Atrial fibrillation in athletes

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Sports Cardiology (M Papadakis, Section Editor)

Atrial Fibrillation (AF) in Endurance Athletes: a Complicated Affair

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This article is part of the Topical Collection on *Sports Cardiology*

Agenda

- Review of the literature Afib athletes

(based on observational studies! No randomized trials on athletes)

- Athlete's proarrhythmic heart
- Management of Athletes with Afib
- Future prospectives (big dataset)

ESC GUIDELINES 2016 Afib

- The 2016 European Society of Cardiology (ESC) guidelines Afib management:

"moderate regular physical activity is recommended to prevent AF, while athletes should be counselled that long-lasting intense sports participation can promote AF"

(Class of recommendation 1, Level of evidence A)

OBSERVATIONAL STUDIES

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- No Eur
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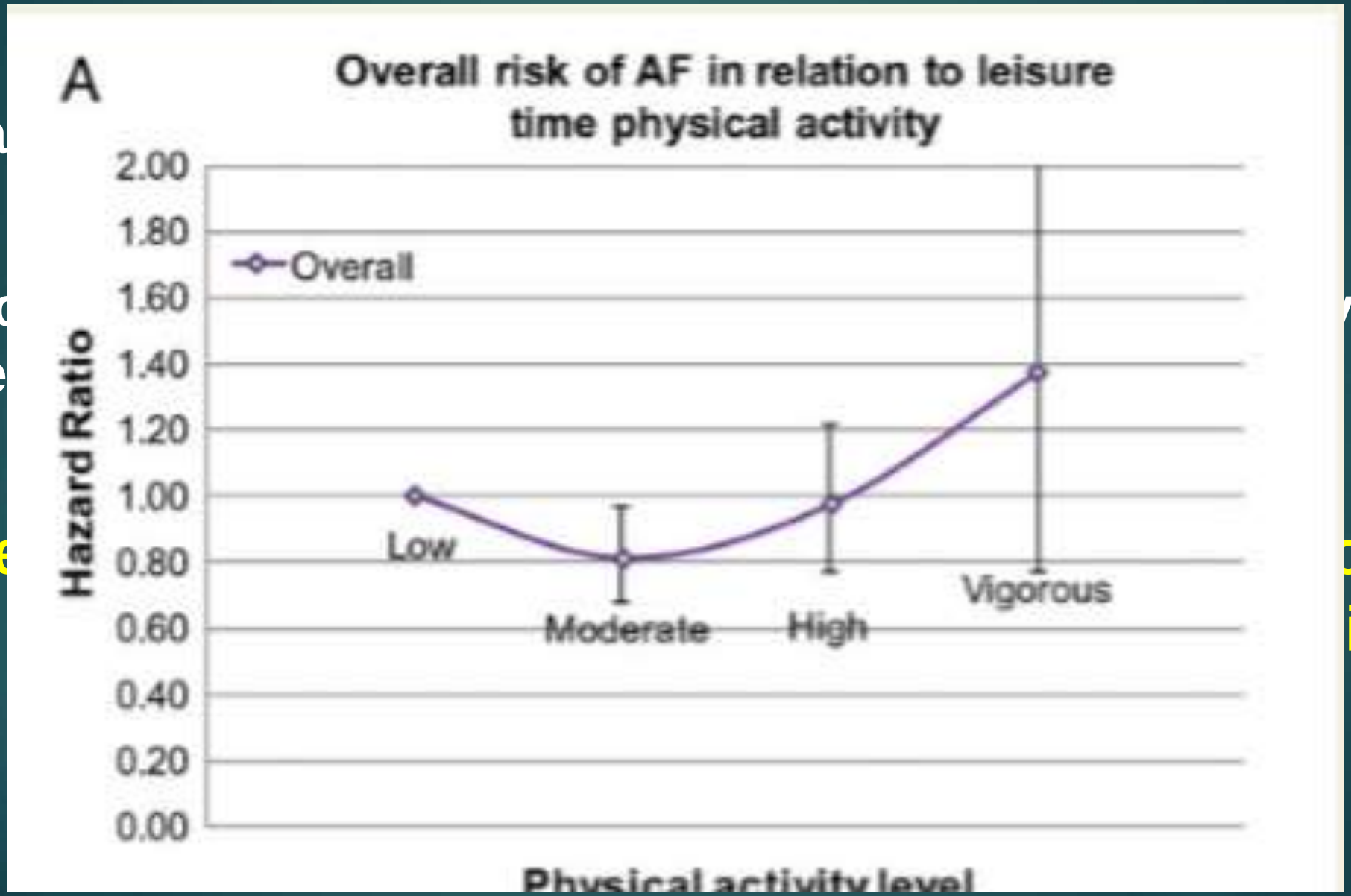


First Case Series Linking AF and Endurance Sports

Lone atrial fibrillation in vigorously exercising middle aged men: case-control study

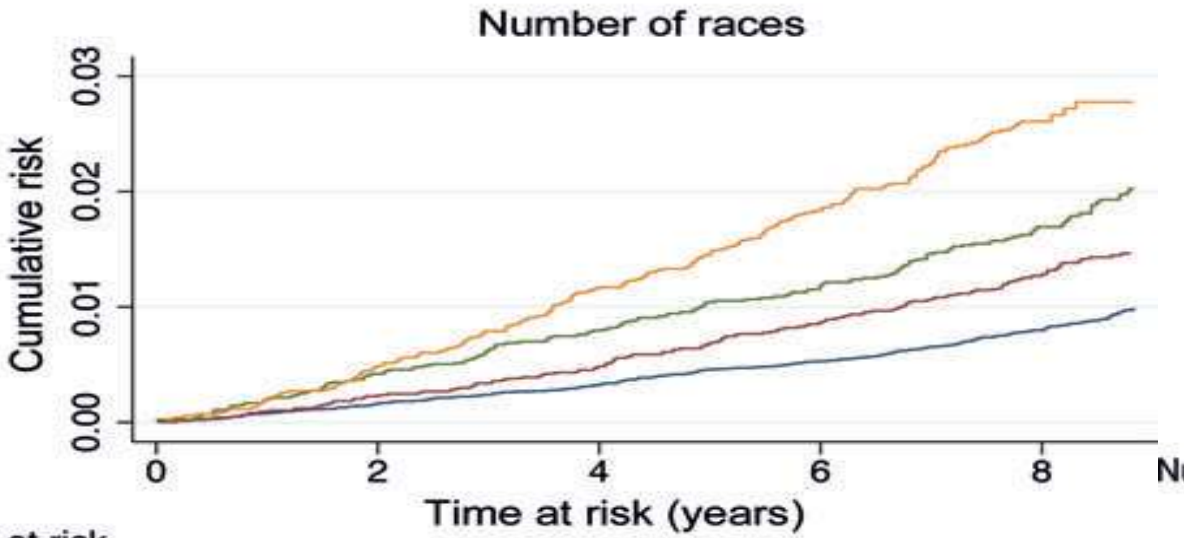
Jouko Karjalainen, Urho M Kujala, Jaakko Kaprio, Seppo Sarna, Matti Viitasalo

