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Published in:
The Journal of Cardiovascular Nursing

DOI:
10.1097/JCN.0000000000000476

Publication date:
2018

Document version
Publisher's PDF, also known as Version of record

Journal of Cardiovascular Nursing
Vol. 33, No. 3, pp 261–268 | Copyright © 2018 The Author(s). Published by Wolters Kluwer Health, Inc.

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Background: Low sleep quality is common in patients with atrial fibrillation (AF). Positive effects of cardiac rehabilitation on patients treated for AF with ablation have been found, but whether cardiac rehabilitation affects sleep quality is unknown. The objectives of this study were to investigate (1) differences in sleep quality between cardiac rehabilitation and usual care groups and (2) whether other factors could affect sleep quality. **Methods:** From the randomized CopenHeart$_{RFA}$ trial, 210 patients treated for AF with ablation were included. A rehabilitation program consisting of physical exercise and psychoeducational consultations was tested. Sleep quality was measured with the Pittsburg Sleep Quality Index (PSQI) questionnaire before intervention and at the end of intervention. Anxiety, depression, and European Heart Rhythm Association scores were assessed. **Results:** No difference between groups in sleep quality was found (PSQI global mean [SD] score, 6.60 [3.61] points for the cardiac rehabilitation group [n = 83] and 6.08 [3.60] points for the usual care group [n = 90]; *P* = .34), although improvements in sleep quality were noted in both groups. Sleep latency, duration, and efficiency were significant by type of AF at 1 month. Anxiety, depression, and higher European Heart Rhythm Association scores at 4 months were associated with a higher PSQI global mean score at the end of intervention. **Conclusion:** The rehabilitation program showed no effect on sleep quality. A large proportion of patients reported poor sleep quality, and patients reporting anxiety, depression, or AF symptoms described worse sleep quality compared with patients who did not experience anxiety, depression, or AF symptoms. More research in the field is warranted.

KEY WORDS: atrial fibrillation, cardiac rehabilitation, cardiovascular diseases, sleep

Sleep is a fundamental behavior that has been shown to be associated with morbidity and recovery. Disturbed sleep is reported by up to 70% of patients with heart disease.[1] Research findings have contributed to an increasing awareness of sleep and sleep disorders. Disturbance and lack of sleep are associated with a number of dysfunctions such as mood disturbance, excessive exhaustion, decreased alertness, and reaction time and have a negative effect on daytime functioning and quality of life.[2] Sleep disorders increase the risk of morbidity and mortality and can contribute to the development of conditions such as hypertension and heart failure.[3,4]

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This study was funded by the Metropolitan University College, The Heart Centre at University Hospital of Copenhagen, The Lundbeck Foundation (grant number FP 62/2011FP, 74/2012, 2014-3962); The Health Foundation (grant number 15-B-0114); and the Danish Strategic Research Council (grant number 10–092790).

The authors have no conflicts of interest to disclose.

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DOI: 10.1097/JCN.0000000000000476

Atrial fibrillation (AF) affects approximately 2% of the population in the Western world.[5–7] The prevalence of AF is growing mainly because of the increasing age of our population and because AF can be observed as a complication from other heart diseases where improved treatments have led to an increased number of patients living with heart disease.[6,8,9] Symptoms of AF include palpitations, dyspnea, fatigue, dizziness, and syncope,[10,11] and AF is observed as having a negative effect on sleep quality.[12]

A study by Szymanski and colleges[12] showed that low sleep quality is common in patients with AF and affects nearly 50%. Patients with AF have shorter sleep duration and lower self-reported sleep quality than patients in sinus rhythm.[12] Sleep quality may be especially critical to patients with AF due to shortness of breath and the disruptive experience of heart palpitations.[13]

The cardiac rehabilitation trial, CopenHeart, included exercise training and psychoeducational consultations and demonstrated a positive primary outcome, physical capacity in patients treated with catheter ablation for AF (cardiac rehabilitation group vs usual care group, 24.3 vs 21 mL/kg per min; P = .003).[14] Studies have found that lifestyle rehabilitation related to sleep has positive outcomes on heart patients. The interventions have included diet, exercise, weight reduction, and lifestyle modification.[15]

However, to our knowledge, no investigators have investigated the effect of cardiac rehabilitation on sleep quality in patients treated with ablation for AF.

