KATHOLIEKE UNIVERSITEIT
LEUVEN

Do patients with atrial fibrillation benefit from exercise training?

Prof. Luc Vanhees, FESC
Brussels, 1-4-2011

There is no conflict of interest

Content

1) Exercise tolerance in patients with atrial fibrillation

2) Exercise training in patients with atrial fibrillation

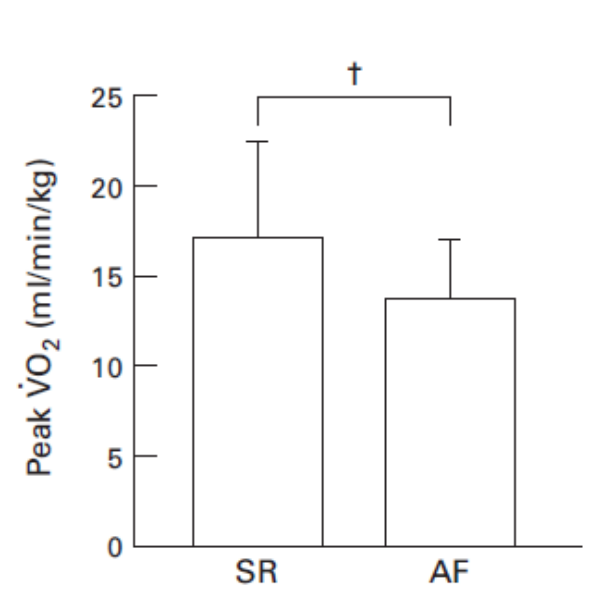
3) Are there risks regarding exercise training in AF?

Atrial fibrillation and exercise tolerance

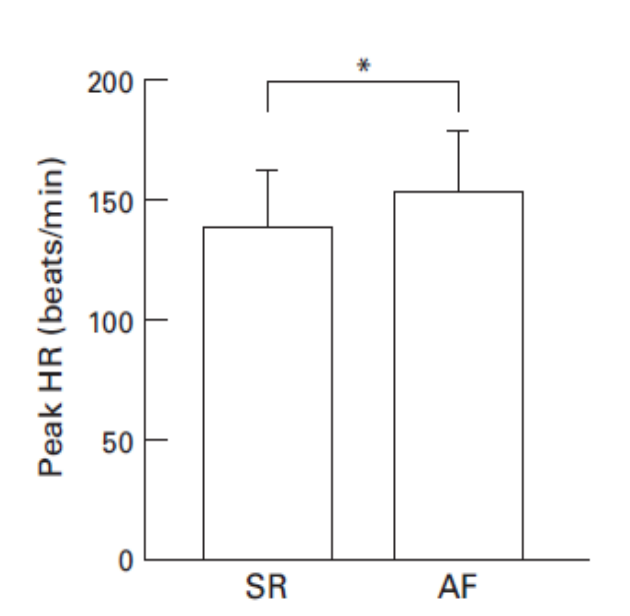
- $VO_2 = Q \times (a\text{-}v)O_{2diff}$
- $Q = HF \times SV$
- $SV = EDV - ESV$
- Atrial fibrillation
  - Variable diastolic filling because of variable RR-interval
  - Decreased efficacy of the heart pump
  - Q (cardiac output) decrease by 10%

? Exercise tolerance ($peakVO_2$)

Atrial fibrillation is associated with a lower exercise capacity in male CHF patients



Diff **19%**



Diff 10%

➔Atrial fibrillation is associated with a 19% lower peak VO2 in patients with CHF

➔Atrial fibrillation reduces exercise capacity

Pardaens et al, Heart, 1997; 78: 564-568

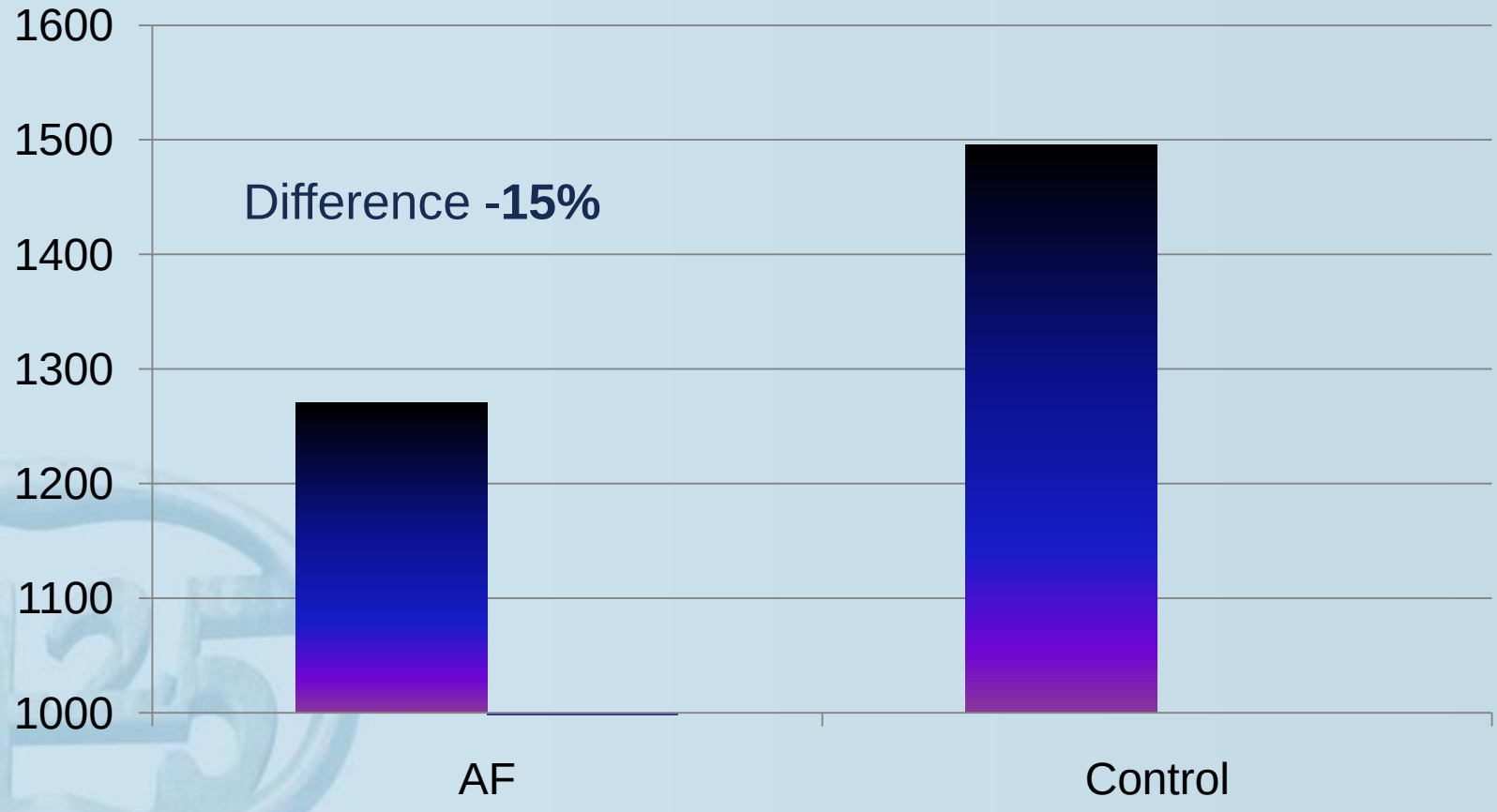
Exercise tolerance: peak VO_2

Variable	Control	Atrial fibrillation	Total database
Number of patients (n) (m/f)	44 (41/3)	19 (17/2)	2116 (1951/165)
Reason for referral to program:			
- Ischemic heart disease	23 (52.3 %)	10 (52.6 %)	1625 (77.2 %)
- Artificial valve	21 (47.7 %)	9 (47.4 %)	70 (3.3 %)
- Other	-	-	409 (19.4 %)
Age (years)	63.2 ± 3.9	63.3 ± 5.9	54.2 ± 9.2
Body mass index (kg/m2)	24.7 ± 2.4	24.7 ± 2.7	25.4 ± 3.1
Cholesterol level (mg/100ml)	221 ± 48	203 ± 42	226 ± 45
History of hypertension	9 (20.4 %)	6 (31.6 %)	506 (23.9 %)
History of Diabetes	1 (2.3 %)	0 (0 %)	85 (4.0 %)
Smoking habits :			
- current smoking	1 (2.3 %)	0 (0 %)	177 (8.4 %)
- past smoking	29 (66 %)	12 (63.2 %)	1605 (75.9 %)

Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Exercise tolerance: peak VO_2

- Peak VO2 in patients with AF was significantly lower compared with control CAD group (1271 ± 368 versus 1496 ± 414 ml/min, p<0.05)



Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Exercise tolerance: peak VO_2

Variable	Control group	Atrial fibrillation group
Number of patients (n)	44	19
Peak VO_2 (ml/min)	1496 ± 414	1271 ± 368 *
Peak VO_2/weight (ml/min/kg)	20.2 ± 5.5	16.9 ± 5.2 *
Peak oxygen pulse (ml/beat)	11.7 ± 2.9	9.8 ± 3.2 *
Heart rate at rest (beats/min)	72 ± 12	81 ± 18 *
Heart rate at 80 watt (beats/min)	108 ± 17	119 ± 37
Peak heart rate (beats/min)	129 ± 22	135 ± 35
Resting systolic blood pressure (mmHg)	139 ± 22	142 ± 16
Resting diastolic blood pressure (mmHg)	83 ± 9	78 ± 11
R at peak exercise (VCO_2/VO_2)	1.09 ± 0.08	1.08 ± 0.10
V_EO_2 at peak exercise (V_E/VO_2)	39 ± 7.5	39.6 ± 7.6

Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Exercise tolerance: peak VO_2

Variables entered in the model	R^2 model	Partial R of AF
Atrial fibrillation	0.0066 ***	-0.0812 ***
Atrial fibrillation + age ,sex ,BMI	0.3155 ***	-0.0434 **
Atrial fibrillation + age , sex, BMI + other significant covariates §	0.5707 ***	-0.0597 **
Atrial fibrillation + age, sex , BMI + significant covariates § + significant medications $	0.5783 ***	-0.051 *

* p<0.05; ** p<0.01; p<0.001;
§ other significant co-variants were dyspnea, previous smoking habits, resting systolic blood pressure, resting heart rate, peak heart rate, ST depression, myocardial infarction, hypertension, PTCA and claudication;
$ significant medications were beta-blockers, angiotensin conversion enzyme inhibitors and calcium antagonists.

Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Permanent atrial fibrillation affects exercise capacity in CHF patients

Table 3 Cardiopulmonary exercise test data in study groups according to cardiac rhythm

	HF patients with atrial fibrillation, *n* = 180	HF patients with sinus rhythm, *n* = 762	*P*-value
Respiratory exchange ratio	1.11 ± 0.12	1.13 ± 0.17	0.53
Peak VCO_2, mL/min	1126 ± 413	1303 ± 514	0.005
Peak VO_2, mL/min	1024 ± 370	1156 ± 422	<0.0001
Peak VO_2/kg, mL/min/kg	13.4 ± 4.2	15.2 ± 5.0	<0.0001
Peak VO_2, % of predicted	50 ± 16	56 ± 19	<0.0001
Peak heart rate, bpm	136 ± 34	125 ± 23	<0.0001
Peak O_2pulse, mL/bpm	7.5 ± 2.8	9.3 ± 3.4	<0.0001
Peak workload, Watts	81 ± 32	95 ± 35	0.0002
Peak VE, L/min	46 ± 14	47 ± 16	0.10
VE/VCO_2 slope	36.6 ± 9	34.3 ± 9	0.14
VO_2/WR slope	8.4 ± 1.6	8.6 ± 2.2	0.46
VO_2 at AT, ml/min	901 ± 316	836 ± 297	0.03
VO_2 at AT (% of peak VO_2)	83 ± 21	71 ± 21	<0.0001
VO_2 at AT, mL/min/kg	12.1 ± 3.1	10.9 ± 2.9	0.04
Heart rate at AT, bpm	116 ± 31	101 ± 20	<0.0001
O_2pulse at AT, mL/bpm	7.6 ± 3.2	8.5 ± 3.2	0.006

→Diff **12%**

→ Diff 8%

Data are expressed as mean ± SD.
Anaerobic threshold (AT) was identified in 779 patients (132 with atrial fibrillation and 647 with sinus rhythm); VO_2/WR slope was calculated in 518 patients (96 with atrial fibrillation and 418 with sinus rhythm). All *P*-values are adjusted by ANCOVA for age, gender, and study center.
VO_2, oxygen consumption; VCO_2, carbon dioxide production; VE, ventilation; WR, work.

Agostoni et al, Eur Heart J 2008; 29: 2367-2372

Oxygen uptake kinetics and cardiopulmonary performance in lone atrial fibrillation

- Conclusion:

  higher HRpeak at AT and at maximal exercise

  23% lower peakVO2 at AT and at maximal exercise

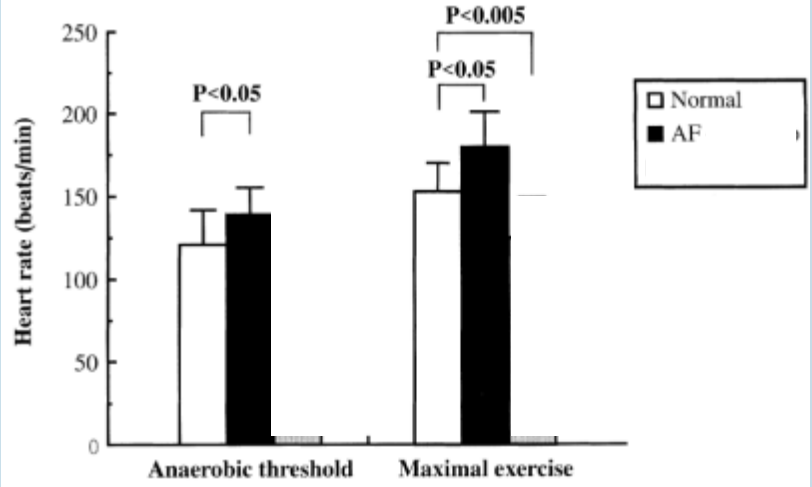


FIGURE 4. Heart rate changes in normal subjects and in patients with chronic AF receiving either placebo or sotalol.

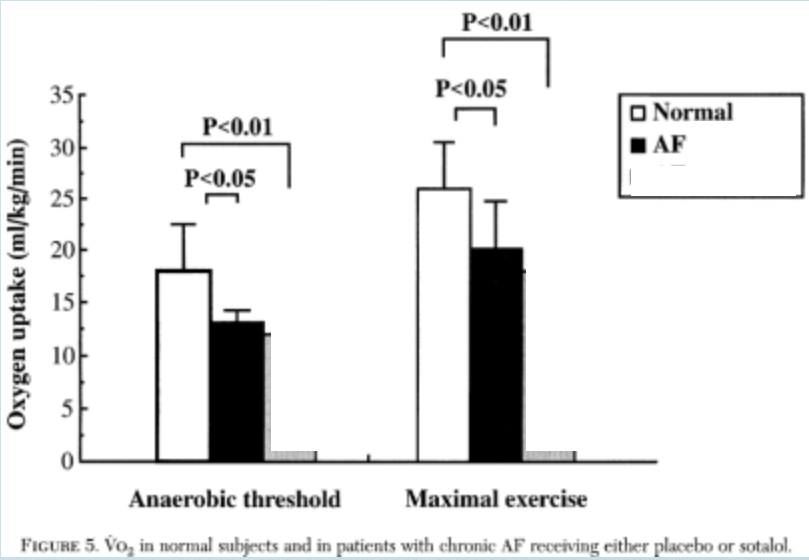
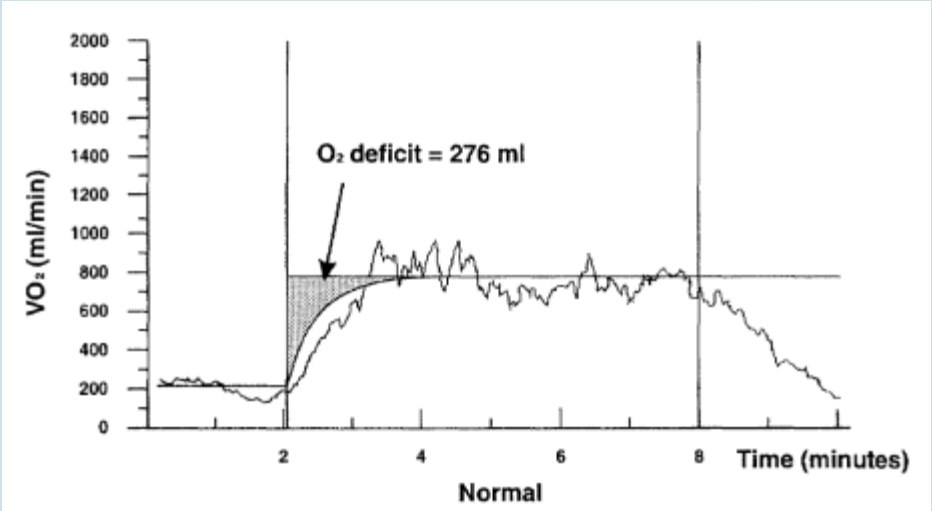
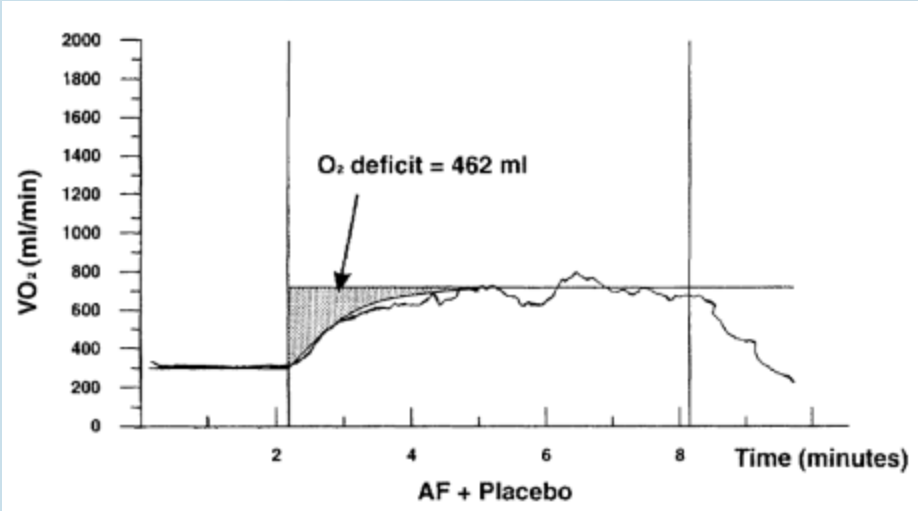