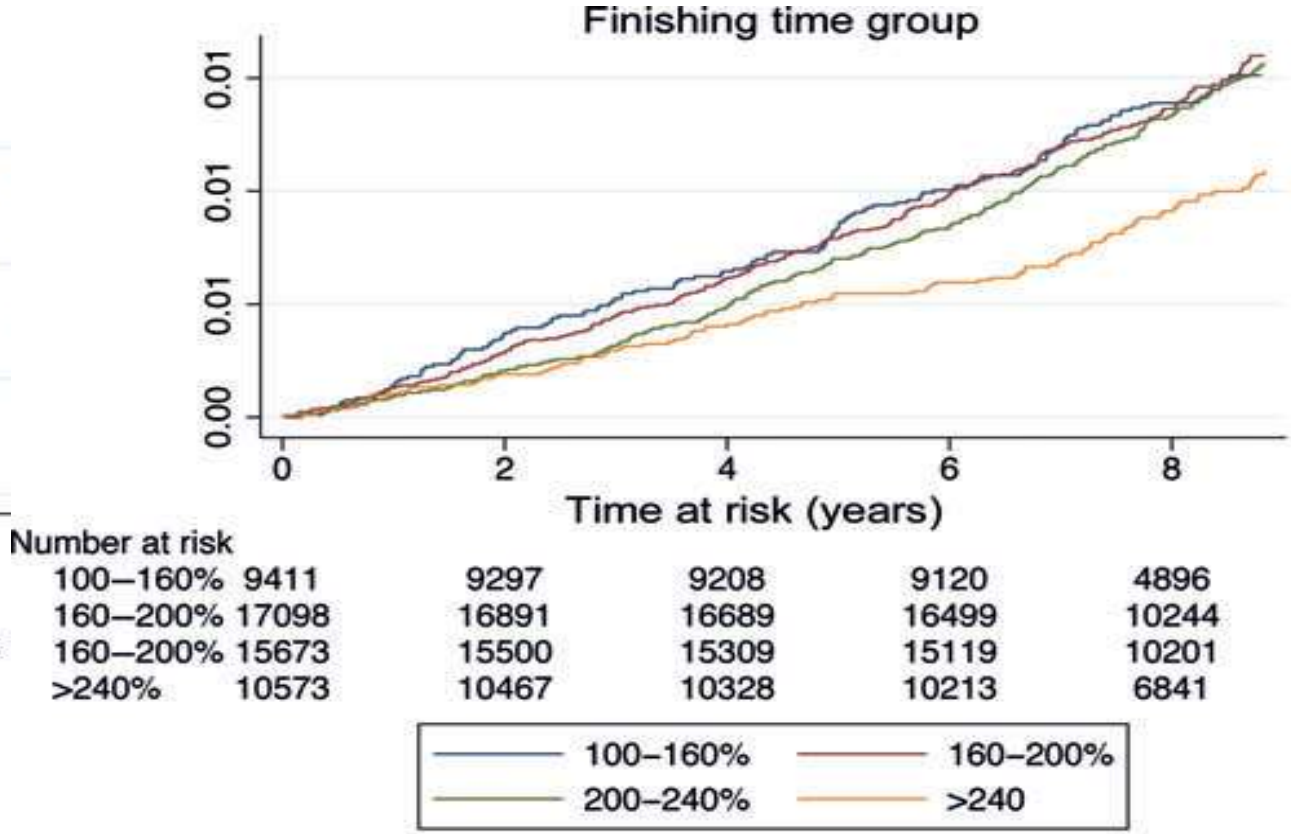
- Orienteering competitors: a competitive sport, originating in Sweden, that tests the skills of map reading and cross-country running, in which competitors race through an unknown area to find various checkpoints by using only a compass and topographical map, the winner being the finisher with the lowest elapsed time.
- 60 top ranked in 1984 in 5 different age classes (35-39, etc); 300 total; 262 (92%) participated in questionnaire: "Has a doctor ever told you that you have atrial fibrillation or atrial flutter." Current age 48 mean.
- Control group: 495 men age 50 mean; had been studied at age 35-39; had been healthy at 20 for military.
- Orienteers: lower mortality (1.7% v 8.5%); lower CAD (2.7% v 7.5%), fewer AF risk factors (10% v 30%). In men w/o AF risk factors lone AF occurred in 12/228 (5.3%) vs 2/212 (0.9%) of controls.
- Orienteers: Lone AF prevalence as of 1995 was 4.2% (4/95) for 46-54 yo; 5.6% (4/72) for 55-62 yo and 6.6% (4/61) for 63-70 yo. 3 had AFL too.

Karjalainen J et al, BMJ 1998;316:1784

Risk of arrhythmias in 52 755 long-distance cross-country skiers: a cohort study

Kasper Andersen[1]*, Bahman Farahmand[2,3], Anders Ahlbom[2], Claes Held[1], Sverker Ljunghall[1], Karl Michaëlsson[4], and Johan Sundström[1]





Observational studies on athletes

- Andersen data confirmed by different observational studies on smaller populations including control groups (athletes vs non athletes)

  - Runners
  - Skiers
  - Cyclist

  ENDURANCE ACTIVITY

BostonMaster Sport med open 2016, Baldesberger S Eur Heart J 2008,

Van Buuren F Acta Cardiol 2001

OBSERVATIONAL STUDIES

- Calvo Europace 2016: dose-response relationship between phisical activity and lone atrial fibrillation
  - U shaped relationship

Table 5 Risk of AF associated with the prese

Variables	Univariat
	OR
Abdominal obesity	3.03
Height (>179 cm)	3.31
Obstructive sleep apnoea	5.01
Sport activity	
Sedentary	1
High-intensity exercise <2000 h	0.38
High-intensity exercise ≥2000 h	3.88

Table 6 Risk of AF in specific exercise subgroups

	Unadjusted data	Adjusted for lifetime-accumulated exercise
Competitive sport	2.74 (0.88–8.47)	0.88 (0.23–3.43)
Exercise type		
Team sports	1	1
Endurance sports	3.4 (1.37–8.4)	5.68 (1.72–18.7)
Other	3.03 (0.9–9.7)	4.59 (0.5–41.1)

