# Lifestyle Therapy for the Management of Atrial Fibrillation



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Atrial fibrillation (AF) is a common arrhythmia associated with increased risk of morbidity and mortality. There is evidence that lifestyle interventions may serve as complementary treatments to reduce AF burden. The objective of this review was to summarize the efficacy of lifestyle interventions for the management of AF. Studies which included patients with systolic heart failure (ejection fraction  $\leq 40\%$ ), and those limited to an examination of vigorous physical activity were excluded from our search. Studies were identified through a search of the following databases: MEDLINE, EMBASE, CINAHIL, and PubMed, run from inception through August 2016. All studies were graded for quality using the Oxford Centre for Evidence-based Medicine recommendations. Meta-analyses of the studies were not performed due to the heterogeneity of the studies. From a total of 1,811 publications, 10 articles were identified and included. Selected publications included 1 study on yoga, 2 studies on acupuncture, 3 studies that examined weight loss programs, and 4 studies that evaluated the impact of moderate physical activity. Yoga was associated with less symptomatic AF episodes and improved quality of life. Acupuncture was associated with reduced AF occurrence in patients with persistent and paroxysmal AF. Weight loss was associated with a significant reduction AF burden and symptoms. Moderate exercise resulted in greater arrhythmia free survival and a mean reduction in AF burden. In conclusion, evidence exists to suggest that yoga, weight loss, and moderate exercise are associated with reductions in AF burden and symptoms. Evidence is greatest for weight loss and moderate exercise. © 2018 Elsevier Inc. All rights reserved. (Am J Cardiol 2018;121:1112–1117)

Healthy lifestyle characteristics have been associated with a lower risk of atrial fibrillation (AF), whereas AF risk increases with excess weight, stress, the metabolic syndrome, and obesity- associated chronic conditions.<sup>1-4</sup> Lifestyle modification has been shown to reduce both AF symptoms and arrhythmia burden and can be used in conjunction with or in place of antiarrhythmic medications and/or procedures. Lifestyle interventions including yoga and exercise programs have been associated with reductions in AF burden,<sup>2,5–7</sup> whereas weight loss and acupuncture have been evaluated for AF management.<sup>7,8</sup> To further understand current evidence, we conducted a systematic review of nonpharmacological therapies for AF. No funding sources were used for this review.

### Methods

Studies were identified through a search of databases (MEDLINE, EMBASE, and CINAHL) from inception through August 12, 2016. Search terms included AF, exercise, yoga, acupuncture, acupressure, meditation, tai chi, hypnosis, and diet. (See Appendix S1 for the reproducible search strategies.) Titles and abstracts were reviewed for all identified citations. Major exclusion criteria included citations published in a language other than English, case reports, and animal studies. Studies that were limited to patients with systolic heart failure (an ejection fraction of 40% or less) and those limited to an examination of vigorous physical activity (i.e., marathon running) were also excluded. Any irregularities were addressed by repeated review and mutual discussion among the authors. Evidence grade (1 to 5) was assigned using a rating scheme modified from the Oxford Centre for Evidenced-based Medicine.<sup>9</sup> A meta-analysis of the studies was not performed because of the heterogeneity of the interventions, the study designs, the difference in reporting AF as an outcome, and the overall quality of the studies. The data were summarized as a systematic review using PRISMA recommendations.<sup>10</sup>

## Results

The search identified 1,811 publications; after reviewing the titles and abstracts, 1,800 were excluded. The remaining full-text articles (n = 11) were reviewed, and 1 article was