FIGURE 5. $\dot{V}O_2$ in normal subjects and in patients with chronic AF receiving either placebo or sotalol.

Lok et al, Chest 1997; 111: 934-940

Oxygen uptake kinetics and cardiopulmonary performance in lone atrial fibrillation





- Conclusion:

  during constant submaximal exercise: larger oxygen deficit in AF patients!

Lok et al, Chest 1997; 111: 934-940

Effect of catheter ablation of the atrioventricular junction on exercise tolerance in paroxysmal atrial fibrillation

6 weeks after ablation of the AV junction

Treadmill exercise duration increased from 6.4 ± 4.6 to 9.9 ± 2.6 minutes (p = 0.03) (Diff **35%**) and correlated strongly with changes in functional capacity measured with the McMaster Health Index (r = 0.70, P = 0.03).

Kay et al, Am J Cardiol 1988; 62: 741-744

Delayed improvement in exercise capacity after cardioversion of atrial fibrillation to sinus rhythm

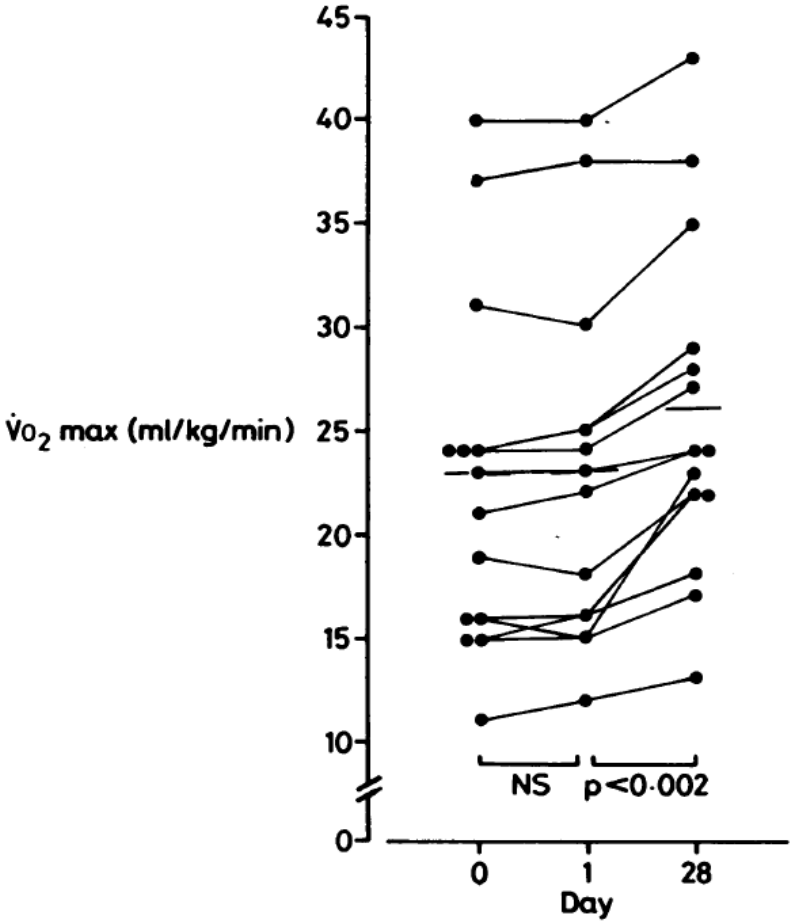


Fig 2 *Change in symptom limited maximal oxygen consumption ($\dot{V}O_2$ max) before and on day 1 and 28 after DC cardioversion of atrial fibrillation to sinus rhythm.*

Delayed improvement in exercise capacity / peak VO2 after cardioversion:

No effects on day 1, significant higher peak VO_2 on day 28

Diff **23%**

Lipkin et al, Br Heart J 1988; 59: 572-577

The effect of cardioversion on maximal exercise capacity in patients with chronic atrial fibrillation

- Conclusion: ± 39 days after cardioversion:

  Decrease in resting heart rate of 37 beats/min (113 +/- 16 versus 76 +/- 10 beats/min, p<0.001)

  Submaximal exercise: mean heart rate was ± 50 beats/min lower following cardioversion (p<0.001), but VO2 was not different

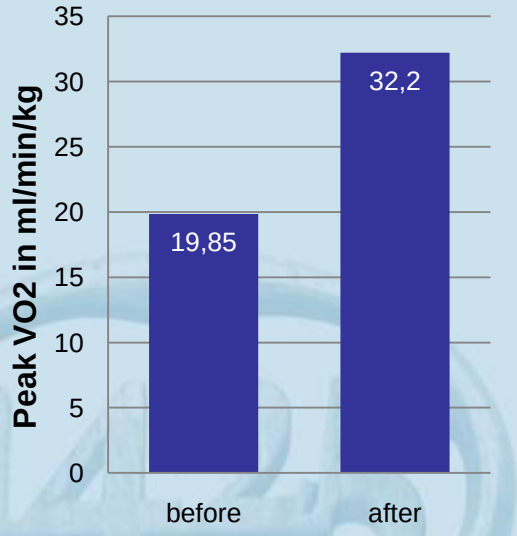
  Maximal exercise: heart rate was reduced (192 +/- 24 to 144 +/- 21 beats/min, p<0.001) and peakVO2 was ± **10%** higher (1.86 +/- 0.5 to 2.06 +/- 0.5 L/min, p<0.05)

Atwood et al, Am Heart J 1989; 118: 913-918

Improvement in exercise performance after successful cardioversion in patients with persistent atrial fibrillation and symptoms of heart failure