OBSERVATIONAL STUDIES: GENDER DIFFERENCE IN ATHLETES

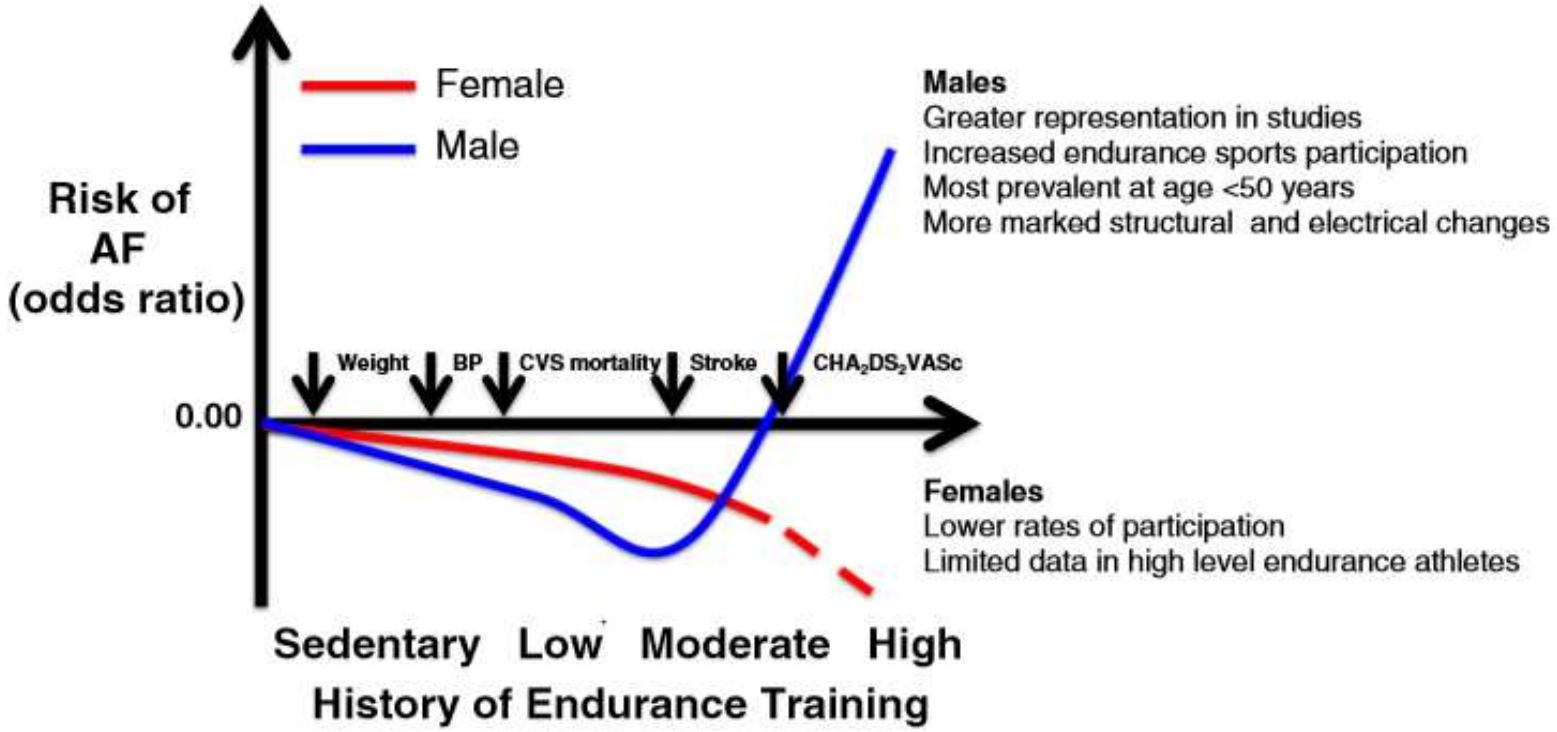


Fig. 1. Schematic of AF risk in males and females according to levels of participation in endurance sports. Male and female athletes show different risk profiles for AF as levels of endurance exercise increase. High-intensity endurance training is associated with increased risk of AF in males. The reverse is seen in females, although less data is available in females (dashed line). Despite an increasing AF burden in male endurance athletes, weight, blood pressure (BP), cardiovascular (CVS) mortality, stroke, and CHA_2DS_2-VASc scores fall in this group. Figure modified from Mohanty et al [40].