Therefore, the objectives of this study were to investigate (1) differences in sleep quality between the cardiac rehabilitation and usual care groups using data from the CopenHeart trial and (2) to explore variables that possibly could affect sleep quality.

Methods

Design

This study is an explorative study and reports results on sleep quality from the CopenHeart trial.[14,16] In the CopenHeart trial, a comprehensive rehabilitation program was designed and tested for patients treated for AF with catheter ablation in 2 university hospitals in Denmark. The intervention is described in detail elsewhere.[16]

Trial Patients and Intervention

In total, 210 consecutive patients treated with radiofrequency catheter ablation for AF were included in the CopenHeart trial. Patients 18 years or older, Danish speaking, and providing oral and written informed consent were eligible for participation. The following patients were excluded: (1) those unable to understand trial instructions; (2) pregnant or breastfeeding women; (3) those with a reduced ability to follow the planned program due to other physical illness; (4) those who, before ablation, had been engaged in intense physical exercise or sports at a competitive level several times a week; or (5) those who were enrolled in a clinical trial that prohibited participation in additional trials.

Patients were centrally randomized 1:1 to comprehensive cardiac rehabilitation plus usual care (cardiac rehabilitation group vs usual care group). Outcome assessment, data management, analyses, and conclusions were performed by a blinded statistician and research staff.

The intervention consisted of usual care, which included 1 consultation at 3 to 4 months with a cardiologist at the treating hospital and, in addition, a physical exercise program and psychoeducational consultations. The physical exercise program was designed to increase physical capacity measured by VO_2 peak. The training program consisted of graduated cardiovascular training based on intensity prescription using the Borg scale[17] and strength exercises altered stepwise during training sessions. The program included 3 sessions per week for 12 weeks.

The aim of the psychoeducational consultations was to provide emotional support and improve coping skills and illness appraisal to enable the patients to respond appropriately to physical and psychological symptoms. The psychoeducational consultations were inspired by the 3 dimensions described in Parse's[18] *Human Becoming Practice Methodologies*. The patients were offered four 1-hour consultations over the first 6 months after enrollment. There were no specific interventions carried out that focused on sleep quality, but sleep could have been discussed in the psychoeducational consultations if wanted by the patient.

Ethics

The trial was approved by the local ethics committee (number H-1-2011-135) and the Danish Data Protection Agency (registration number 2007-58-0015). It was registered at ClinicalTrials.gov (NCT01523145) and complied with the Declaration of Helsinki.

Outcome Measure

The outcome measure for this study is sleep quality. The patients in the CopenHeart trial answered a questionnaire exploring their sleep quality at month 1 (before intervention) and month 6 (end of intervention). To explore the effect of other outcomes on sleep quality, anxiety, depression, and the severity of AF symptoms measured by the European Heart Rhythm Association (EHRA) scores were examined at 4 months (end of the physical exercise program).

Pittsburgh Sleep Quality Index

Sleep quality was measured by the Pittsburg Sleep Quality Index (PSQI) questionnaire.[19] Psychometric

evaluation of the PSQI is limited, but studies indicate that it has overall high internal homogeneity, internal consistency, and test-retest reliability[20] and its validity has been confirmed in various patient groups.[2,21–24] A Cronbach's α of .83 was demonstrated for internal consistency reliability, and validity was demonstrated as the PSQI distinguishes patients with a sleeping disorder from patients without one.[25]

The self-rated questionnaire consists of 14 questions concerning factors that might influence sleep quality. Five additional questions are answered by the bed partner or roommate. From the 19 questions, 7 component scores are grouped, all weighted equally on a 0-to-3 scale. The components include subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction due to sleepiness. From the 7 component scores, a global score can be calculated. The PSQI global score ranges from 0 to 21. High scores indicate poor sleep quality. Patients scoring higher than 5 on PSQI global are characterized as poor sleepers.[19] Patients were asked to fill out the questionnaire from usual sleep habits over the previous 30 days.