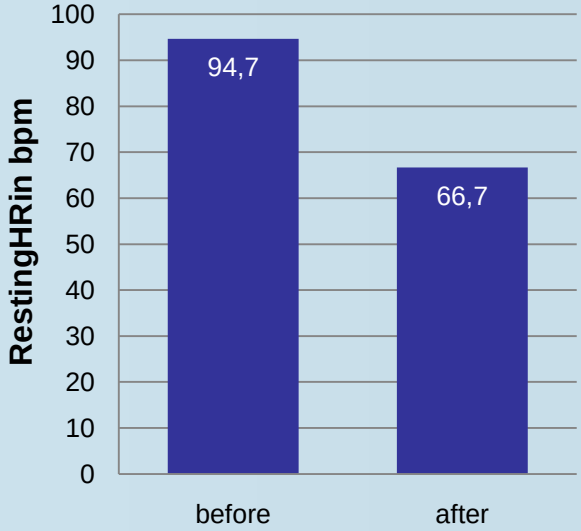
Peak VO2

38% increase*



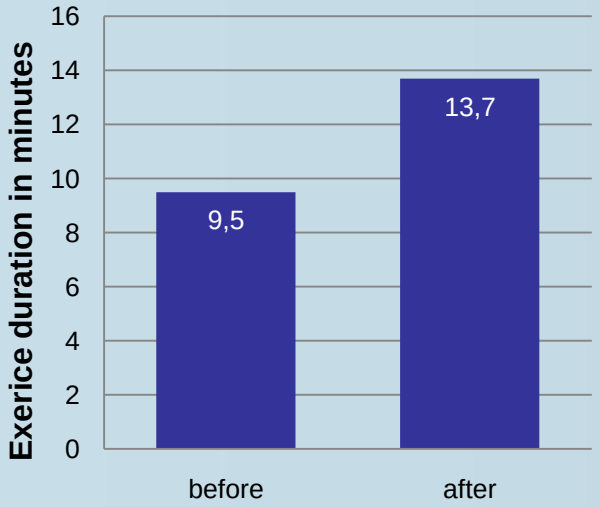
Resting HR

30% decrease*



Exercise duration

30% increase*



* $p<0.05$

Wozakowska-Kaplon et al, Kardiol Pol 2003; 59: 213-223

Conclusion

- Patients with atrial fibrillation in comparison to control cardiac patients in sinus rhythm have
  - Lower Peak VO_2 : **-10 to -23%**
  - Higher heart rate at rest and peakHR
  - Lower workload
  - Lower peak O_2pulse and lower O_2pulse at anaerobic threshold
  - Lower peak VO_2 and higher VO_2 at anaerobic threshold
  - Higher peak HR and higher HR at anaerobic threshold

- Patients with atrial fibrillation, compared to themselves in sinus rhythm have
  - Lower Peak VO_2 : **-10 to -38%**
  - Higher heart rate at rest and peakHR

➔ **Atrial Fibrillation is associated with a reduced exercise capacity**

Content

1) Exercise tolerance in patients with atrial fibrillation

2) Exercise training in patients with atrial fibrillation

3) Are there risks regarding exercise training in AF?

Atrial fibrillation and heart failure

CHF and AF frequently coexist:

Framingham study (Benjamin et al., JAMA, 1994):

- CHF is associated with a 5- to 6-fold increased risk of AF.

Euro Heart Failure Study (Cleland et al., Eur Heart J, 2003):

- up to 45% patients with CHF presented with AF.

→ In patients with CHF, AF is a marker of increased mortality.

Executive summary of the Position Paper of the Working Group on Cardiac Rehabilitation and Exercise Physiology of the European Society of Cardiology (ESC): core components of cardiac rehabilitation in chronic heart failure

Table 2 Continuum of cardiac rehabilitation services

Phases	Main elements
Inpatient cardiac rehabilitation	1. Assessment and risk screening 2. Optimization of pharmacological therapy 3. Identification and treatment of HF causative factors 4. Management of HF-related diseases and competing comorbidities 5. Mobilization and initiation of individualized activity program 6. Assessment of psychological issues 7. Development of an action plan by patient and carers to ensure early response to symptoms (problem recognition) 8. Development of identification and modification of risk factors (patients and carer education) 9. Discharge planning (referral to outpatient rehabilitation)
Outpatient cardiac rehabilitation	1. Individual assessment and regular review, with attention to physical, psychological and social parameters 2. Referral to HF specialist, if required 3. Supervised group or individual training 4. Resistance training as appropriate 5. Instruction on self-monitoring during physical activity and regular review of physical activity program 6. Support skill development to enable behaviour change and maintenance 7. Management of psychological issues (depression), emotions, sleep disorders 8. Self-management issues (management of symptoms, medications)
Continued care (disease progression prevention)	Home visits, telephone contacts, clinic/cardiologist/physician regular review, medications/weight checks, maintenance of understanding and physical activity, family support

HF, heart failure.

Corra et al, Eur J Cardiovasc Prev Rehabil 2005; 12: 321-325

Principles of exercise prescription for patients with chronic heart failure

Table 1 Core components of cardiac rehabilitation in chronic heart failure

Baseline clinical assessment and risk stratification
Treatment of causative factors of heart failure (hypertension, coronary artery disease, atrial fibrillation, and valvular heart disease) and correction of precipitating causes (non-compliance with drugs, use of non-steroidal anti-inflammatory drugs and cyclooxygenases-2 inhibitors, nasal decongestants, infections, pulmonary emboli, dietary indiscretion, inactivity, hyperthyroidism)
Optimal pharmacological therapy directed by national and international guidelines
Management of HF-related diseases and competing comorbidities
Implementation of a continuing program on physical activity and exercise training
Counseling and education: lifestyle, dietary recommendations, coping strategies, medications, self-monitoring, prognosis
Psychological support
Planning of continuum of care thorough an efficient, organized linkage between hospital and community

Adapted from Corra U (2007) Cardiac rehabilitation in chronic heart failure. In: Perk J, Mathes P, Gohlke H, Monpere C, Hellemans I, McGee H, Sellier H, Saner H (eds) European Society of Cardiology Textbook on Cardiovascular Prevention and Rehabilitation. Springer-Verlag, London

Myers, Heart Fail Rev 2008; 13: 61-68

Principles of exercise prescription for patients with chronic heart failure

Table 2 Relative and absolute contraindications to exercise training among patients with stable chronic heart failure

Relative contraindications

1. ≥1.8 kg increase in body mass over previous 1–3 days
2. Concurrent continuous or intermittent dobutamine therapy
3. Decrease in systolic blood pressure with exercise
4. New York Heart Association Functional Class IV
5. Complex ventricular arrhythmias at rest or appearing with exertion
6. Supine resting heart rate ≥100 beats·min^{-1}
7. Preexisting comorbidities

Absolute contraindications

1. Progressive worsening of exercise tolerance or dyspnea at rest or on exertion over previous 3–5 days
2. Significant ischemia at low work rates (<2 METS, or ≈50 W)
3. Uncontrolled diabetes
4. Acute systemic illness or fever
5. Recent embolism
6. Thrombophlebitis
7. Active pericarditis or myocarditis
8. Moderate to severe aortic stenosis
9. Regurgitant valvular heart disease requiring surgery
10. Myocardial infarction within previous 3 weeks
11. New onset atrial fibrillation

From Recommendations for exercise training in chronic heart failure patients

Working Group on Cardiac Rehabilitation & Exercise Physiology and Working Group on Heart Failure of the European Society of Cardiology. Eur Heart J 2001;22:125–135

Myers, Heart Fail Rev 2008; 13: 61-68

Cardiovascular Prevention and Rehabilitation (EACPR)