TROMSO STUDY : LONGITUDIAL PROSPECTIVE COHORT 10184 WOMEN

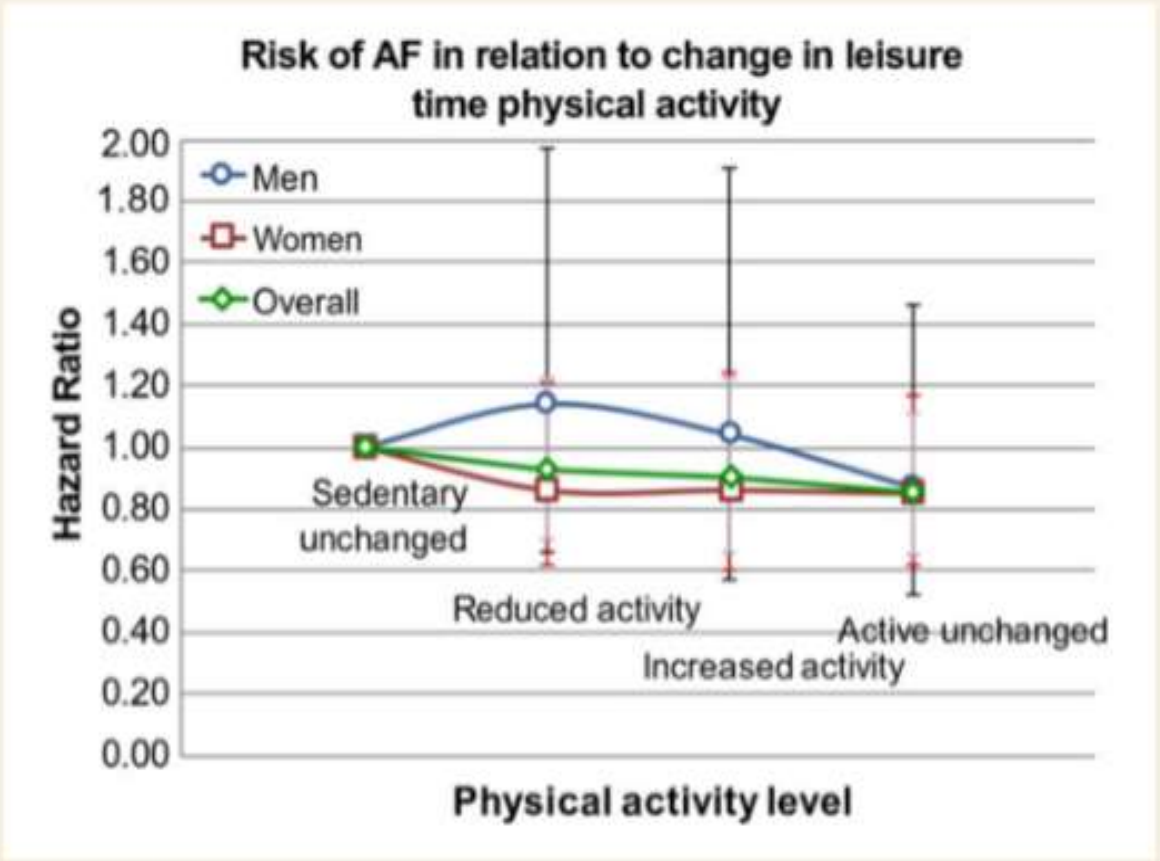
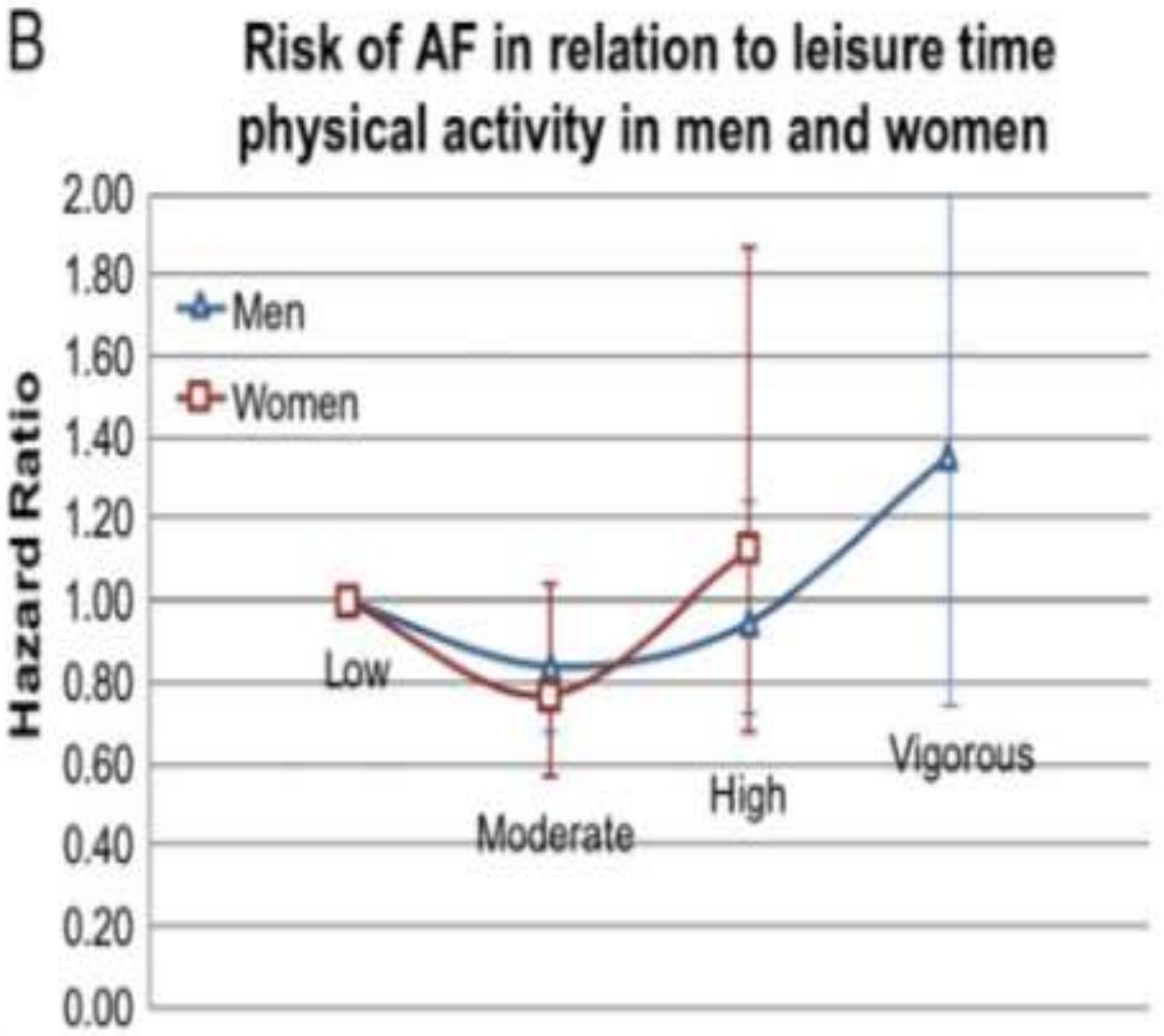


Figure 5 Risk of AF in relation to change in leisure time physical activity.



6 studies athletes Vs control (mean age 51, male 93%)

OR athletes 5

Europace 2009

19 studies (511.503 pts)

Subanalysis of athletes HR 1.98

U shaped (intense endurance and sedentary lifestyle associated with Afib)