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 Table 1

 Studies of lifestyle therapy for atrial fibrillation

Intervention	Year	Author	Subjects	AF Type	Study Design	Outcomes	Results	Evidence Quality*
Yoga	2013	Lakkireddy	52	Paroxysmal AF	Cohort study	AF episodes	Number of symptomatic AF episodes Yoga: $3.8 \pm 3$ vs Control: $2.1 \pm 2.6$ (p < 0.001)	2
Acupuncture	2011	Lomuscio	80	h/o persistent AF post CV	RCT	Recurrent AF	Amiodarone 27%; Acupuncture 35%; Sham 69%; Control 54% <sup>†</sup>	1
	2012	Lombardi	31	Paroxysmal AF	Cohort study	AF episodes	Episodes reduced from median of $15 \text{ to } 2 \text{ (p} = 0.0018)$	2
Weight Loss	2013	Abed	150	Paroxysmal & persistent AF	RCT	AF burden, symptom severity	AF burden score 11.8 vs 2.6 (p < 0.001) Symptom severity score 8.4 vs 1.7 (p < 0.001)	1
	2014	Pathak	149	s/p ablation for AF	Cohort study	AF burden, symptom severity	Frequency, duration, and symptom severity decreased in weight loss group (p < 0.001)	2
	2015	Pathak	355	Paroxysmal & persistent AF	Cohort study	AF episodes	Group with the most WL had the greatest reduction in burden and severity ( $p < 0.001$ )	1
Exercise	2008	Plisiene	10	Permanent AF	Cohort study	VR control	Trend toward decrease of mean VR by $12\%$ (76 ± 20 to $67 \pm 12$ bpm; p = 0.05)	3
	2012	Osbak	49	Permanent AF	RCT	Exercise capacity	Exercise capacity, muscle strength, and 6-minute hall walk test improved (p < 0.01)	1
	2015	Pathak	308	Paroxysmal & persistent AF	Cohort study	AF symptoms & episodes	Arrhythmia-free survival was greatest in patients with high cardiorespiratory fitness (p < 0.001).	2
	2016	Malmo	51	Paroxysmal & persistent AF	RCT	AF episodes & AF Duration	Mean time in AF reduced from 8.1% to 4.8% (p = 0.001)	1

AF = atrial fibrillation; CV = cardioversion; h/o = history of; RCT = randomized controlled trial; s/p = status post; VR = ventricular rate; WL = weight loss. \* Ratings modified from Oxford Centre for Evidence-based Medicine for ratings of individual studies.

<sup>†</sup> Reported as rate of recurrence in each arm of the trial.

excluded as a duplicate. The remaining 10 publications (Table 1) that met all inclusion/exclusion criteria included 1 study on yoga, 2 studies on acupuncture, 3 studies that examined weight-loss programs, and 4 studies that examined moderate physical activity. No studies that met our inclusion criteria were identified that examined tai chi, meditation, hypnosis, or acupressure. Study designs were highly heterogeneous. The results of the systematic search are shown in Figure 1.

A single-center, nonrandomized study examined yoga intervention among patients (n = 52, mean age 60 years) with paroxysmal AF on stable pharmacotherapy.<sup>5</sup> Patients who had recent AF ablation, advanced heart failure, or a life expectancy under 1 year were excluded. Participants served as their own controls by completing a 3-month control phase before the 3-month yoga intervention, which comprised weekly 60minute Iyengar yoga classes taught by a trained instructor. Participants were asked to attend 2 classes per week. The primary outcomes were change in symptomatic and asymptomatic AF measured with a symptom diary and event recorder. Secondary outcomes included change in quality of life (QoL) as measured by the Short Form 36, change in depression (Zung self-assessment depression score), and change in anxiety (Zung self-assessment anxiety score). Results were reported on 49 of the 52 enrolled subjects. Mean duration of AF was 63.9 months, and 38 of the 49 participants were taking antiarrhythmic medications. The yoga intervention was associated with less symptomatic AF episodes ( $3.8 \pm 3$  vs  $2.1 \pm 2.6$ ; p <0.001) and less asymptomatic AF episodes ( $0.12 \pm 0.44$  vs  $0.04 \pm 0.20$ ; p <0.001). Significant correlations were noted between changes in anxiety and heart rate, and AF episodes (both symptomatic and asymptomatic). Compliance was high, with all 49 participants completing at least 2 classes per week (mean completion of 3 per week). The limitations of the study included a singlecenter design, a small sample size, and the lack of a separate control group.

We found 2 publications that examined acupuncture as a treatment for AF.<sup>11,12</sup> The first by Lomuscio et al used a singlecenter, randomized control trial (RCT) design in which patients with persistent AF who had recently converted to sinus rhythm after electrical cardioversion were randomized to acupuncture (n = 17), sham acupuncture (n = 13), and neither acupuncture nor antiarrhythmic therapy (n = 24).<sup>11</sup> A group of 26 patients who were receiving amiodarone also served as a comparator group. Patients with left ventricular ejection fractions  $\leq$ 45% were excluded from the study. The primary outcome of interest was recurrent AF. Follow-up was

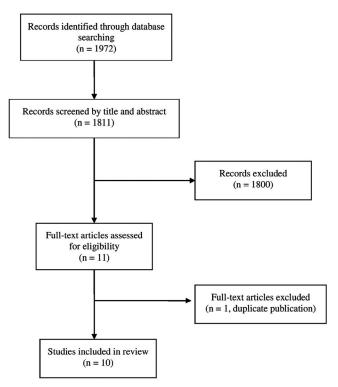


Figure 1. Results of systematic review.

