Yoga and Cardiovascular System

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Adverse Effects of Acute Emotional Stress on the Heart

- **Left Ventricular Dysfunction (Stress Cardiomyopathy or Takotsubo Cardiomyopathy)**
- Typically occurs in an older woman.
- Sudden chest pain and shortness of breath occurs soon after an emotionally stressful or traumatic experience.
- Left ventricular dysfunction most prominently affects the cardiac apex.
- Effects of high levels of catecholamines have been implicated.

- **Myocardial Ischemia**
- Systemic vascular resistance increases during mental or emotional stress although myocardial oxygen demand also increases.
- Individuals with coronary artery disease may develop myocardial ischemia during emotional or mental stress even if their exercise or chemical nuclear stress test results are negative.

- **Ventricular Arrhythmias**
- At least 20% of episodes of serious ventricular arrhythmias or sudden cardiac death are precipitated by intense or unusual emotional stress.
- Intense emotions may lead to particularly lethal ventricular arrhythmias.
- Asymmetric brain activity may produce areas of inhomogeneous ventricular repolarization that create electrical instability in the heart.

- **Atrial Fibrillation**
- Emotional stress is a common triggering factor identified by patients with atrial fibrillation.
- Emotional stress may directly stimulate or alter the balance of autonomic input in the atria and lead to the initiation of atrial fibrillation

JAMA, July 18, 2007—Vol 298, No. 3

Table. General Approach to Patients With Emotional Stress–Induced Cardiac Events

Treatment	Evidence	Reference(s)
Pharmacological		
β-Blockers	Decreased ventricular arrhythmias in a small case series	27
Nonpharmacological		
Social support	Decreased cardiovascular responsiveness to experimental stress in small groups of patients	38-40
Meditation	Decreased premature ventricular contractions in a small case series	42,43
Relaxation therapy	Decreased heart rate, angina, arrhythmias, cardiac events, and cardiac death in patients with ischemic heart disease based on meta-analysis of controlled trials	44
Biofeedback	Increased heart rate variability in 63 patients with ischemic heart disease	45
Hypnosis	Reduced repolarization inhomogeneity during emotional stress in 12 healthy individuals	46
Slow breathing	Reduced blood pressure in 20 hypertensive patients and augmented vagal heart rate regulation in 46 patients with ischemic heart disease	47,48
Yoga	Reduced blood pressure in hypertensive patients	49,50

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EFFECTS OF HATHA YOGA ON LUNG FUNCTION AND OVERALL CARDIOVASCULAR ENDURANCE IN HEALTHY ADULTS

- Studies are consistent in reporting significant improvement in most measures of cardiopulmonary
- status (e.g., exercise performance) in young, healthy subjects.

- Improvements in lung function, however, were not consistent and were subject to the length of yoga training, the type of yoga practice used (e.g., breathing exercises and yoga postures), and the type of subject followed over time (e.g., untrained versus elite athlete).

- The longer the period of yoga practice, the stronger the benefit in overall cardiopulmonary endurance.

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- Heart failure and coronary disease
  - Lipids
  - Hypertension
  - Arrhythmias

Safety and effects of yoga practice on physical function

- **Inclusion:**
- 1) Age between 30 and 75 years of age,
- 2) New York Heart Association classification (NYHA) I-III,
- 3) had permission from their cardiologist to participate,
- 4) had a normal mini-cognitive examination to exclude those with symptoms of dementia, and
- 5) were able to read and understand English

- **Exclusion:**
- 1) history of medication noncompliance,
- 2) were hospitalized < 3 months before study participation,
- 3) a myocardial infarction or unstable angina < 6 months before study participation,
- 4) had severe pulmonary obstructive disease with a forced expiratory volume in 1 second < 1 L and,
- 5) experienced resuscitation during sudden cardiac death without subsequent automatic internal cardiac defibrillator placement.

Journal of Cardiac Failure Vol. 16 No. 9 2010

- Participants were asked to complete 8 weeks of yoga classes.
- Baseline measures were taken before yoga classes began and final measures taken after completion of the program.
- At home, participants were asked to practice the breathing portion of the class (15 minutes) 3 times weekly.
- They were given a compact disc recorded from the class to practice the breathing portion of the program
  at home.
- Yoga classes lasted 60 minutes and were conducted twice weekly for a total of 16 classes over an 8-week period
- Asanas were modified to suit subjects's physical limitations

Table 2. Functional and Psychological Measures (n = 12)