Hospital Anxiety and Depression Scale

Patients with symptoms of anxiety or depression were identified by the Hospital Anxiety and Depression Scale (HADS) questionnaire. The HADS consist of 14 items on 2 subscales: an anxiety scale (HADS-A) and a depression scale (HADS-D), with each scale including 7 items. Each item is rated from 0 to 3 points. Seven is considered a cutoff score for each subscale, a score from 0 to 7 is considered normal, and scores of 8 or higher indicate the presence of a clinical mood disorder.[26,27] The HADS is extensively validated and recommended for use in cardiac patients.[28] It is a generic instrument to identify patients with symptoms of anxiety and/or depression.[26] Internal consistency is considered high, with a Cronbach's α of .83 for HADS-A and .82 for HADS-D.[27]

Statistical Analysis

Differences between groups for baseline results for PSQI at 1 month were tested using independent samples *t* test for binary variables. Levene test was used to verify the assumption of equal variances. Analysis of variance was used to detect whether there were age differences between groups. The difference between the intervention and usual care groups at 6 months was tested using independent samples *t* test.

To examine the effect of intervention group, anxiety, depression, type of AF, and the severity of AF symptoms (EHRA scores) on sleep quality, a linear regression model was used including variables measured at month 4 that were believed to possibly affect sleep quality. The model was adjusted for intervention group, age, sex, smoking, living with partner, educational level, and PSQI score at 1 month. An independent *t* test was undertaken to compare means for EHRA score, HADS-A and HADS-D, type of AF, and intervention group. All analyses were undertaken using SPSS version 22 (IBM Corp, Armonk, New York), and statistical significance was attained at $P \leq .05$.

Results

At month 1, 194 (of 210 randomized patients) (92%) answered the PSQI questionnaire (98 from the cardiac rehabilitation group and 96 from the usual care group), and 173 patients (82%) answered the PSQI questionnaire at month 6 (83 from the cardiac rehabilitation group and 90 from the usual care group).

Baseline characteristics showed that the cardiac rehabilitation and usual care groups were well matched at baseline (Table 1). Mean age was 59 years, and approximately two-thirds were male (cardiac rehabilitation group, n = 74; usual care group, n = 77). Greater than 50% of the patients had more than 3 years of college education (cardiac rehabilitation group, n = 58; usual care group, n = 51). Patients in the cardiac rehabilitation group had a mean body mass index (BMI) of 27, and patients in the usual care group had a mean BMI of 28. Approximately 50% of the patients were taking β-blockers (cardiac rehabilitation group, n = 55; usual care group, n = 56).

At month 1 (Table 2), the overall PSQI global mean scores for patients with paroxysmal AF showed significantly longer sleep duration ($P = .02$) and worse sleep efficiency ($P = .05$) than patients with persistent AF. By contrast, patients with persistent AF had worse sleep latency ($P < .01$). Patients with a BMI of 24.9 or lower had better sleep latency than patients with a BMI of 25 and higher ($P = .02$), whereas patients with a BMI of 25 and higher experienced more sleep disturbances ($P = .01$).

The global mean (SD) score for PSQI at month 6 in the cardiac rehabilitation group (n = 83) was 6.60 (3.61), and in the usual care group, it was (n = 90) 6.08 (3.60; $P = .34$). At 1 month, 85% of the patients reported poor sleep quality (87% in the cardiac rehabilitation group and 82% in the usual care group). At 6 months, 55% of the patients reported poor sleep quality (58% in the cardiac rehabilitation group and 52% in the usual care group).

Regression analysis (Table 3) demonstrated that higher EHRA scores at 4 months were associated with a higher PSQI global mean score at 6 months (PSQI global mean [SD] score, 5.93 [3.05] for EHRA 1–2 vs 7.59 [4.26] for EHRA 3–4). The same was found for HADS-A and

TABLE 1 Patients' Baseline Demographics

	Intervention	Control
	n (%)	n (%)
Age, mean (SD), y	60 (9.7)	59 (12.3)
Sex (male)	74 (70.5)	77 (73.3)
Living with partner	82 (78.1)	85 (81)
Educational level		
<3 y of college education	58 (60.9)	51 (53.6)
Type of AF		
Paroxysmal	76 (72.4)	76 (72.4)
Persistent	29 (27.6)	29 (27.6)
Symptoms of AF		
Palpitations	68 (64.8)	53 (50.5)
Angina	19 (18.1)	16 (15.2)
Dyspnea	62 (59)	64 (61)
Dizziness	71 (68)	77 (73)
Fatigue	60 (57)	48 (46)
Syncope	2 (1.9)	3 (2.9)
BMI, mean (SD), kg/m^2	27 (4.4)	28 (5.6)
Smoking, mean (SD)		
Current smoking	2 (1.9)	3 (2.9)
Medications		
β-Blocker	55 (52.4)	56 (53.3)
Other antidysrhythmics	7 (6.9)	3 (2.9)
Diuretics	5 (4.8)	3 (2.9)
Psychotropic medication	3 (2.9)	6 (5.7)
Sleep medication or morphine	1 (1)	2 (1.9)
EHRA score		
1–2	60 (57.1)	60 (57.1)
3–4	44 (41.9)	45 (42.9)
Treatment		
Previous ablation	41 (39.1)	49 (46.7)
Previous cardioversions	49 (46.7)	54 (51.4)