12 months, during which patients received monthly electrocardiograms.

Both the acupuncture group and the sham acupuncture group received 10 sessions (1 per week), beginning within 48 hours of cardioversion. Acupuncture targets were chosen based on previous literature that suggest the spots were associated with modulation in the autonomic nervous system or improvements in palpitations, or supraventricular tachycardia.

During the 1-year follow-up, AF recurred in 35 patients: 35% in the acupuncture group, 69% in the sham acupuncture group, 54% in the control group, and 27% in the amiodarone group. The investigators noted a significant difference in the active groups (acupuncture and amiodarone groups) compared with the control groups (control and sham acupuncture) with lower rates of AF in the active groups (p = 0.002) and with no difference in AF recurrence between the amiodarone group and the acupuncture group (hazard ratio 1.15, 95% confidence interval 0.38 to 3.49, p = 0.80) after adjustment for ejection fraction, hypertension, and left atrial diameter.

In a related study by the same investigators, acupuncture was examined in patients with paroxysmal AF in addition to persistent AF.<sup>12</sup> Those with persistent AF were the same participants studied in the earlier report<sup>11</sup>; therefore, we will only discuss the findings related to participants with paroxysmal AF. Most participants were receiving antiarrhythmic medications. All participants received acupuncture with the same protocol described in the first study; however, no sham acupuncture or control group was included for those with paroxysmal AF. Over an average of 10 months of follow-up, there were significant reductions in the median number

of AF episodes (15 [interquartile range 6 to 50] to 2 [interquartile range 1 to 10], p = 0.0018) with no associated adverse effects related to the acupuncture. Limitations of both studies included a single-center design, monthly electrocardiograms to diagnose AF, and small sample sizes. Furthermore, the second study was limited by lack of randomization.

Three studies were identified that reported on the use of a weight-loss intervention. All of these studies were conducted at the same medical institution; 1 was an RCT and 2 were observational studies.<sup>3,8,13</sup> All patients underwent management of cardiometabolic risk factors including hypertension, hyperlipidemia, glucose intolerance, sleep apnea, and alcohol and tobacco use. All 3 studies used a modified low-calorie, low–glycemic index diet followed by a weight maintenance phase. Goal-directed face-to-face clinic visits were scheduled every 3 months, and patients were prescribed a written low-intensity exercise (walking or cycling) plan. For the studies, outcomes included AF symptom burden assessed with the AF Severity Scale,<sup>14</sup> duration and frequency of AF episodes assessed by a 7-day Holter, and left atrial area and left ventricular wall thickness determined by echocardiography.

In the RCT, Abed et al randomized 150 patients with symptomatic AF (paroxysmal or persistent) who were in sinus rhythm at the time of enrollment to either a weight-loss program or general lifestyle advice. Patients were followed for a median duration of 15 months.<sup>3</sup> The intervention group demonstrated a greater reduction in weight (14.3 vs 3.6 kg; p <0.001), AF symptom burden scores (11.8 and 2.6 points, p < 0.001), and symptom severity scores (8.4 and 1.7) points, p <0.001). Holter monitoring demonstrated greater reductions in AF episodes and duration of AF in the intervention group compared with the control group. Echo reductions in left atrial size and left ventricular thickness were observed at 12 months compared with baseline in both groups. Improvements in cardiovascular risk factors were observed in both groups; however, greater improvements were observed for the intervention group compared with the control group. Limitations of the study included use of a single-center and a predominantly white-male study population.

In a second nonrandomized observational study (ARREST-AF Cohort Study), the same investigators enrolled 149 AF patients with a body mass index  $\geq 27 \text{ kg/m}^2$  and at least 1 risk factor for developing AF who were referred for AF ablation.<sup>8</sup> Patients were offered enrollment in the weightloss programs; those who refused were considered as the control group. Patients in the intervention group (n = 61) had greater weight loss and blood pressure reductions, improved lipid profiles, and improved glucose control than those in the control group (n = 88). The intervention group also reported greater reductions in AF frequency (assessed by symptoms, electrocardiograms, and 7-day ambulatory monitoring), burden, and symptoms. Furthermore, patients in the intervention group were less likely to require multiple ablations or the additional use of antiarrhythmic therapies after the initial AF ablation compared with the control group. The primary limitation of this study is the fact that the control group contained patients who refused to participate in the intervention; as such, these patients likely differ from those who participated in the intervention. As a result, the positive outcomes reported in this publication may not be explained by weight loss alone. Further limitations to the study included

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the use of a single-center, nonrandomized study design and a small sample size.