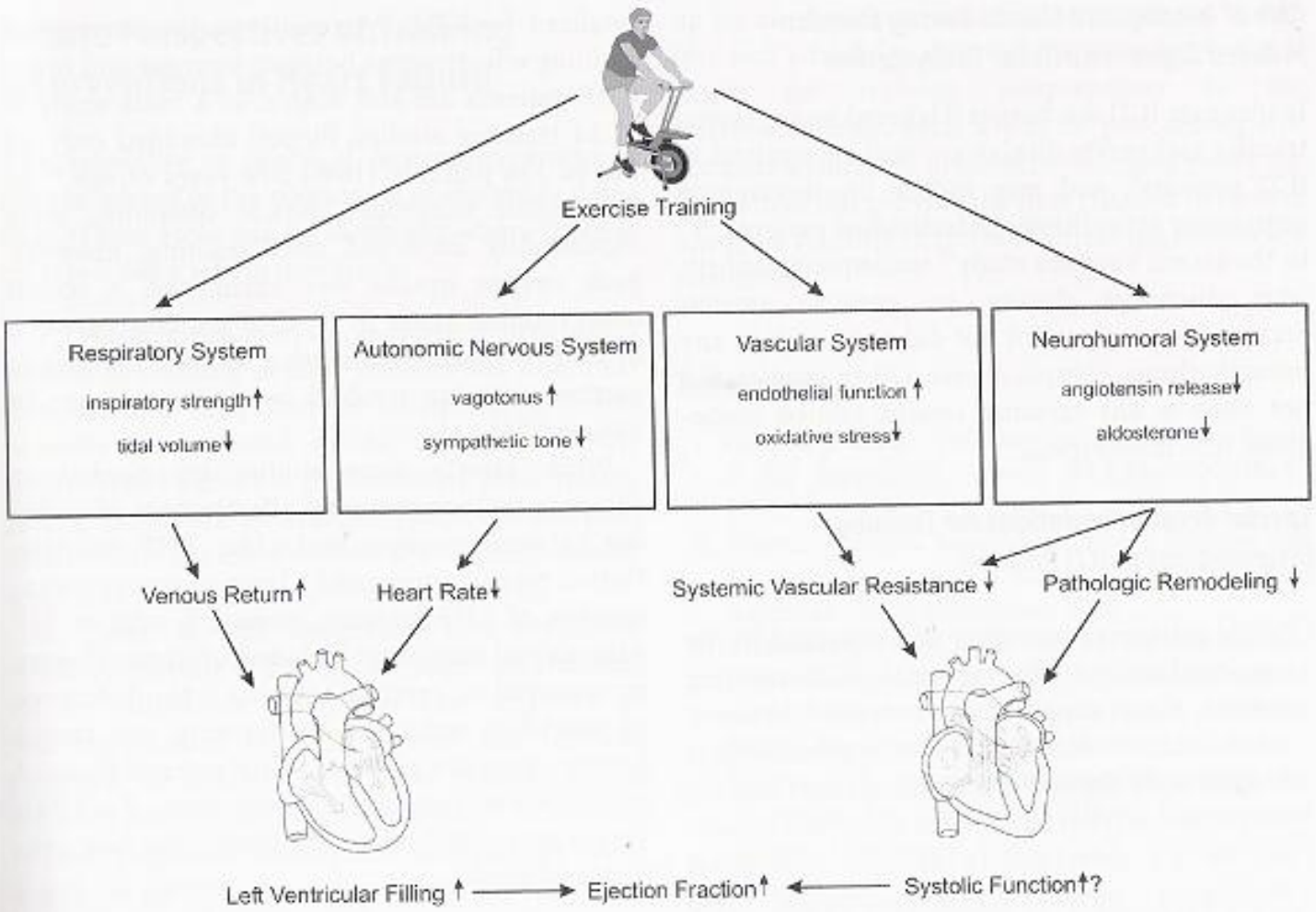


FIGURE 19-6. Effects of exercise training on cardiac dimensions and ejection fraction. Note that ejection fraction is improved as a consequence of reduced afterload and improved preload rather than by intrinsic myocardial effects.

Exercise training in patients with chronic atrial fibrillation

- Exercise training
  unsupervised walking
  5 times/week, 1 year
  intensity: pace based on 60% to 80% of the peakVO2

- Results
  peakVO2 increased with **15%**

Mertens et al, J Cardiopulm Rehab 1996; 16: 193-196

Exercise performance and training in cardiac patients with atrial fibrillation

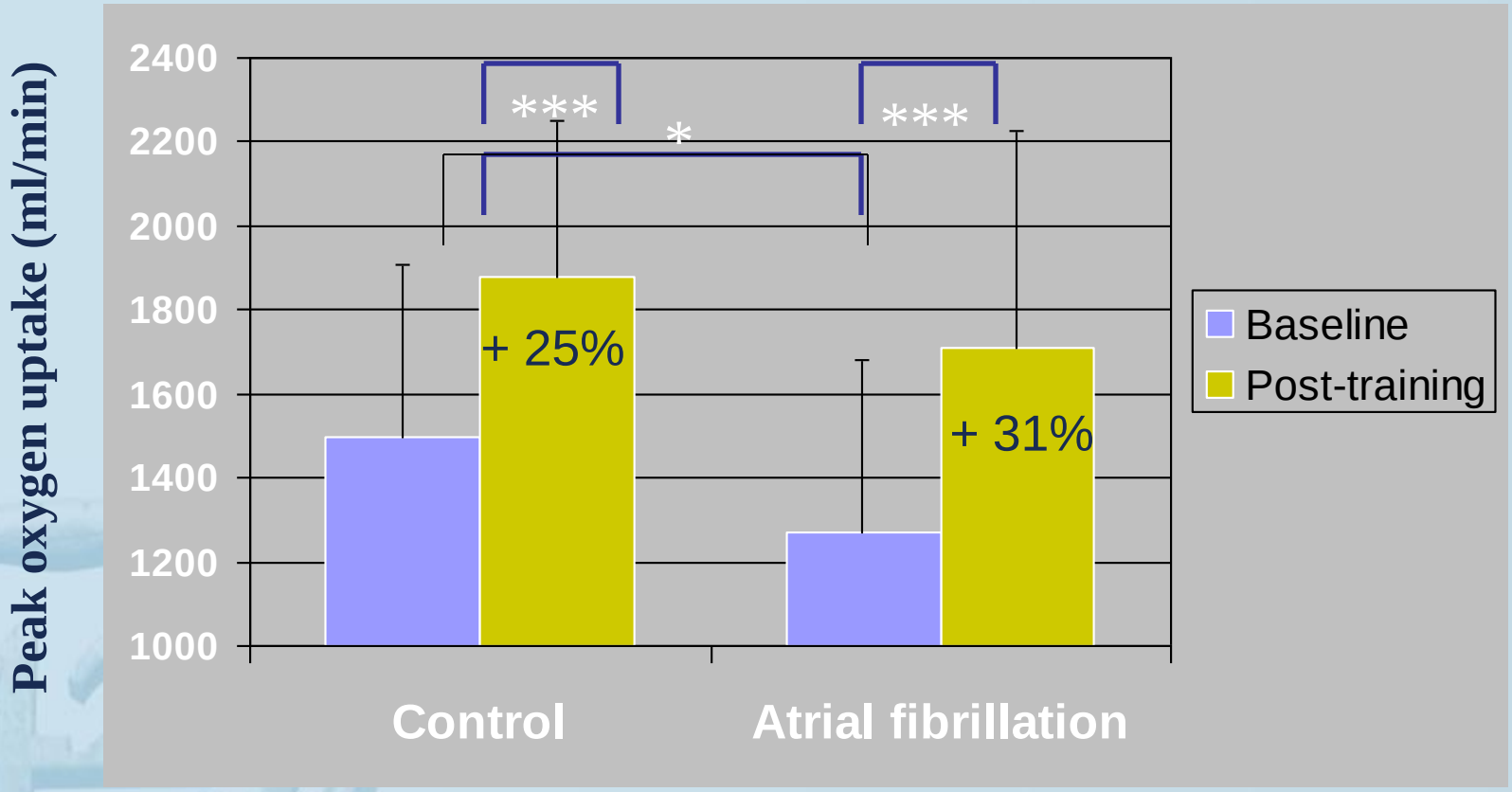
Data in patients with AF (n=19) were compared with a matched control group of patients in sinus rhythm (n=44).

Exercise training

- ambulatory, supervised
- aerobic training, calisthenics, relaxation
- 90min, 3 times/week, 3 months
- intensity (Karvonen) 60-90% Hrpeak

Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Exercise performance and training in cardiac patients with atrial fibrillation



* p < 0.05; *** p < 0.001

Vanhees et al, J Cardiopulm Rehabil 2000; 20: 346-352

Short-term exercise training in patients with chronic AF: effects on exercise capacity, …

- Exercise training

  3 times/week, 2 months, 75min

  aerobic training, strengthening exercises

  intensity 70-90% Hrpeak

- Results:

  Cumulated work at Borg scale 17 increased by **41%** +/- 36%.

  Heart rate at rest and after 10 minutes of exercise decreased: 75 ± 14 to 68 ± 14 bpm and 145 ± 19 to 137 ± 21 bpm

  Health related QOL and symptoms during exercise testing improved

Hegbom et al, J Cardiopulm Rehabil 2006; 26: 24-29
Hegbom et al, Int J Cardiol 2007; 116: 86-92

Effects of short-term exercise training on symptoms and QOL in pts with chronic AF

Table 3
Quality of life and symptom scores before and after the training (n=28), mean±S.D.