Clinical Data	Before Yoga Mean ± SD	After Yoga Mean ± SD	*P* Value
Endurance (m)	436.7 ± 82.0	465.5 ± 82.2	<.02*
Balance (sec)	26.9 ± 19.7	40.0 ± 18.5	.05*
Upper body strength (total no.)	16.5 ± 6.9	19.6.9 ± 8.6	.04*
Lower body strength (total no.)	11.6 ± 3.6	13.4 ± 4.8	.01*
Flexibility: right shoulder (°)	−18.5 ± 18.5	−16.3 ± 14.5	.20
Flexibility: left shoulder (°)	−19.7 ± 19.4	−17.5 ± 17.5	.07
Flexibility: right hip (°)	−14.0 ± 16.3	9.0 ± 8.3	.27
Flexibility: left hip (°)	−11.3 ± 14.7	−7.6 ±7.1	.32
Flexibility: thighs (cm)	12.3 ± 11.7	13.2 ± 11.4	.43
Quality of life score (1-100)	80.2 ± 11.6	78.0 ± 15.0	.60
Symptom stability (1-100)	47.7 ± 7.5	65.9 ± 20.2	.02•
Beck Depression Inventory	7.4 ± 6.0	7.1 ± 5.7	.77

- In 1 study involving yoga and/or yoga breathing (pranayama) and patients with HF, researchers instructed patients in slow breathing patterns (breathing at a rate of 6 breaths per minute) and examined the effect

  on baroreflex sensitivity, a measure of ANS tone and the autonomic nervous system.

- Improvements in baroreflex activity were found.

  (Bernardi L, Porta C, Spicuzza L, et al. Slow Breathing increases arterial baroreflex sensitivity in patients with chronic heart failure. Circulation 2002;105:143e5.)

- The same group of researchers examined the effect of 4 weeks of yoga-type breathing

  training in patients with HF and found that dyspnea, exercise tolerance, and oxygenation was improved

- (Bernardi L, Spadacini G, Bellwon J, et al. Effect of breathing on oxygen saturation and exercise erformance in chronic heart failure. Lancet 1998;351:1308e11.)

Effects of yoga on inflammation and exercise capacity in patients with systolic heart failure

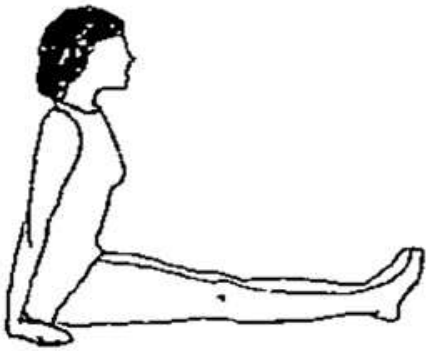
- **Inclusion:**
- 1) systolic HF with a left ventricular ejection fraction (LVEF) < 50% determined by transthoracic echocardiography within 6 months before enrollment;
- 2) New York Heart Association (NYHA) Class I-III;
- 3) were able to walk without assistance; and
- 4) had been on stable medical therapy for heart failure 6 months before enrollment
- **Exclusion**
- 1) significant comorbidities with a life expectancy < 6 months;
- 2) were pregnant or breast-feeding; or
- 3) were unable to attend yoga sessions twice per week.

Journal of Cardiac Failure Vol. 14 No. 5 June 2008

- 9 patients were in yoga and 10 in control group

- Yoga sessions lasted for 70 minutes/twice per week, for a total of 16 supervised sessions over 8 weeks.
- Protocol: a 10-minute warm-up phase, a 40-minute period of standing or seated yoga postures (Asanas), and finally a 20-minute relaxation phase including breathing exercises (pranayama) and meditation.
- Heart rate and blood pressure before and after each yoga session was obtained.
- After 2 weeks of participation in monitored sessions, the treatment subjects were given a handout and a video of the same yoga postures done during the sessions.
- Patients were instructed to perform at least 1 session at home for a minimum of 3 yoga sessions per week during the treatment period.

1



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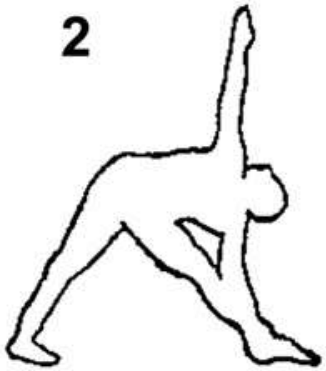

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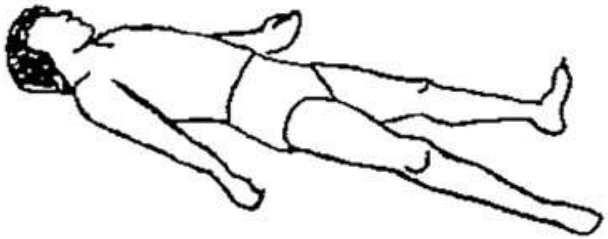