The same investigators also reported an observational study of 355 overweight or obese patients with AF participating in a weight management program with a follow-up ranging from 46.0 to 48.4 months.<sup>13</sup> Participants were grouped by the amount of weight loss:  $\geq 10\%$  (n = 135), 3% to 9% (n = 103), and < 3%(n = 117). The primary outcome was AF burden as measured by the AF Severity Scale and Holter monitoring. AF burden symptom severity was reduced and arrhythmia-free duration was improved in the patients who achieved  $\geq 10\%$ weight loss compared with the other 2 groups. Patients who achieved a weight loss of  $\geq 10\%$  had almost a sixfold reduction in the risk of AF recurrence compared with patients who had a weight loss of <3% (hazard ratio 5.9, 95% confidence interval 3.4 to 10.3). When weight fluctuations were analyzed, there was a greater risk of recurrent AF in participants whose weight fluctuated >5% between annual visits, whereas attendance in the weight management clinic was associated with less weight fluctuations. Limitations to the study included the use of a single-center, observational study design and the lack of reporting on the ethnic makeup of the cohort.

Four studies that examined exercise or cardiorespiratory fitness and AF characteristics (symptoms, burden, frequency, or rate control) were identified.<sup>2,6,7,15</sup> In a small study of 10 patients, Plisiene et al enrolled patients with chronic permanent AF for more than 6 months. Participants were mostly male with a mean age of 59.15 Participants were asked to perform 2 exercise sessions per week, each lasting 45 minutes. The exercise consisted of brisk walking alone or with jogging. The primary outcome was adequate ventricular rate control assessed through exercise testing and Holter recording. Secondary outcomes included QoL measured through the Short Form 36 and subjective exercise capacity measured by the Borg Scale. Mean resting ventricular rate was decreased by 12% after 4 months of exercise training  $(76 \pm 20 \text{ beats})$ min to  $67 \pm 20$  beats/min; p = 0.05). Participants reported improved exercise capacity and QoL including reduced depressive symptoms and improved physical health. Limitations included a nonrandomized study design and a small sample size. In addition, physical activity that participants may have performed outside of the prescribed exercise sessions was not recorded.

Osbak et al conducted an RCT of 49 patients with permanent AF who were randomized to exercise training or a usual care control group.<sup>6</sup> The training consisted of 12 weeks of supervised aerobic exercise 3 times per week for 60 minutes, of which at least 30 minutes were at 70% maximal exercise capacity estimated by the Borg Scale. The primary outcomes were change in muscle strength, exercise capacity, lean body mass, fat percentage, and QoL. The study population was predominantly male with a mean age of 69 to 70 years. The mean body mass index was 29 kg/m<sup>2</sup>. At 12 weeks, the exercise group demonstrated improvements in muscle strength, exercise capacity, and QoL compared with the control group. Limitations of this study were the small sample size and no evidence of sustainability of the exercise program.

Using an RCT design, Malmo et al examined exercise training on AF symptoms, exercise capacity, and cardiac function.<sup>7</sup> This was a single-center trial of 51 patients with AF (either paroxysmal or persistent) randomized to aerobic interval training (n = 26) or usual care (n = 25). The exercise program consisted of walking (or running) on a treadmill at 60% to 70% of maximal heart rate for a brief warm-up, followed by 4-minute intervals at 85% to 95% of maximal heart rate with 3 minutes of recovery between intervals (repeated 4 times), ending with a 5-minute cool-down period. Participants completed exercise sessions 3 times per week for 12 weeks. The total study duration was 20 weeks. Implantable loop recorders were used to assess AF characteristics for 4 weeks before the exercise training and for 4 weeks after the completion of the program. Participants were given heart rate monitors and instructed to continue their exercise program at home. The primary outcome, time in AF, was reduced from baseline in the exercise group and increased in the control group. Mean time in AF increased from 10.4% to 14.6% in the control group and was reduced from 8.1% to 4.8% in the exercise group (p = 0.001). Compared with the control group, patients in the exercise group had greater improvement in OoL, general health, and vitality, and a reduction in both AF symptom and frequency. There was also a trend toward fewer cardioversions and AF-related hospital admissions in the exercise group. Limitations included a single-center design, lack of long-term follow-up, and lack of information on the ethnicity of the study population.

