience decreased cognitive function, including decreased memory and attention, is not surprising.[17] Self-care is a complex decision-making process requiring sufficient knowledge and skill,[29] and patients who have sleep deprivation or fragmentation may not be able to obtain and process self-care knowledge learned, interpret changes in symptom status, and make a decision to seek care in a timely manner.[6,28,30] As a result of poor self-care performance, patients' heart failure status may become worse, and hospitalization may be required.[6]

The other potential reason for the relationship between sleep quality and poor prognosis is related to an increase in physiological perturbations such as chronic inflammation and a shift in sympathovagal balance. According to Motivala,[10] impaired sleep contributes to chronic inflammation involved in systemic circulation of inflammatory markers (eg, C-reactive protein and interleukin 6) and sympathetic activation, which results in activation of cytokines and inflammatory markers.[10] Empirical evidence in patients with chronic illness including heart failure supports the relationship between sleep disturbance and the physiological responses just mentioned (eg, sympathovagal imbalance).[31-33] Among patients with sleep problems due to sleep-disordered breathing, nocturnal intermittent hypoxia is associated with elevated sympathetic activity and hypertension,

endothelial dysfunction via oxidative stress, and adverse cardiac remodeling.[34,35] Thus, the physiological consequences of poor sleep may adversely affect prognosis in heart failure.

Of note, 63% of patients in our study were considered poor sleepers (PSQI scores >5), which is slightly lower than the percentages (65.3%-96.0%). in other studies of patients with heart failure.[17-20] Because sleep problems, which result in poor sleep quality, increase with age,[36] this difference may be related to the differences in the mean age of the patients in the studies: 62 years in our study and 69 to 74 years in other studies.[17-20] However, the prevalence of poor sleepers among patients with heart failure, including the patients in our study, is higher than the prevalence among healthy persons (10%)[37] and persons with other chronic illnesses (49%-65%).[23,38] The larger number of poor sleepers among patients with heart failure highlights the importance of sleep problems in patients with this illness.

In our study, 51% of the patients had experienced sleep disturbance at least once per week during the preceding month, and 53% had habitual sleep efficiency of less than 85%, indicating that those patients were awake more than 15% of the time spent in bed during the night despite an attempt to sleep. Among reasons for sleep disturbance, urination during the night, waking up in the middle of the night or early in the morning, snoring or coughing, and pain were cited by more than half of the patients in our study. Nocturia has consistently reported as the most prevalent reason for interference with sleep during the night.[17-20] Its prevalence can be as high as 86.5% in patients with heart failure.[13,39] Patients who often woke up more than twice per night for urination were more likely than other patients to have impaired sleep efficiency and to experience severe daytime sleepiness.[39] Because evening doses of diuretics or fluid intake in the late evening contributes to nocturia,[19] clinicians need to adjust timing for doses of diuretics and evaluate patients' patterns of fluid consumption to alleviate nocturia-related sleep disturbance.

Snoring is a typical indication of obstructive sleep apnea.[40] Although we did not collect information on sleep-disordered breathing (ie, obstructive and central sleep apnea), sleep-disordered breathing is a common comorbid condition in patients with heart failure.[30,40] Sleep-disordered breathing is characterized by repetitive episodes of apnea or hypopnea or both followed by a recovery phase with hyperpnea. Oxyhemoglobin desaturations, frequent arousals, and activation of the sympathetic nervous system during sleep due to sleep-disordered breathing[30] contribute to sleep disruption.[30,40]

Depressive symptoms and medications that cause daytime sleepiness are modifiable factors associated with impaired sleep.[41] Like Riegel et al,[41] we found that poor sleepers had higher levels of depressive symptoms than did good sleepers. Although we did not collect data on medications that induce daytime somnolence, we did not find a significant relationship between sleep quality and the prescription of β-blockers, which are associated with somnolence, insomnia, and nightmares.[42] Possibly poor sleep quality is responsible for the composite of polypharmacy rather than a single drug associated with sleep disturbance. Thus, clinicians should review patients' medications that may cause sleep disturbance.

Because sleep is imperative for human survival,[7] a full understanding of sleep quality and its impact is important. The significant relationship between poor sleep quality and mortality in heart failure highlights the need for adequate assessment and management of sleep disturbance among patients with heart failure.

> A self-reported sleep quality questionnaire is a quick tool to determine which patients with heart failure are at risk for a poor prognosis.

Sleep disturbance can be evaluated by using objective (eg, polysomnography and actigraphy) or subjective (eg, PSQI) methods. In sleep research, polysomnography is acknowledged as the gold standard method of measurement to objectively visualize sleep-wake patterns.[43,44] However, this method is costly and requires specialized equipment, space, and trained personnel. Actigraphy, which requires a portable small device, is another method for obtaining objective estimates of sleep-wake patterns. Although actigraphy does not provide more sophisticated information on sleep than polysomnography does, the portability of the equipment allows clinicians to assess patients' general sleep patterns in the patients' home environments instead of in an unfamiliar laboratory setting.[44]

Subjective measures of sleep disturbances, such as questionnaires and sleep diaries, can be used to assess sleep disturbance. Although self-reported measures are widely used because of their practicality, patients' reports of some sleep behaviors (eg, snoring and leg jerks) may not be reliable.[43] Unruh et al[36] found low correlations between subjective and objective sleep quality (correlations, 0.12-0.30). The limited correlation between self-reported sleep

and objectively measured sleep may occur because a person's subjective perception of sleep experiences assessed with self-reports is different from sleep-wake patterns measured with objective tools.[27,44] Thus, subjective and objective sleep measures are complementary to each other.

Although assessing sleep with both subjective and objective measures is important to comprehensively understand patients' sleep, such a dual assessment may not be feasible in a busy clinical setting. Self-reported sleep assessment tools that are short and easy to complete (eg, PSQI) would be an attractive option for clinicians to screen patients for sleep problems, and further detailed diagnostic studies could be done for patients whose self-reported sleep measures indicated sleep disturbance. Because we found a significant relationship between PSQI scores and cardiac events, PSQI may be a useful tool in screening for sleep disturbance among patients with heart failure.

Limitations

We did not objectively measure sleep states by using polysomnography or actigraphy. Our interest in this study was self-reported quality of sleep, which is a subjective concept of how individuals judge their sleep states. Martin et al[27] found that self-reported sleep was more sensitive than objectively measured sleep quality as a predictor of mortality among older adults after discharge from a rehabilitation unit. Because subjective and objective measures of sleep indicate slightly different aspects of sleep, including both objective and subjective measures is needed for future research to obtain a whole picture of the relationship between sleep disturbances and cardiac outcomes in heart failure. Our study was a secondary analysis of data from an observational study. Consequently, data on certain variables that may influence sleep quality, such as diagnosis of sleep-disordered breathing or history of treatment for other sleep disorders, were not available. Such information should be included in future research.

Conclusions

In summary, our results indicate that impaired sleep quality measured by using self-reports is commonly experienced by patients with heart failure and increases the risk for poor prognosis in heart failure. Because sleep quality is a potentially modifiable factor, clinicians should comprehensively assess sleep quality and develop interventions to enhance the quality. Also, our finding that self-assessed sleep quality was predictive of survival free of cardiac events indicates that a simple questionnaire rather than objective measures can be used to quickly gather information on sleep quality in a busy clinical setting.

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