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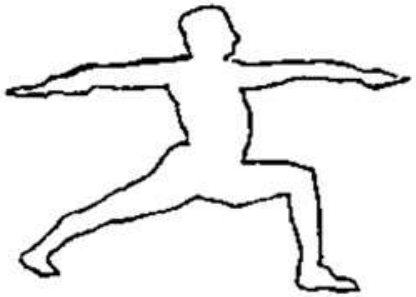

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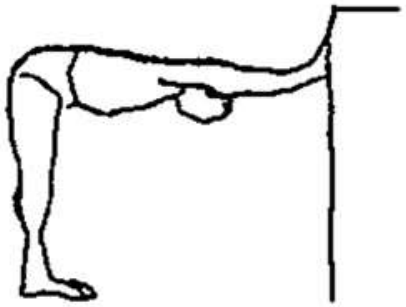
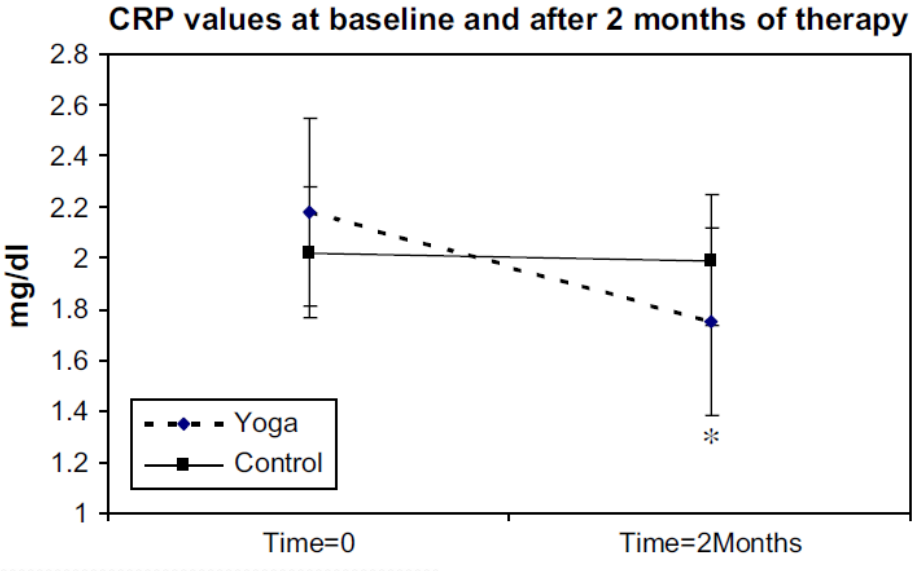
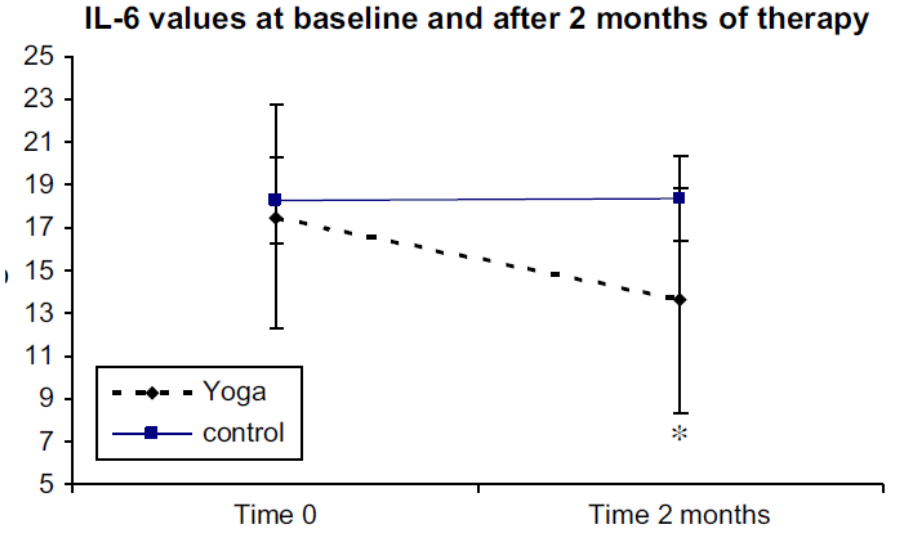
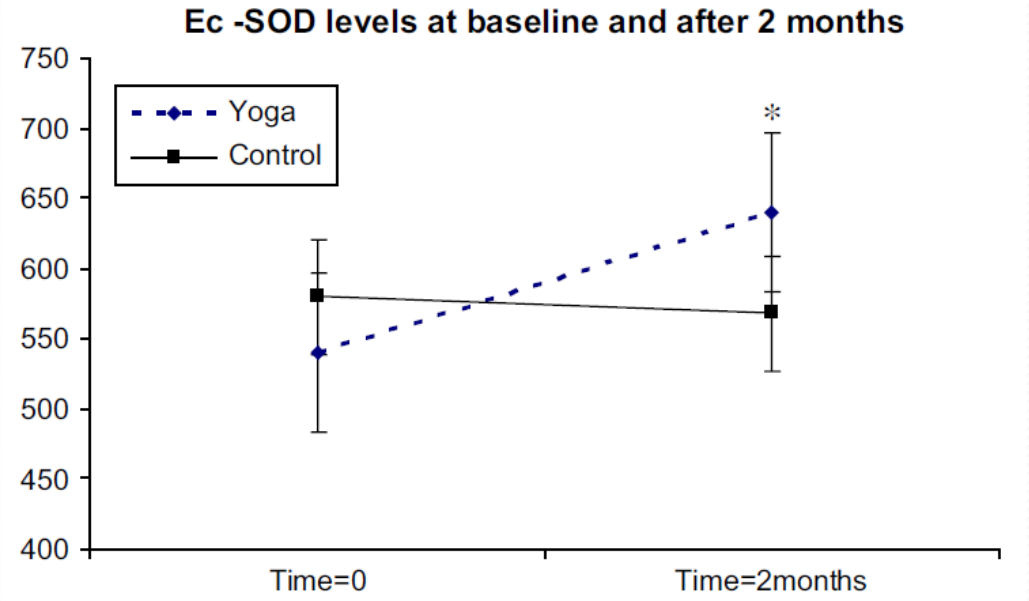