In an observational study, Pathak et al used their cohort of patients with symptomatic paroxysmal or persistent AF and sought to examine the role of cardiorespiratory fitness improvement on rhythm control.<sup>2</sup> A total of 308 obese patients with symptomatic paroxysmal or persistent AF and a body mass index  $\geq$  27 kg/m<sup>2</sup> who underwent exercise stress testing (baseline and follow-up) were included in the analysis. The mean follow-up period was  $49 \pm 19$  months. All patients were seen in a comprehensive clinic that managed cardiometabolic risk factors. This clinic also provided a weight-loss intervention (described in the previous section) in addition to an exercise plan. Low-intensity exercise for 20 minutes 3 times per week was initially recommended followed by an increase to at least 200 minutes per week of moderate-intensity exercise. The primary outcomes of interest were AF symptom burden assessed by the AF Severity Scale and freedom from AF assessed by a 7-day Holter. Baseline cardiorespiratory fitness was associated with lower risk of AF recurrence. AF symptoms were reduced in both those who had a metabolic equivalents (METs) gain of <2 and those with a METs gain of  $\geq 2$ , with a greater reduction in symptoms observed for those who had a METs gain of  $\geq 2$ . Among those with gains of  $\geq 2$ METs, 61% were free of AF without antiarrhythmic medications or ablation compared with 18% of participants who gained <2 METs. Each MET gained was associated with a 9% reduction in the risk of AF after adjustment for weight loss during follow-up and baseline cardiorespiratory fitness.

#### Discussion

Although significant progress has been made in the treatment of AF through pharmacological therapies and procedures such as left atrial catheter ablation and left atrial appendage closure,<sup>16–22</sup> nonpharmacological therapies for AF have not been well studied. We found limited evidence supporting the use of complimentary therapies for AF including yoga, weight loss, and moderate exercise.

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The interventions used were associated with improvements in clinical outcomes. Yoga was associated with lower AF episodes and less symptomatic episodes, and compliance for the yoga program was high. Within 2 acupuncture studies, acupuncture reduced AF recurrence. Studies using weight loss included larger numbers of patients and observed reductions in AF symptoms and burden. Exercise interventions were associated with improved QoL and in 2 studies reduced AF symptoms and frequency.

Although these results are encouraging, there are limitations to note. First, the studies were highly heterogeneous with differing protocols and study populations. Furthermore, the majority of studies included small numbers of participants, were performed at single centers, and were observational studies (i.e., nonrandomized). Protocols that included weight loss incorporated dietary, exercise, and risk factor management in one program; thus, understanding the impact of weight loss alone is not possible. Study populations also differed from those with paroxysmal AF to those recently cardioverted or who had undergone ablation. Some groups included received antiarrhythmic medications. In addition, our search was limited only to articles that were written in English. Therefore, there may be relevant studies written in other languages that could have increased the strength of evidence in our current review.

No publications were identified for many nonpharmacological therapies (tai chi, hypnosis, meditation, or acupressure) that have been examined in other conditions and are frequently used by cardiac patients.<sup>23–25</sup> Similarly, although alcohol and smoking are associated with AF, we did not find publications that reported on inventions that targeted these lifestyle behaviors.

In the coming years, AF will continue to pose a significant economic and public health burden. The goal of this review was to identify interventions that could be generalizable to a broad patient population and which could be implemented with current treatment strategies. For example, weight loss and exercise may be of particular importance in patients who have previously undergone ablations. Such an intervention is supported by data to suggest obesity is a predictor of AF recurrence after catheter ablation among young adults.<sup>26</sup>

In conclusion, although limited, there is evidence to suggest yoga, weight loss, and moderate exercise may be associated with reductions in AF burden and symptoms. Evidence is greatest for weight loss and moderate exercise. These interventions may be complementary with other therapies including antiarrhythmic medications, cardioversion, and AF ablation procedures. Additional studies using RCT study designs and larger study populations are warranted to evaluate these studies further.

#### Supplementary Data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.amjcard.2018.01.023.

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