Abbreviations: AF, atrial fibrillation; BMI, body mass index; EHRA, European Heart Rhythm Association.

HADS-D where an association between higher scores were found with higher scores of PSQI global (PSQI global mean [SD] score, 5.73 [3.13] for HADS-A ≥ 8 vs 8.46 [4.81] for HADS-D ≥ 8; P = .02). No statistically significant difference was seen for type of AF or intervention group versus usual care group.

Discussion

Sleep quality is low in most patients with heart disease. For example, in patients with heart failure, 63% report poor sleep quality that is associated with reduced cardiac event-free survival.[29] In AF specifically, sleep quality is poor in 50% to 55% of patients.[12,30,31] In this exploratory study, we examined sleep quality among AF patients being treated with ablation and who then participated in a randomized rehabilitation trial. There was no difference in sleep quality between the cardiac rehabilitation and usual care groups. However, 85% of all patients reported poor sleep quality at 1 month, and 55% reported poor sleep quality at 6 months. In comparison, the prevalence of poor sleep quality was found to be 38% in the general population in a large cross-sectional study in 2016.[32] The lack of difference in sleep quality found between the cardiac rehabilitation and usual care groups was also seen in a study including patients with an ICD.[30] We also found that more symptomatic patients experienced poorer sleep quality and patients with high scores for anxiety and depression experienced poorer sleep quality compared with patients with low scores regardless of type of AF.

It is notable that a high number of patients in this study reported low sleep quality even 6 months after ablation when most patients should be in sinus rhythm. Sleep quality has been reported to be low in other cardiac patient groups participating in cardiac rehabilitation for myocardial infarction, coronary artery bypass surgery, or cardiac catheterization.[33]

Depression is associated with poor sleep quality.[34] According to the *International Classification of Disease, 10th Revision*, sleep disturbance is a symptom of depression[35] and sleep disorder can be a predictor for depressive relapse, as well as sleep disturbances can lead to depression.[36] This is in line with the findings in this study where it was demonstrated that patients with high scores for depression had poor sleep quality.

We found that worse AF symptoms were associated with poor sleep quality. When comparing the EHRA and PSQI scores from this study with the results that Szymanski and colleagues[12] reported, the same trend is observed in that patients with more AF symptoms experienced worse sleep quality. The relation between AF symptoms and sleep quality is multifactorial. Atrial fibrillation is associated with an increase in sympathetic activity that can produce symptoms and result in poor sleep quality.[37] Moreover, symptoms of AF, depression, anxiety, and poor sleep quality are linked and mutually reinforcing.

These findings suggest that future interventions targeting sleep quality in patients with AF should include elements to decrease AF symptoms, depression, and anxiety. The intervention tested in the CopenHeart trial aimed at providing emotional support and improving coping skills and illness appraisal to enable patients to respond appropriately to physical and psychological symptoms. Therefore, we had hypothesized that the intervention could have an influence on sleep quality, as well as the primary and secondary outcomes. Our results suggest that, in addition to addressing negative emotions, it is important to directly address poor sleep quality as well.