CRP values at baseline and after 2 months of therapy
mg/dl
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
Yoga
Control
*
Time=0
Time=2Months


IL-6 values at baseline and after 2 months of therapy
25
23
21
19
17
15
13
11
9
7
5
Yoga
control
*
Time 0
Time 2 months


Ec -SOD levels at baseline and after 2 months
750
700
650
600
550
500
450
400
Yoga
Control
*
Time=0
Time=2months

Exercise and quality of life results

Test	Between-Group Differences: Control % Change from Baseline	Yoga % Change from Baseline	*P* Value Versus Control
Treadmill Time (s)	−7.5	18.0	.030
VO_{2Peak} (mL·kg·min)	−7.1	17.0	.020
Weight (lb)	1.7	1.1	.654
Flexibility (inches)	−16.5	−7.8	.643
MLHFQ-T	2.9	−25.7	.643
MLHFQ-P	−4.8	−21.4	.699
MLHFQ-E	6.3	−36.0	.774

Yoga after myocardial infarction

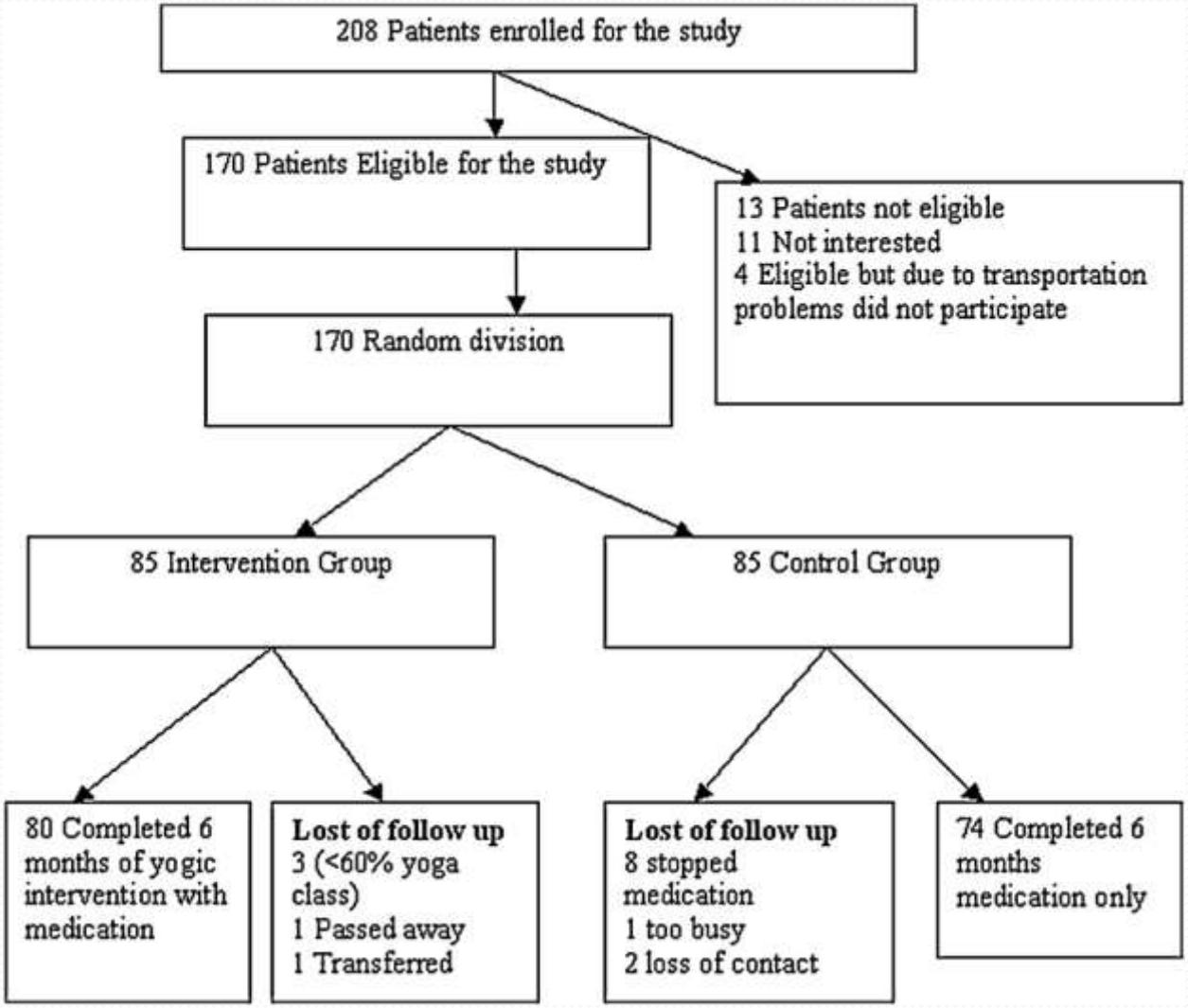
- Patients who were taught relaxation therapy after having sustained a myocardial infarction were shown to experience fewer cardiac events in a 5-year period than patients who were not taught this technique (van Dixhoorn and Duivenvoorden. *J Cardiopulm Rehabil*. 1999;19(3):178-185)

- Patients were randomly assigned to either physical exercise training only or to exercise training plus individualized instruction on relaxation therapy (focusing on relaxing imagery and initiating voluntary changes in posture, muscle tension, and breathing techniques).

- Although relaxation therapy was taught to these individuals for only 1 hour per week for 6 weeks, the effects were long lasting.