Int J Cardiol 2014

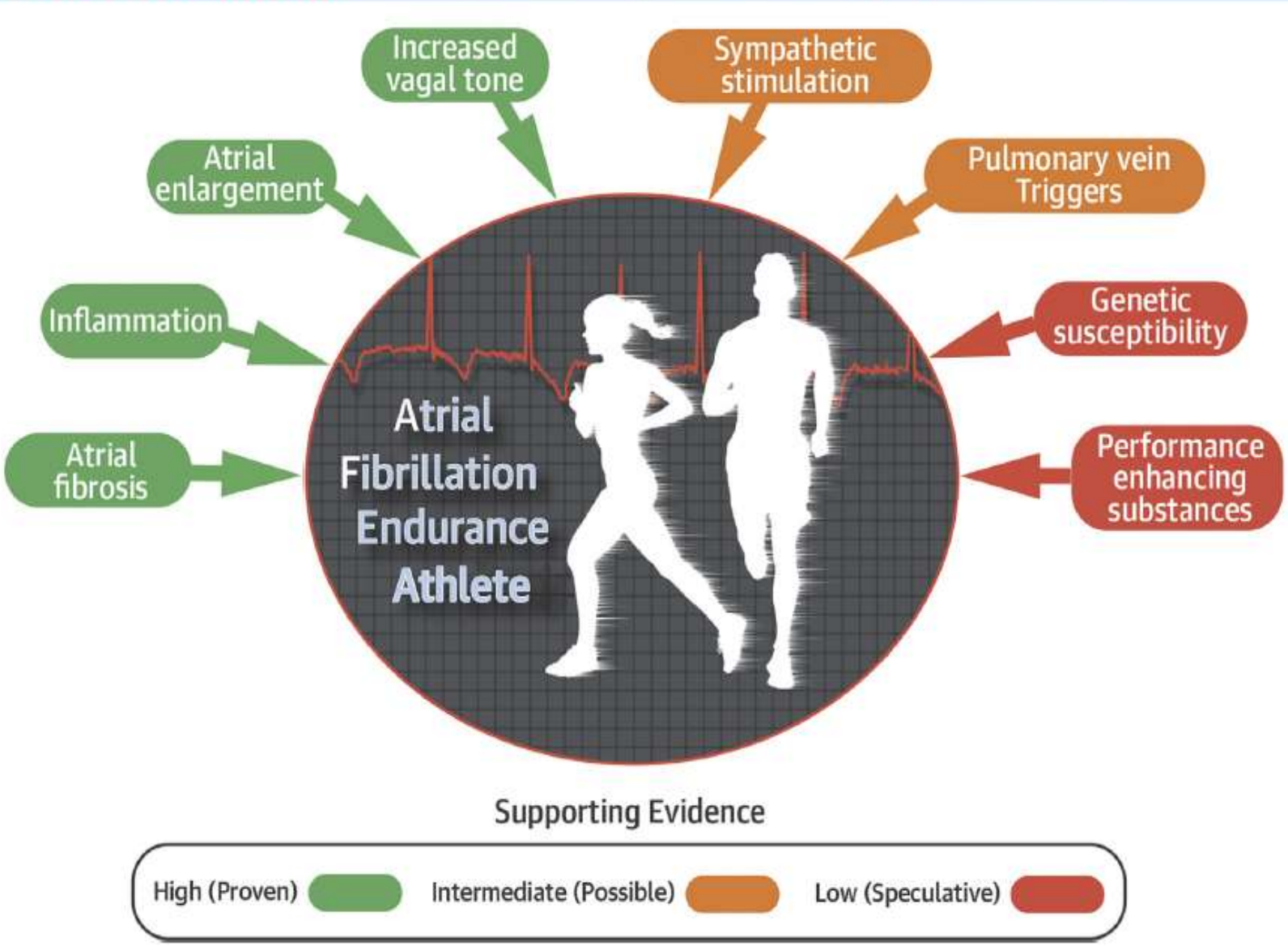
8 studies including 9.113 individuals

OR athletes (<54 years) 1,64

Int J Cardiol Heart Vasc 2018

PREDICTORS OF AFib IN ENDURANCE ATHLETES

CENTRAL ILLUSTRATION Proposed Pathophysiologic Mechanisms of AF in the Endurance Athlete



Estes III, N.A.M. et al. J Am Coll Cardiol EP. 2017;3(9):921-8.

Multiple factors contributing to atrial fibrillation (AF) with intense endurance exercise are shown with color coding according to the strength of the supporting evidence. PV = pulmonary vein.

Predictors of Afib in athletes

- Increased Left atrial volume (cohort of 1777 sports men more common in rowing and cycling)
- Bradicardia /higher vagal tone (Norwegian cross country skiers) –decreased expression of Current If SN automacity
- Cumulative duration of high intensity endurance training (cut off 2000 hours intense exertion/lifetime)

ESC
European Society of Cardiology

Europace (2018) **20**, 1401–1411
doi:10.1093/europace/eux294

REVIEW

The athlete's heart is a proarrhythmic heart, and what that means for clinical decision making

Hein Heidbuchel*

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Received 16 July 2017; editorial decision 20 August 2017; accepted after revision 25 August 2017; online publish-ahead-of-print 13 December 2017