In recent years, obstructive sleep apnea has been found to be a strong predictor of AF with up to 40% to 50% of AF patients experiencing obstructive sleep apnea.[38,39] Sleep apnea is associated with antidysrhythmic drug failures after cardioversion or catheter ablation, AF recurrence, and an increase of greater

TABLE 2 Baseline Cross-section of Sleep Quality on All Domains at Pittsburgh Sleep Quality Index Measured at 1 Month

	Subjective Sleep Quality		Sleep Latency		Sleep Duration		Habitual Sleep Efficiency		Sleep Disturbances		Sleep Medications		Daytime Dysfunction		Overall PSQI Score (Global)	
	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	mean (±SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Age, y																
18–49	1.09 (0.82)	.95	2.94 (0.35)	.82	1.03 (0.56)	.29	0.59 (0.84)	.83	1.25 (0.44)	.04	0.03 (0.18)	<.01	0.75 (0.76)	.78	7.54 (2.38)	.72
50–59	1.13 (0.75)		2.91 (0.35)		0.75 (0.62)		0.63 (0.95)		1.58 (0.63)		0.36 (0.87)		0.89 (0.63)		8.15 (2.51)	
60–69	1.07 (0.79)		2.87 (0.41)		0.89 (0.71)		0.76 (1.01)		1.43 (0.55)		0.25 (0.62)		0.87 (0.58)		7.97 (2.78)	
>69	1.03 (0.7)		2.91 (0.39)		0.8 (0.71)		0.63 (0.88)		1.34 (0.48)		0.74 (1.21)		0.84 (0.63)		8.13 (2.21)	
Sex																
Female	1.2 (0.67)	.19	2.82 (0.33)	.13	0.91 (0.74)	.53	0.86 (0.94)	.1	1.52 (0.63)	.19	0.55 (1)	.04	0.89 (0.59)	.54	8.59 (2.37)	.03
Male	1.04 (0.78)		2.93 (0.47)		0.84 (0.64)		0.6 (0.93)		1.39 (0.52)		0.24 (0.69)		0.83 (0.65)		7.72 (2.57)	
Living with partner																
Yes	1.04 (0.77)	.15	2.92 (0.34)	.15	0.82 (0.44)	.14	0.61 (0.91)	.12	1.40 (0.54)	.12	0.26 (0.71)	.07	0.84 (0.64)	.51	7.76 (2.45)	.02
No	1.25 (0.69)		2.81 (0.53)		1.00 (0.74)		0.91 (1.06)		1.56 (0.61)		0.61 (1.08)		0.92 (0.60)		8.9 (2.71)	
Educational level																
<3 y[a]	1.05 (0.73)	.9	2.89 (0.42)	.98	0.93 (0.61)	.26	0.63 (0.96)	.7	1.45 (0.55)	.32	0.2 (0.62)	.09	0.83 (0.62)	.54	7.72 (2.37)	.37
>3 y[a]	1.07 (0.75)		2.90 (0.36)		0.81 (0.7)		0.69 (0.92)		1.37 (0.5)		0.39 (0.86)		0.89 (0.64)		8.04 (2.57)	
BMI, kg/m^2																
≤24.9	1 (0.89)	.7	3 (0.00)	.02	0.89 (0.74)	.76	0.67 (0.96)	.72	1.21 (0.41)	.01	0.21 (0.49)	.19	0.72 (0.65)	.32	7.62 (3.08)	.56
25+	1.06 (0.73)		2.91 (0.33)		0.84 (0.74)		0.59 (0.85)		1.49 (0.58)		0.38 (0.87)		0.87 (0.69)		7.96 (2.47)	
Smoking																
Current smoker	1.07 (0.78)	.95	2.89 (0.32)	.91	0.83 (0.58)	.81	0.73 (1.08)	.78	1.67 (0.48)	.02	0.44 (0.75)	.41	0.81 (0.62)	.75	8.19 (2.59)	.64
Never smoked	1.08 (0.76)		2.90 (0.39)		0.86 (0.68)		0.67 (0.92)		1.39 (0.56)		0.31 (0.81)		0.86 (0.63)		7.94 (2.54)	
Type of AF																
Paroxysmal	1.12 (0.77)	.36	2.86 (0.44)	<.01	0.92 (0.69)	.02	0.76 (0.9)	.05	1.42 (0.54)	.94	0.35 (0.85)	.68	0.86 (0.63)	.75	8.15 (2.66)	.11
Persistent	1 (0.75)		3.00 (0.00)		0.64 (0.57)		0.46 (0.75)		1.43 (0.61)		0.29 (0.67)		0.82 (0.62)		7.49 (2.20)	
Symptoms of AF																
Palpitations																
Yes	1.14 (0.75)	.2	2.88 (0.43)	.37	0.90 (0.69)	.33	0.68 (0.92)	.93	1.39 (0.54)	.26	0.46 (0.96)	<.01	0.88 (0.68)	.51	8.21 (2.65)	.12
No	1 (0.78)		2.93 (0.31)		0.80 (0.64)		0.67 (0.98)		1.48 (0.57)		0.14 (0.44)		0.81 (0.55)		7.64 (2.36)	
Angina																
Yes	1.19 (0.78)	.4	2.78 (0.49)	.14	1.13 (0.81)	.01	0.88 (1.07)	.22	1.47 (0.62)	.65	0.44 (0.91)	.39	0.84 (0.63)	.95	8.50 (3.12)	.29
No	1.06 (0.76)		2.92 (0.35)		0.80 (0.62)		0.64 (0.92)		1.42 (0.54)		0.30 (0.78)		0.85 (0.63)		7.87 (2.41)	
Dyspnea																
Yes	1.11 (0.76)	.51	2.89 (0.39)	.69	0.94 (0.73)	.06	0.76 (1.01)	.11	1.46 (0.57)	.38	0.35 (0.8)	.65	0.88 (0.69)	.44	8.22 (2.69)	.1
No	1.04 (0.78)		2.91 (0.37)		0.74 (0.94)		0.54 (0.82)		1.38 (0.54)		0.29 (0.81)		0.81 (0.54)		7.60 (2.27)	
Dizziness																
Yes	1.21 (0.73)	.13	2.84 (0.5)	.26	0.98 (0.84)	.1	0.88 (1.07)	.1	1.46 (0.63)	.59	0.31 (0.77)	.85	0.96 (0.66)	.11	8.50 (2.96)	.1
No	1.03 (0.77)		2.92 (0.32)		0.80 (0.58)		0.59 (0.87)		1.41 (0.52)		0.33 (0.81)		0.80 (0.61)		7.76 (2.33)	