- Heart failure and coronary disease
- Lipids
- Hypertension
- Arrhythmias

Effect of yogic practices on lipid profile and body fat composition in patients with coronary artery disease



Complementary Therapies in Medicine (2011) **19**, 122—127

Yoga exercises

- Jal Neti (nasal cleansing) once in a week; cleaning the nasal passage
- Shavashana (body awareness, 10—15 min
- Bhujangasana (5 times in 3 min) lying flat on the stomach with the legs straight and the soles of the feet uppermost.
- Shashankasana (5 times in 3 min) sitting in Vajrasana then bending forward and placing the hand and foreheads rest on the floor in front of the knees.
- Ushtrasana (5 times in 3 min) kneel and adjust the knees and feet so that they are separated by the same width as the hips.
- Hasthutthanasana (5 times in 3 min) inhale deeply and slowly raising the arms above the head bending the head slightly backward and look up at the hands.
- Shiddhasana (changing the feet, 5 min) sitting with the legs straight in front of the body. Bending the right leg and placing the sole of the foot flat against the inner left thigh.
- Nadi Shodhan Pranayama (5 times in 6—7 min) with om chanting (3 times in 2 min) was also done.

- Total duration of these practices was 35—40 min/day, five days a week for six months

Table 2 Comparison of difference in pre treatment and post treatment scores among yoga and non yoga groups.