Competitive Sport: ARRHYTHMIA TRIGGER , SUBSTRATE PROMOTOR AND INDUCER

1. Athlete with underlying and pre-existing heart disease

2. Physical activity may promote arrhythmias in genetic mutation (with silent phenotype)

3. Remodeling by sport activity induce a substrate for arrhythmias

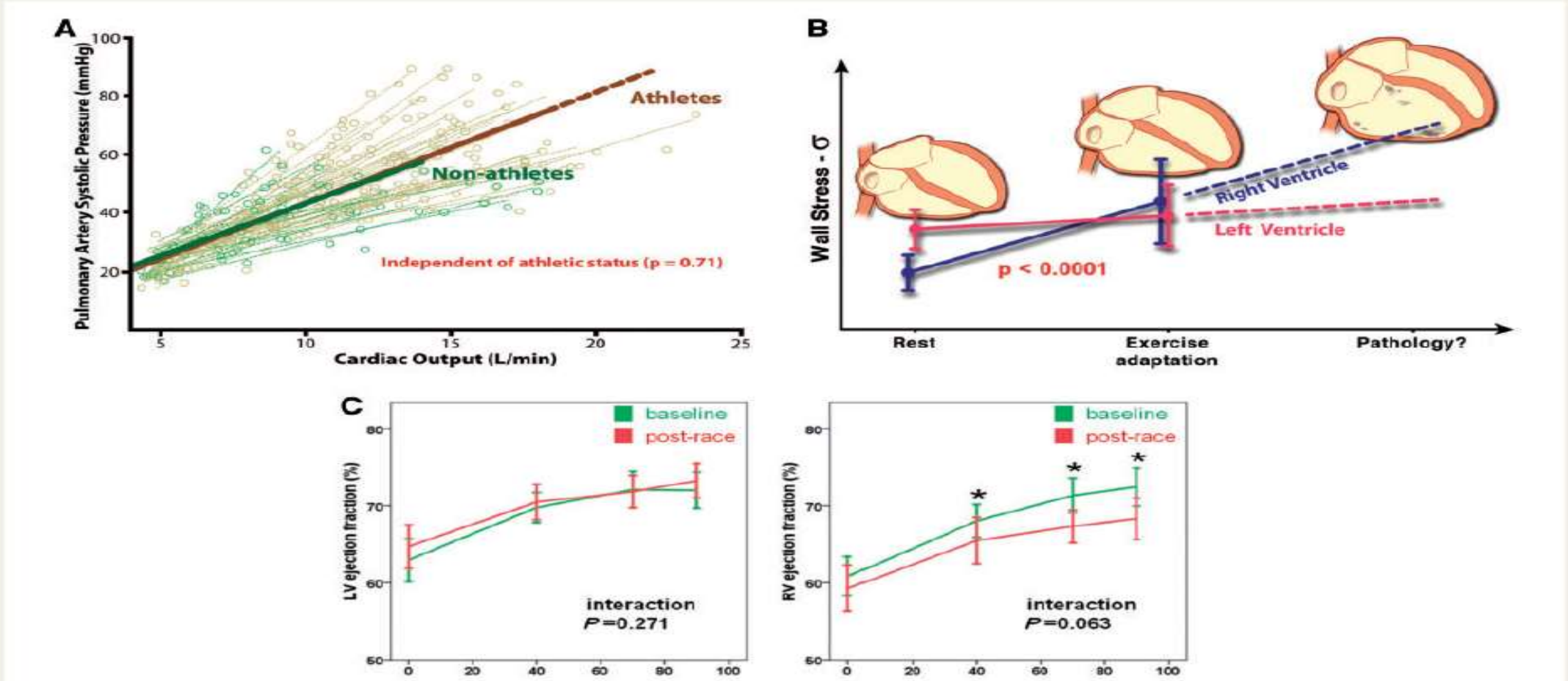


Figure 2 Particular strain on the right ventricle during endurance sports activity. (*A*) Pulmonary pressures increase almost linearly with increasing cardiac output, irrespective whether one is trained or not. In athletes, however, higher cardiac output will translate into higher peak systolic pressures. (*B*) This leads to higher increase of RV wall stress than LV wall stress during sports. (*C*) In turn, this may explain why at the end of an endurance event transient contractile dysfunction of the RV, but not of the LV, is observed during incremental workloads in an exercise cardiac magnetic resonance imaging setup. Data are presented as means and 95% confidence intervals. *P*-values are shown for the interaction between the change in ejection fraction and endurance exercise. Asterisks denote statistically significant differences between baseline and post-race measures ($P < 0.05$ by paired samples *t*-test). Adapated from and reproduced with permission from Heidbuchel *et al*, *Br J Sports Med* 2012 (A&B),[23] and Claessen *et al*, *Med Sci Sports Exerc* 2014 (C).[20]

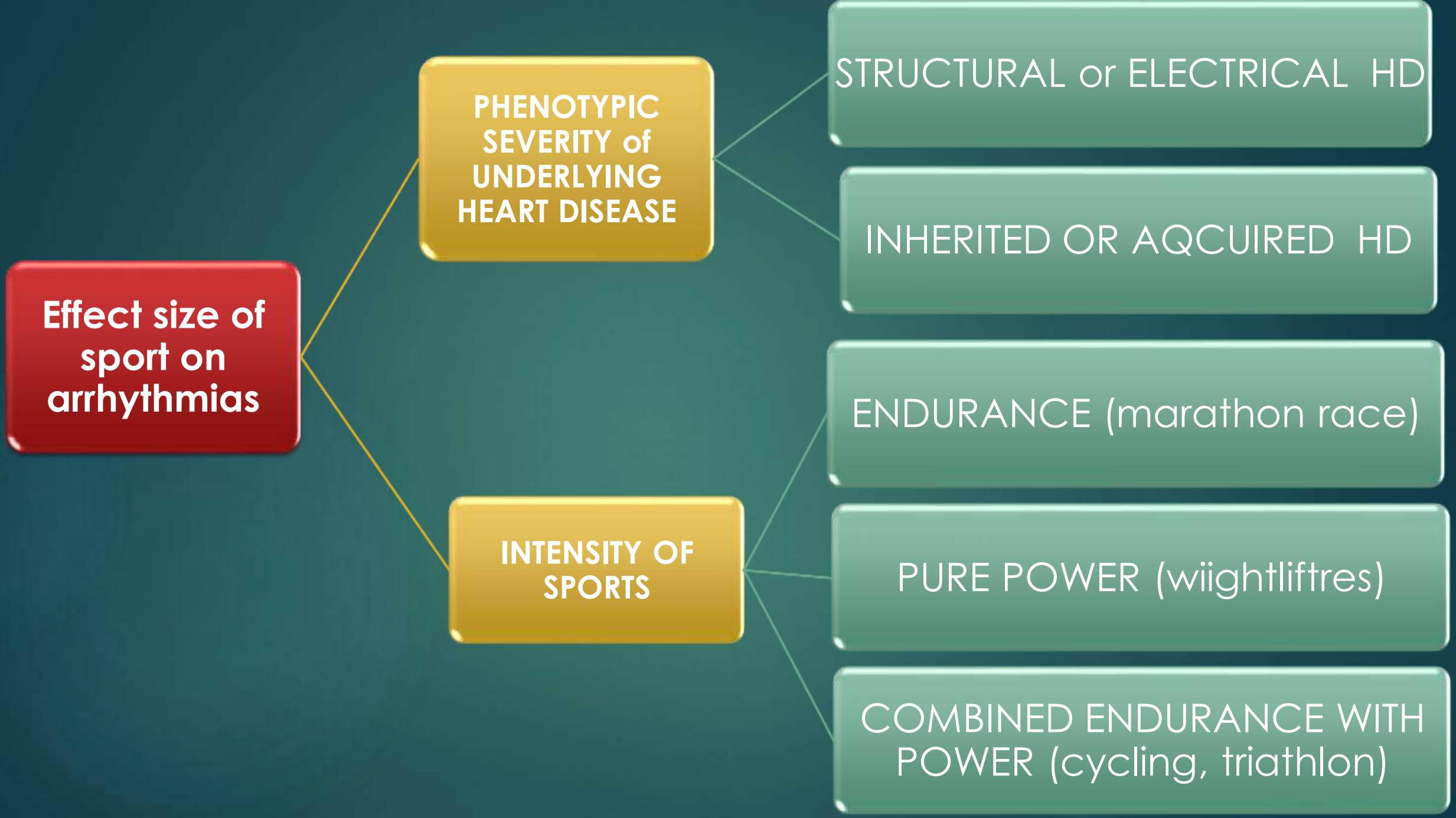
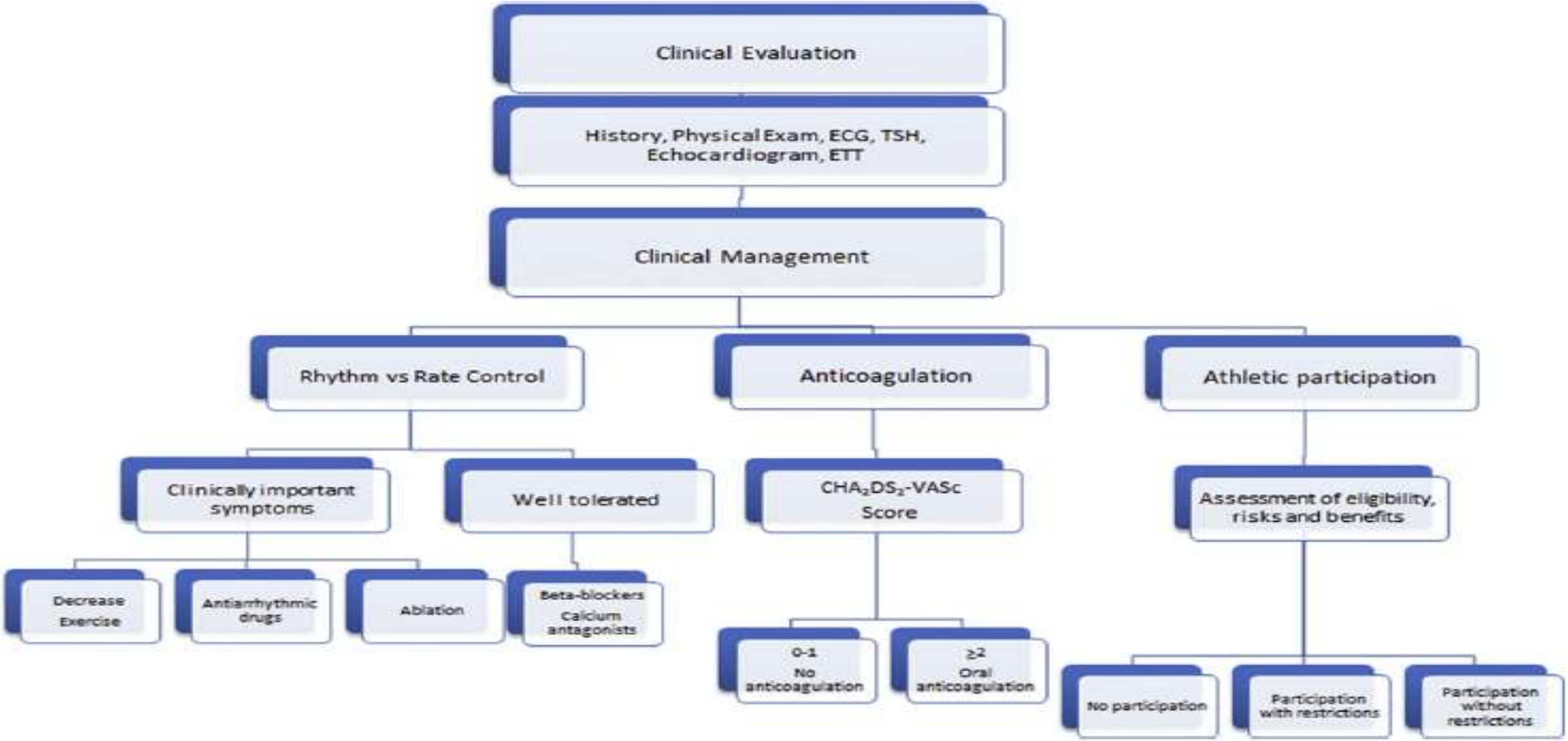