(*continues*)

TABLE 2 Baseline Cross-section of Sleep Quality on All Domains at Pittsburgh Sleep Quality Index Measured at 1 Month, Continued

	Subjective Sleep Quality		Sleep Latency		Sleep Duration		Habitual Sleep Efficiency		Sleep Disturbances		Sleep Medications		Daytime Dysfunction		Overall PSQI Score (Global)	
	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	mean (±SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Fatigue																
Yes	1.02 (0.82)	.31	2.94 (0.23)	.09	0.83 (0.66)	.63	0.59 (0.85)	.31	1.41 (0.58)	.69	0.28 (0.70)	.43	0.89 (0.64)	.43	7.79 (2.62)	.35
No	1.13 (0.71)		2.86 (0.47)		0.88 (0.67)		0.74 (1.01)		1.44 (0.54)		0.37 (0.87)		0.82 (0.62)		8.13 (2.48)	
Syncope																
Yes	1.50 (1)	.27	2.50 (0.58)	.04	1 (0.82)	.67	1.50 (1.29)	.08	1.75 (0.50)	.24	0.50 (1.00)	.66	1.25 (0.50)	.20	10.0 (2.58)	.11
No	1.07 (0.76)		2.91 (0.37)		0.85 (0.67)		0.65 (0.93)		1.42 (0.56		0.32 (0.8)		0.84 (0.63)		7.93 (2.53)	
Medications, β-blockers																
Yes	1.10 (0.79)	.78	2.89 (0.39)	.89	0.83 (0.6)	.59	0.66 (0.93)	.83	1.47 (0.57)	.31	0.28 (0.75)	.41	0.86 (0.61)	.75	7.93 (2.32)	.81
No	1.07 (0.74)		2.90 (0.37)		0.89 (0.74)		0.69 (0.96)		1.38 (0.53)		0.38 (0.86)		0.84 (0.65)		8.02 (2.78)	
EHRA score																
1–2	1.04 (0.78)	.31	2.90 (0.35)	.79	0.81 (0.66)	.25	0.64 (0.96)	.56	1.40 (0.53)	.43	0.30 (0.75)	.69	0.81 (0.63)	.25	7.80 (2.65)	.25
3–4	1.15 (0.75)		2.89 (0.42)		0.93 (0.67)		0.73 (0.93)		1.46 (0.59)		0.35 (0.87)		0.91 (0.64)		8.23 (2.34)	

Abbreviations: AF, atrial fibrillation; BMI, body mass index; EHRA, European Heart Rhythm Association; PSQI, Pittsburgh Sleep Quality Index.
[a]College education.