Variables	Difference in scores		*t* value	*p* value
	Yoga *n* = 80Mean, sd	Non yoga *n* = 74Mean, sd		
BMI	1.45, 1.74	0.96, 1.16	2.04	0.04*
Fat%	3.09, 3.36	1.28, 2.26	3.87	0.0002*
Fat mass	1.99, 2.70	2.68, 4.05	1.24	0.21
Fat free mass	1.51, 6.35	−0.54, 6.24	2.03	0.04*
Total body water	2.47, 3.26	2.95, 4.01	0.82	0.41
SBP	11.02, 9.46	7.05, 6.29	3.043	0.002*
DBP	8.85, 7.92	6.01, 4.98	2.63	0.009*
HR	4.17, 10.64	−2.32, 7.12	4.42	0.0001*
Total cholesterol	28.29, 30.86	5.31, 40.93	3.95	0.0001*
HDL	6.44, 4.92	2.00, 6.88	4.63	0.0001*
Triglyceride	38.04, 37.39	7.33, 34.82	5.26	0.0001*
LDL	15.10, 45.23	1.09, 39.64	2.05	0.04*

Abbreviations: *, statistically significant; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HR, heart rate; HDL, high density lipoprotein; LDL, low density lipoprotein.

- Heart failure and coronary disease
- Lipids
- Hypertension
- Arrhythmias

Table 1. Evidence supporting CAM approaches to BP reduction

INTERVENTION	EVIDENCE
Dark chocolate	Meta-analysis of 5 RCTs
Coenzyme Q10	Meta-analysis of 12 RCTs
Melatonin	2 RCTs
Vitamin D	2 RCTs, 2 case-control studies
Qigong	4 of 5 trials including 2 RCTs
Slow breathing	Systematic review
Meditation	Meta-analysis of 9 RCTs
Acupuncture	2 of 3 RCTs

BP—blood pressure, CAM—complementary and alternative medicine, RCT—randomized controlled trial.

- A systematic review found 5 prospective studies, 2 of which were RCTs, involving a total of 356 patients, investigating the role of slow, controlled breathing in hypertension. Four out of 5 trials demonstrated benefit, with the only negative trial involving 30 diabetic patients for whom autonomic dysfunction was deemed a confounding factor.

  (Parati G, Carretta R. Device-guided slow breathing as a non-pharmacological approach to antihypertensive treatment: efficacy, problems and perspectives. *J Hypertens* 2007;25(1):57-61.)

- 2 randomized trials showed modest reduction of BP with yoga with or without biofeedback. Size were small and medical therapy was not well defined

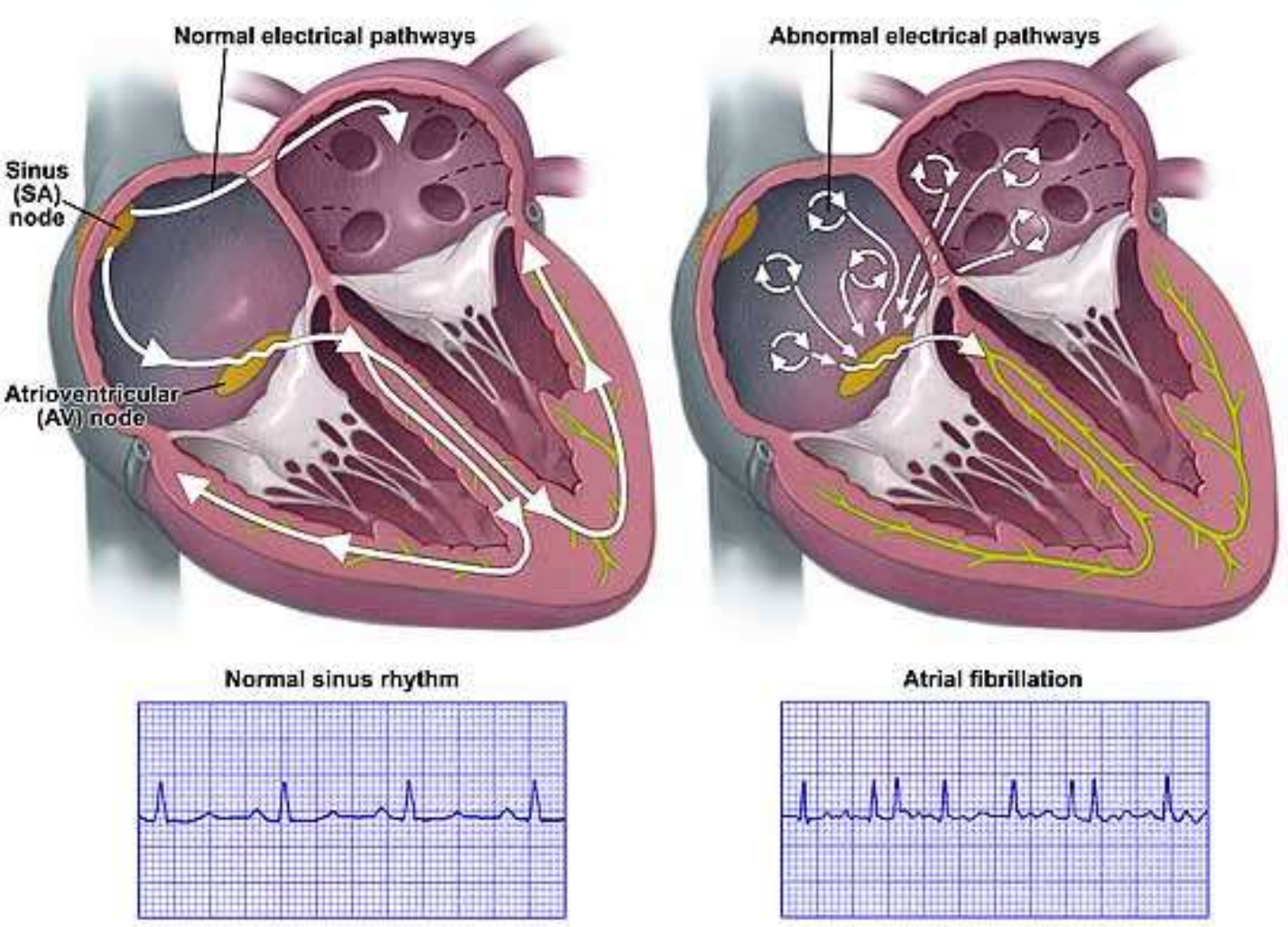
- (J Clin Hypertens (Greenwich). 2007 Oct;9(10):800-1.)