	Before training	After training	p-value
SF-36 scale (0–100 range[a])			
Physical functioning	82±14	86±10	0.01
Role-physical	77±29	86±25	0.10
Bodily pain	82±17	92±14	0.01
General health	73±14	77±16	0.17
Vitality	61±14	68±13	0.01
Social functioning	92±12	95±13	0.13
Role-emotional	85±28	94±20	0.01
Mental health	86±9	85±14	0.32
Physical component summary[b]	49±6	52±6	0.003
Mental component summary[b]	55±7	55±7	0.37
Symptom and Severity Checklist			
Symptom frequency (0–64 range[c])	14±5	12±7	0.12
Symptom severity (0–48 range[c])	12±5	10±6	0.01

SF-36 indicates Short-Form 36.
[a] Higher scores indicates better HRQoL.
[b] Indicates standardized for comparison with an American normal population with mean 50, S.D. 10.
[c] Lower scores indicates less symptoms.

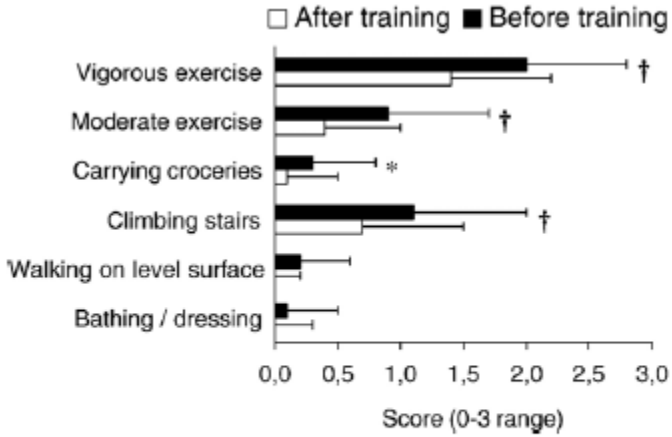


Fig. 3. Activities of Daily Living (ADL) before and after exercise training. Bars indicate standard deviation. † indicates p-value < 0.01. * indicates p-value < 0.05. Lower scores denote less limitation in ADL. N=28.

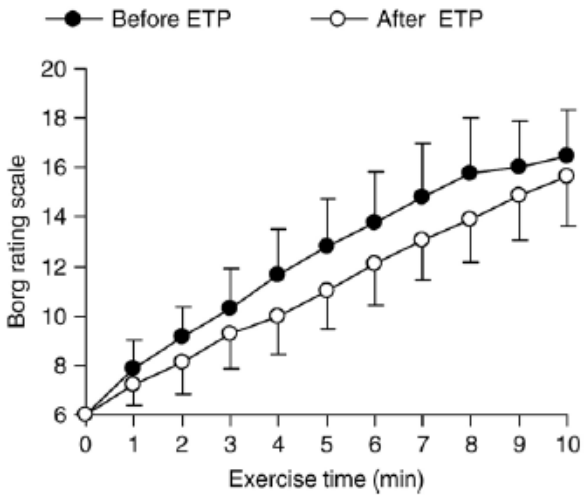


Fig. 1. Borg point scale during cycle ergometer test before and after the exercise training period (ETP). Bars indicate standard deviations. N=28.

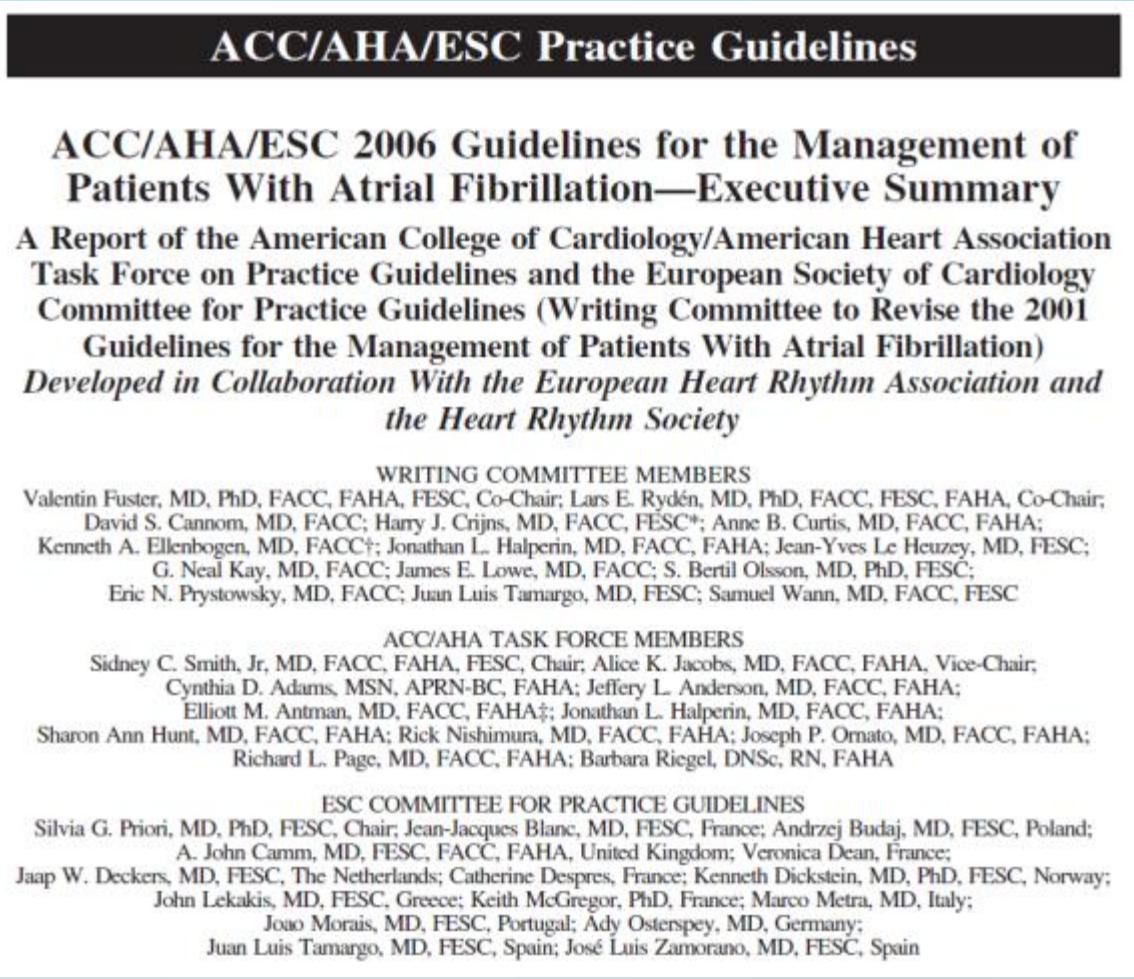
Hegbom et al, Int J Cardiol 2007; 116: 86-92

Recommendations for exercise training

Guidelines focus on maintaining ventricular response to

- 60-80 bpm at rest
- 90-115 bpm during moderate exercise

No recommendations on ET



ACC/AHA/ESC Practice Guidelines

ACC/AHA/ESC 2006 Guidelines for the Management of Patients With Atrial Fibrillation—Executive Summary

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation)

Developed in Collaboration With the European Heart Rhythm Association and the Heart Rhythm Society

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Fuster et al, JACC 2006; 48: 854-906

Recommendations for training

Canadian Journal of Cardiology 27 (2011) 7-13

Viewpoint

Comparing the 2010 North American and European Atrial Fibrillation Guidelines

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[b] *Division of Cardiology, University Hospital, University of Western Ontario, London, Ontario, Canada*

Table 2. Recommendations for long-term rate control

	Recommendation	Strength or class of recommendation	Level or quality of evidence
2010 CCS Guidelines	Treatment for rate control of persistent/permanent AF or AFL should aim for a resting heart rate of less than 100 bpm	Strong	High
2010 ESC Guidelines	Reasonable to initiate treatment with a lenient rate control protocol aimed at resting HR <110 bpm. Reasonable to adopt a stricter rate control strategy when symptoms persist or tachycardiomyopathy occurs, despite lenient rate control: HR <80	IIa	B
2004 CCS Guidelines	HR <80 bpm at rest and <110 bpm during 6 min hallwalk	IIa	C
2010 ACCF/AHA/HRS Focused Update	Treatment to achieve strict rate control of heart rate is not beneficial compared to achieving a resting heart rate <110 bpm in patients with persistent AF who have stable ventricular function (LVEF >0.40) and no or acceptable symptoms related to AF	III – no benefit	B

CCS, Canadian Cardiovascular Society; ESC, European Society of Cardiology; HR, heart rate; ACCF/AHA/HRS, College of Cardiology Foundation/the American Heart Association/Heart Rhythm Society (HRS).