Effect size of sport on arrhythmias
PHENOTYPIC SEVERITY of UNDERLYING HEART DISEASE
STRUCTURAL or ELECTRICAL HD
INHERITED OR AQCUIRED HD
INTENSITY OF SPORTS
ENDURANCE (marathon race)
PURE POWER (wiightliftres)
COMBINED ENDURANCE WITH POWER (cycling, triathlon)

FIGURE 2 Evaluation and Management of AF in the Endurance Athlete



Clinical evaluation and management of the endurance athlete is shown related to rhythm versus rate control, anticoagulation, and athletic participation. ECG = electrocardiogram; ETT = exercise treadmill test; TSH = thyroid-stimulating hormone; other abbreviation as in Figure 1.

Table 1. Summary of key treatment options available to athletes with atrial fibrillation

Treatment options in athletes with AF	Advantages	Disadvantages	Comment
Anticoagulation (CHA_2DS_2-VASc ≥ 2)	Reduces stroke risk	CHA_2DS_2VASc not validated in athletes	There is no evidence that stroke risk in athletes and non-athletes with the same CHA_2DS_2-VASc score are the same
Flecainide	Reduces frequency and/or duration of AF episodes	Should be prescribed with a beta-blocker (see below)	ESC guidelines recommend no sporting activity until 2 half-lives of flecainide have elapsed due to pro-arrhythmic properties and risk of rapidly conducted flutter
Beta-blockers	May reduce AF burden in isolation or alongside flecainide	Reduced performance Poorly tolerated in setting of sinus bradycardia	Athletes are generally intolerant of or unwilling to take beta-blockers
Catheter ablation	May eradicate AF allowing return to full competition	Risk of complications May require multiple procedures	Most popular with athletes. Athletes dislike taking medication and look for a permanent fix

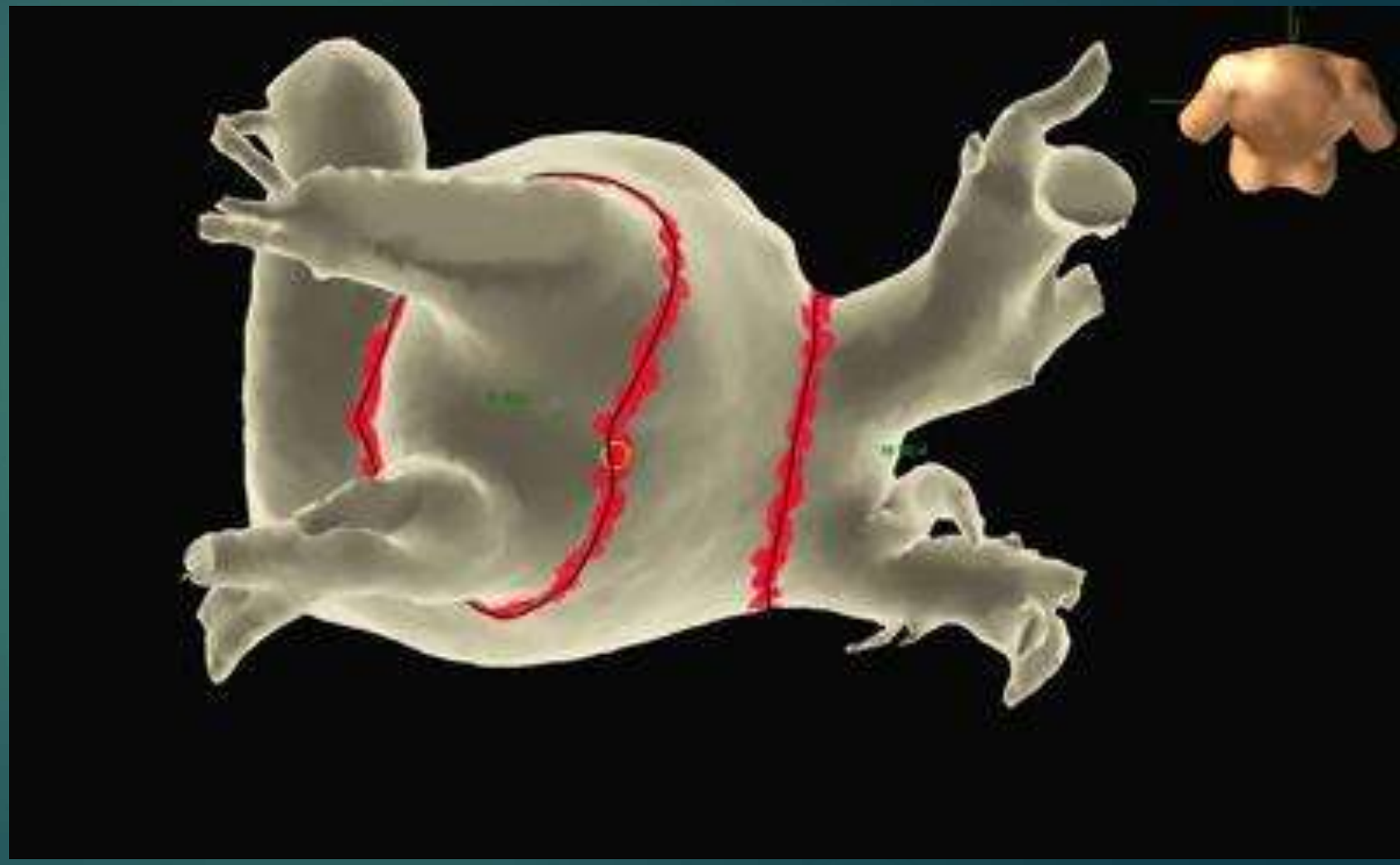
Catheter ablation should be considered in athletes with AF and is often the treatment that the athletes prefer [17]. Results of catheter ablation in small non-randomized cohorts of patients have been described [53–55] and outcomes are reported to be similar to those achieved in non-athletes. Importantly, no data is available on ablation outcomes in athletes with persistent atrial fibrillation or structurally abnormal hearts, e.g., significant atrial dilation or left ventricular dysfunction. Catheter ablation allows the athlete to return to competition without ongoing antiarrhythmic drug use.