- Heart failure and coronary disease
- Lipids
- Hypertension
- Arrhythmias

- A 35 y/o female and a 14 y/o male with palpitation and frequent PVC were treated with pranayama and shavasana for 2 months
- Both palpitation and PVC's decreased after 2 months

International Journal of Cardiology 108 (2006) 124– 125

ATRIAL FIBRILLATION



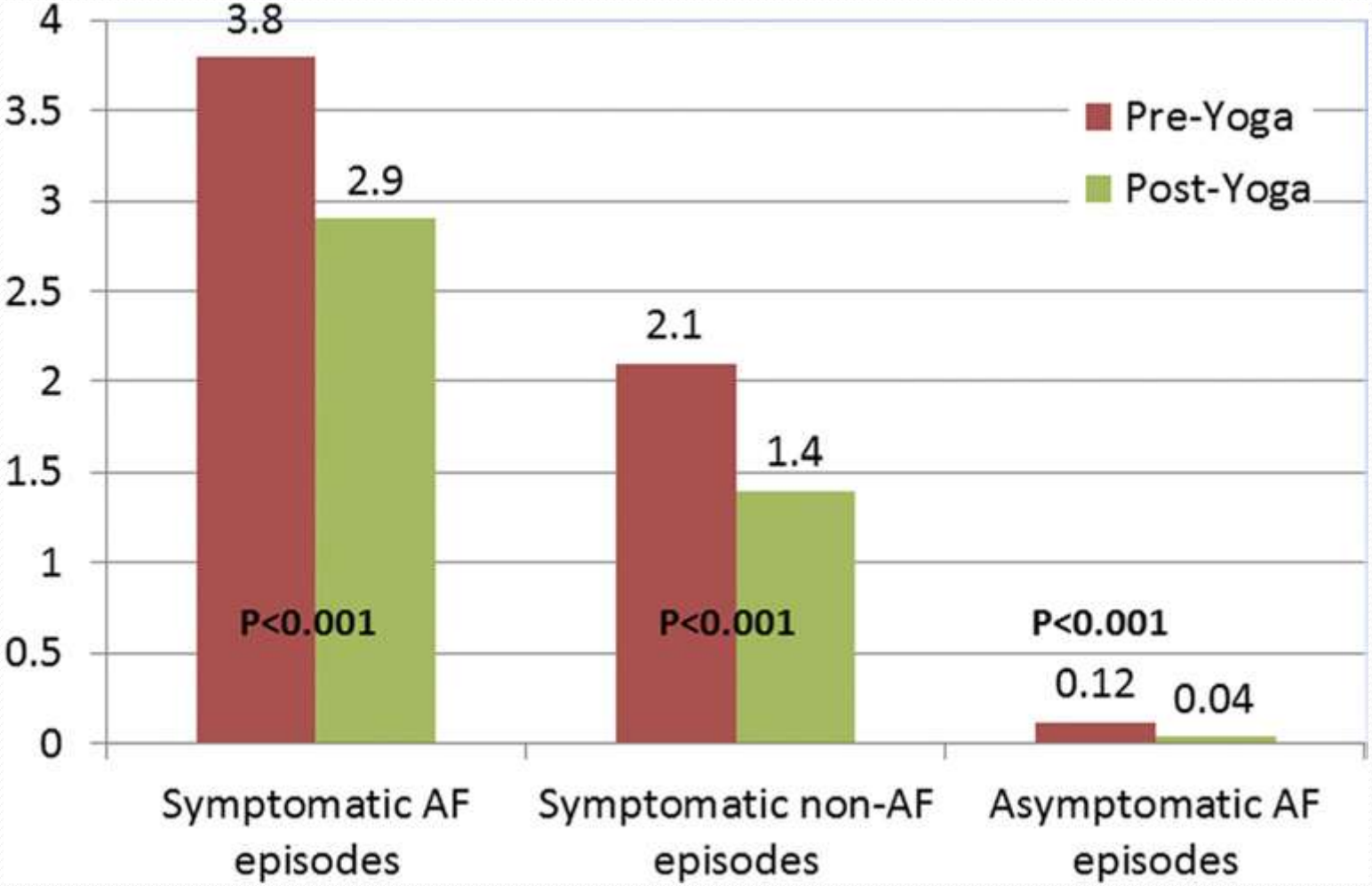
Yoga and atrial fibrillation the yoga my heart study