Gillis et al, Canadian J Cardiol 2011; 27: 7-13

Recommendations for training

Position Paper

Recommendations for participation in leisure-time physical activity and competitive sports in patients with arrhythmias and potentially arrhythmogenic conditions
Part I: Supraventricular arrhythmias and pacemakers

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Table 1 Recommendations for participation in competitive sports and leisure-time physical activity in patients with arrhythmias and potentially arrhythmogenic conditions: supraventricular arrhythmias and pacemakers. (For athletes with structural heart disease, see also the recommendations specific to the disease)

Arrhythmia	Evaluation	Criteria for eligibility	Recommendations	Follow-up
Atrial fibrillation	History, ECG, Echo, ET, Holter	(a) Secondary to reversible cause (b) First onset or very sporadic paroxysms (c) Paroxysmal or permanent, without major cardiac disease Note 1: caution for monotherapy with class 1 antiarrhythmic drugs Note 2: consider prophylactic flutter ablation ('hybrid therapy')	(a) All sports when cause corrected and stable sinus rhythm for >2 months (b) All sports when stable sinus rhythm for >3 months. 'Pill-in-the-pocket' approach for some (c) All sports when proven rate control with absence of haemodynamic impairment (indivualized therapy) Note: AF ablation still investigative in athletes. All sports if asymptomatic for ≥3 months (all) Classical indications for anticoagulation. In such case: no sports with bodily contact or high risk for trauma	(a) Yearly (b) Yearly (c) Every 6 months

Heidbüchel et al, Eur J Cardiovasc Prev Rehab 2006; 13: 475-484

Cardiovascular prevention and rehabilitation

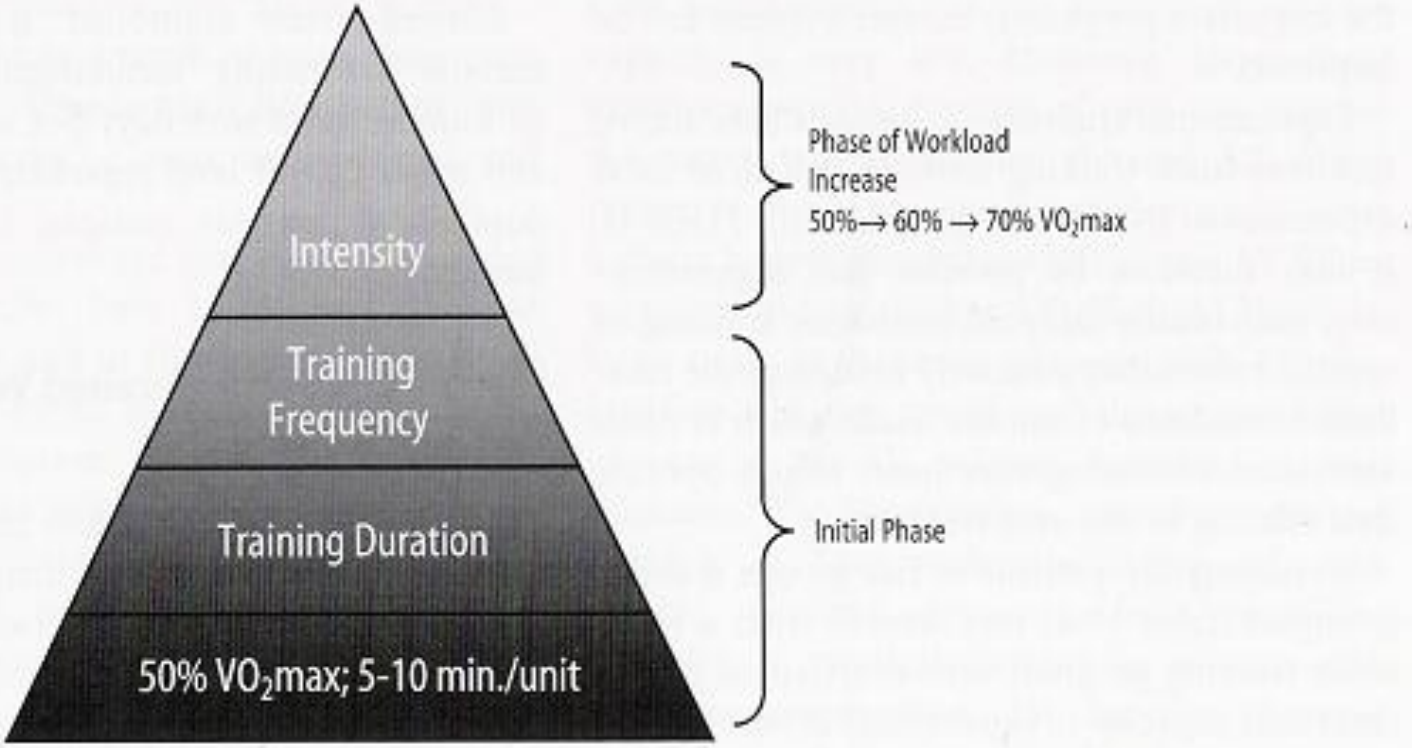


FIGURE 19-5. The training pyramid illustrates the gradual increase in training duration, frequency, and intensity which occurs at the beginning of a training program in CHF patients.

Risk factors for the development / maintenance of atrial fibrillation

- Age
- Heart disease (most important: heart failure)
- High blood pressure
- Alcohol consumption
- Family history/ genetic predisposition
- Obesity
- Metabolic syndrome
- Sleep apnea
- Anger / stress

Therefore: CARDIAC REHABILITATION: focus on decreasing these risk factors

Content

1) Exercise tolerance in patients with atrial fibrillation

2) Exercise training in patients with atrial fibrillation

3) Are there risks regarding exercise training in AF?

Endurance sport practice as a risk factor for atrial fibrillation and atrial flutter

Endurance sport practice increases 2 to 10 times the probability of suffering AF, after adjusting for other risk factors

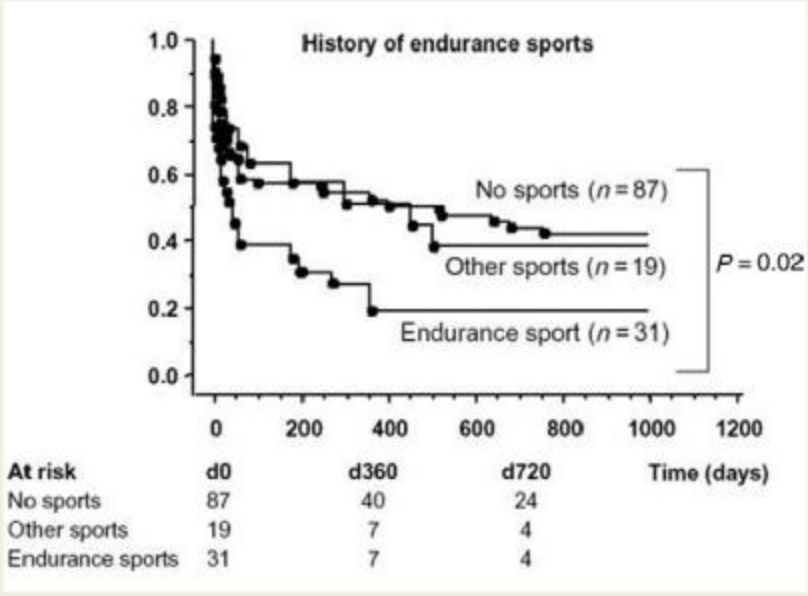
Table I Summary of the published studies analyzing the relationship between atrial fibrillation and atrial flutter and endurance sport practice.