TABLE 3 Effect of Intervention on Quality of Sleep at 6 Months and Variables That Possibly Could Affect Sleep Quality

	PSQI Global Score at 6 mo, Mean (SD)[a]	*P*
EHRA score		
1–2 (n = 111)	5.93 (3.05)	.01
3–4 (n = 29)	7.59 (4.26)	
HADS[b]		
HADS-A < 8 (n = 129)	5.73 (3.13)	<.01
HADS-A ≥ 8 (n = 28)	8.75 (4.41)	
HADS-D < 8 (n = 144)	6.07 (3.39)	.02
HADS-D ≥ 8 (n = 13)	8.46 (4.81)	
Type of AF		
Paroxysmal (n = 119)	6.41 (3.77)	.50
Persistent (n = 43)	5.86 (2.79)	
Intervention group		
Intervention group (n = 77)	6.57 (3.56)	.34
Control group (n = 85)	5.99 (3.52)	

Abbreviations: AF, atrial fibrillation; EHRA, European Heart Rhythm Association; HADS, Hospital Anxiety and Depression Scale; PSQI, Pittsburgh Sleep Quality Index.
[a]Adjusted for baseline characteristics, month 1 PSQI global score, and intervention group.
[b]Measured at month 4.

than 3-fold in ischemic stroke.[40–43] A connection between obstructive sleep apnea and AF is associated with significant atrial remodeling that is characterized by atrial enlargement, reduction in voltage, site-specific and widespread conduction abnormalities, and longer sinus node recovery.[44] Rehabilitation programs that included diet and lifestyle management interventions for adults with obstructive sleep apnea have shown that lifestyle interventions are effective in reducing weight and therefore also improve obstructive sleep apnea parameters.[15] Screening for obstructive sleep apnea is not included in the PSQI; thus, it is not known how many of the patients in our study also experienced obstructive sleep apnea, but patients with a BMI of 25 and higher experienced more sleep disturbances in this study.

Limitations

These analyzes were explorative, meaning that the sample size calculation was done to examine an effect of the primary (physical capacity measured by VO_2 peak) and secondary (quality of life, measured on Short Form-36, Mental Component Scale) outcomes for the CopenHeart trial and not for the sleep analyses.[16] Therefore, the results should be considered as hypothesis generating for future trials. The PSQI has not been validated in an AF population, which is a limitation.

Conclusion and Perspectives

The cardiac rehabilitation program in this study consisted of physical exercise and psychoeducational

What's New and Important

- A cardiac rehabilitation program consisting of physical exercise and psychoeducational consultations showed no effect on sleep quality for patients treated with ablation for AF.
- Anxiety, depression, and symptoms of AF were associated with poor sleep quality for patients treated with ablation for AF and participating in cardiac rehabilitation.

consultations. The program showed no effect on sleep quality. A large proportion of patients continued to report poor sleep quality regardless of group assignment. More symptomatic patients and patients experiencing higher levels of depressive or anxiety symptoms reported poor sleep quality. That is a concern because sleep quality is vital for a person's physical and mental health, and therefore it could be argued that screening for sleep quality should be prioritized by health professionals caring for patients with AF. Screening for depression or anxiety may benefit AF patients with poor sleep quality. Treatment for depression or anxiety can be offered with the aim of also improving the patients' sleep quality. Patients with AF should be examined for sleep disorders and treated if needed. Intervention trials focusing on sleep quality in patients with AF or treated for AF are warranted to guide health professionals in supporting the patients to better sleep quality. Inspiration can be found in intervention trials that include patients with other heart conditions.[45] Trials of nonpharmacological interventions designed to improve sleep quality among patients with AF or treated for AF and interventions targeting both simple identification of sleep disorders and therapy directed against diseases such as sleep apnea are needed.

Acknowledgments

First of all, the authors thank the patients who were included in the CopenHeart RFA trial. They would also like to thank the CopenHeart staff, who were helpful in gathering the data, as well as statistician Steen Ladelund for advice on the statistical analysis for the study. They also thank public health students Iman Hassan and Anne Alexandrine Øhlers who assisted with some of the practical work in relation to this study.

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