- 52 consecutive symptomatic PAF patients with no physical limitations to participate in the prescribed Yoga regimen were enrolled
- 49 completed this prospective, self-controlled, single center study.

- Patients were in the control phase for 3 months when regular exercise of patients' choice was permitted, followed by the study phase when a structured supervised Yoga program (45-minute sessions) consisting of breathing exercises, asanas (positions), meditation, and relaxation was administered 3 times/week for 3 months

- **Results:**
- Yoga intervention significantly reduced the number of episodes of AF during the study phase compared to the control phase (3.8±3 vs 2.1±2.6, $p<0.001$).
- Yoga also reduced depression & anxiety scores measured by the Zung scoring system ($p<0.001$).
- The QoL (SF36) also improved for measurements 1, 4, 5, 6, and 8 (p values of 0.017, <0.001, <0.001, 0.019 and <0.001, respectively).

Effect of Yoga on atrial fibrillation



J Am Coll Cardiol 2013;61:1177–82

Table 1: Comparison of Baseline, Pre and Post Yoga Anxiety, depression and SF-36 QoL scores				
Type of Score	Baseline (Day-0)	Pre-Yoga (Day-90)	Post- Yoga (Day 180)	P value
Zung Depression Score	32.5±8.3	31.1±8.3	28.0±8.3	p<0.001
Zung Anxiety Score	34.6±4.5	33.2±4.4	26.8±5.3	p<0.001
SF36				
-Domain -1 Physical Functioning	82.6±17.1	79.8±17.8	87.6±11.9	p=0.017
-Domain -2 Role Physical	81.2±30.2	78.1±32.9	87.0±27.2	p=0.304
-Domain -3 Bodily Pain	85.2±26.8	85.9±29.0	93.1±17.9	p=0.348
-Domain -4 General Health	61.0±18.3	57.4±19.9	73.9±12.1	p<0.001
-Domain -5 Vitality	77.6±16.6	78.1±17.5	87.1±12.6	p<0.001
-Domain -6 Social Functioning	86.2±22.0	86.5±19.8	92.1±14.4	p=0.019
-Domain 7 Role Emotional	73.3±17.5	70.8±16.4	74.3±16.5	p=0.212
-Domain -8 Mental Health	74.2±15.7	73.3±14.4	79.2±11.8	p<0.001

Conclusion

- Yoga helps shift the balance of autonomic nervous system towards less sympathetic influence
- There is evidence that yoga is safe in HF patients and improves quality of life.
- Slow breathing may help reduce BP.
- Yoga can reduce the frequency and symptoms of atrial fibrillation

Thank You

- Slow respiration may reduce the deleterious effects of myocardial ischemia, and, in addition, it increases calmness and wellbeing

- A slow respiratory rate (6/min) has generally favorable effects on cardiovascular and respiratory function and increases respiratory sinus arrhythmia, the arterial baroreflex, oxygenation of the blood, and exercise tolerance

BMJ VOLUME 323 22–29 DECEMBER 2001