Studies	Type of study	Men (%)	Age	Type of sport(s)	Cases/ controls	Odds ratio (CI) for AF in athletes
Karjalainen *et al.*[5]	Longitudinal case/control	100	47 ± 5 runners, 49 ± 5 controls	Orienteers	262/373	5.5 (1.3–24.4)
Mont *et al.*[6]	Retrospective compared to general population	100	44 ± 13 athletes, 49 ± 11 non-athletes	Endurance sports >3 h per week	70 lone AF	61% in male athletes with lone AF
Elosua *et al.*[7]	Retrospective case/control	100	41 ± 13 AF pat, 44 ± 11 controls	Endurance sports: current practice and >1500 accumulated hours of practice	51/109	2.87 (1.39–7.05) adjusted for age and hypertension
Heidbuchel *et al.*[8]	Case/control in patients undergoing flutter ablation	83	53 ± 9 sports, 60 ± 10 controls	Cycling, running, or swimming >3 h per week	31/106	1.81 (1.10–2.98)
Molina *et al.*[9]	Longitudinal case/control	100	39 ± 9 runners, 50 ± 13 sedentary	Marathon runners	252/305	8.80 (1.26–61.29) adjusted for age and blood pressure
Baldesberger *et al.*[27]	Longitudinal case/control	100	67 ± 7 cyclist, 66 ± 6 golfers	Cyclists	134/62	10% AF in cyclists, 0% AF in controls
Mont *et al.*[10], GIRAFA study	Prospective case/control	69	48 ± 11	Endurance sports	107/107	7.31 (2.33–22.9), >550 h of accumulated heavy physical activity

Mont et al, Europace 2009; 11: 11-17

Endurance sport practice as a risk factor for atrial fibrillation and atrial flutter

Endurance sport practice increases 2 to 10 times the probability of suffering AF, after adjusting for other risk factors



At risk	d0	d360	d720
No sports	87	40	24
Other sports	19	7	4
Endurance sports	31	7	4

Figure 1 Patients with a history of endurance sports before ablation ($n = 31$) developed significantly more atrial fibrillation than controls or those with a history of other type o sports activity after flutter ablation (reproduced from reference 8, with permission).

Mont et al, Europace 2009; 11: 11-17

Endurance sport practice as a risk factor for atrial fibrillation and atrial flutter

The possible mechanisms are still unclear:

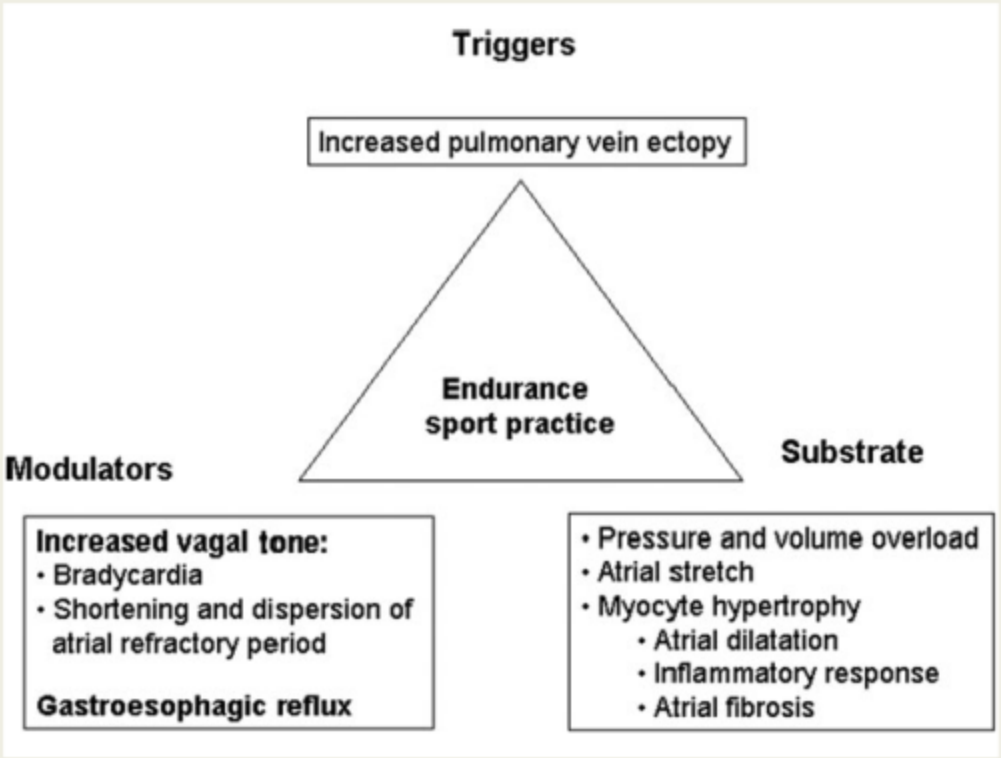


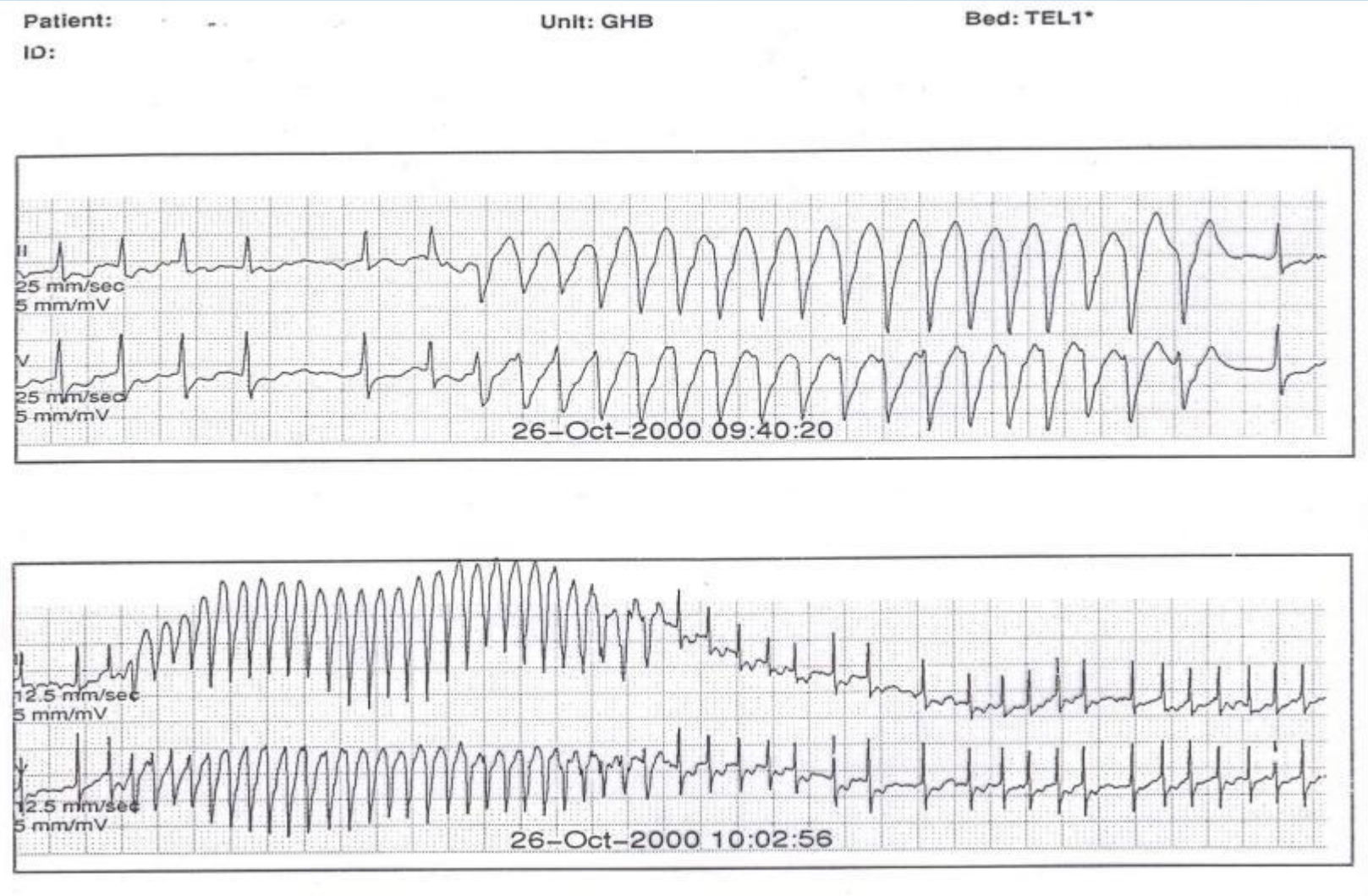
Figure 3 Classical triangle of Coumel suggesting possible etiopathogenic factors influencing the development of atrial fibrillation in athletes.

Mont et al, Europace 2009; 11: 11-17

Complications during exercise training in atrial fibrillation during training

- Stroke or TIA
- Anticoagulation: no contact sports
- Hemorrhage;
- Arrhythmias
  - AF with low ventricular response – arrest
  - Ventricular arrhythmias

Complications during exercise training



Conclusions

- Decreased exercise tolerance in chronic AF
- Few studies reporting effects of exercise training
  - Increase in exercise tolerance, comparable to control patients in sinus rhythm
  - Few recommendations on exercise training
- Exercise training is feasible, but safety precautions should be taken since complications during exercise may occur