CATHETER ABLATION oF AFIB IN ATHLETES

FEW DATA ON PVI ISOLATION IN ATHLETES with PAROXYSMAL AFIB
Koopman Europace 2011
Calvo Europace 2010

Lack of DATA on no PVI ISOLATION /PERSISTENT AFIb

No DATA on long term follow up with high detection tools
ECG PATCHES or ILR



Atrial flutter in athletes

- Prevalence 31% in endurance vs 8% no athletes)
- European Recommendations for partecipation in competitive sport (2006) advice "CT isthmus ablation is MANDATORY in atlhletes with prior atrial flutter in the absence of adequate and safe medical treatment"
- Isthmus ablation is recommended prophylactically in athletes undergoing PVI for Afib.

Eur J Cardiovasc Prev Rehabil 2006;13:676–86

Clinical significance of Afib in endurance Athletes

- KETTUNEN Br J Sport med 2015

- 2363 atheletes without afib vs 1657 controls median f up 50 years
- Reduced total mortality HR 0.70 for athletes
- Reduced ischemic heart disease HR 0.68 for athletes
- Reduced stroke mortality for athletes HR 0.52

EORP AF eurobservational research programme

https://www.escardio.org/Research/Registries-&-surveys/Registry-publications/

Registries & Surveys

- EURObservational Research Programme
- Registry Publications
- Participate in a Registry
- Why Sponsor the EORP?

EORP Publications

Latest results published from the EURObservational Registry Programme (EORP)

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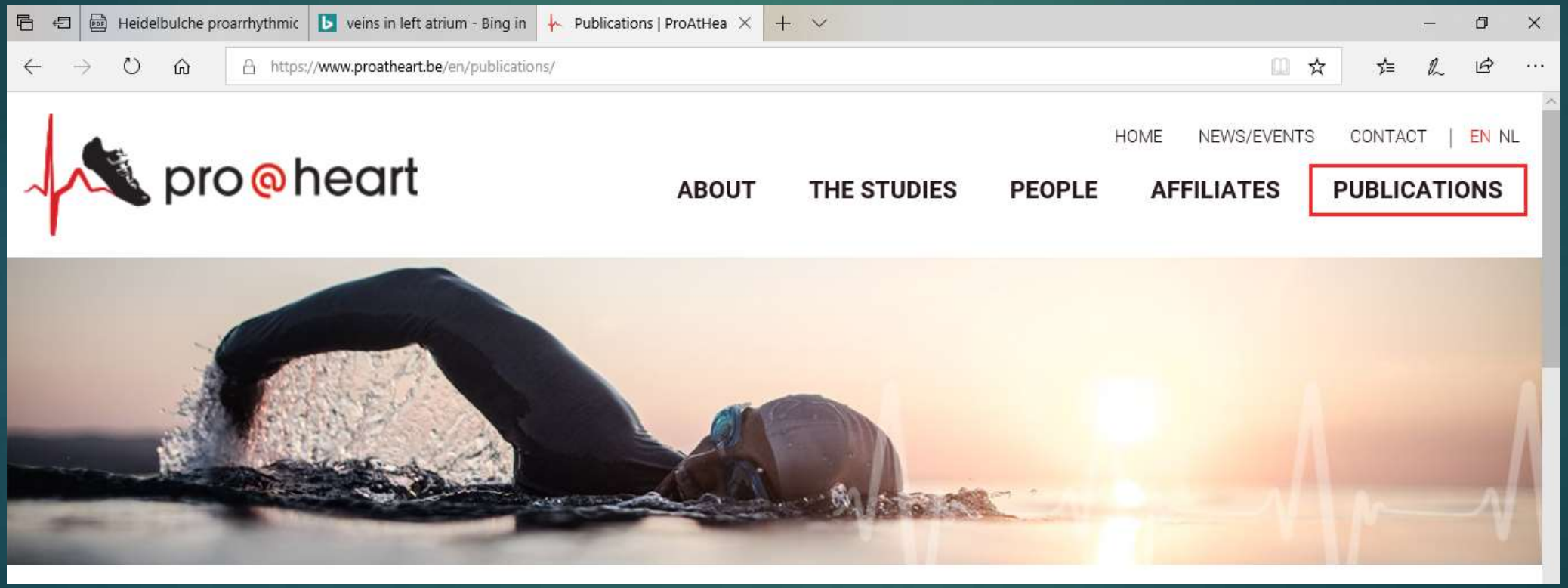
HIGH INTENSITY GROUP LOWER TOTAL MORTALITY

Table 4 Major adverse events during 1-year follow-up according to physical activity categories

	None (n = 949)	Occasional (n = 848)	Regular (n = 503)	Intense (n = 115)	P-value
CHA_2DS_2-VASc score					
Mean score ± SD	3.79 ± 1.74	3.31 ± 1.73	2.44 ± 1.68	2.17 ± 1.78	<0.0001
CHA_2DS_2-VASc class, n (%)					<0.0001
Class 0	22 (5.8)	35 (4.1)	65 (12.3)	19 (16.5)	
Class 1	76 (8.0)	103 (12.1)	101 (19.1)	29 (25.2)	
Class ≥2	851 (89.7)	710 (83.7)	364 (68.7)	67 (58.3)	

Future prospective
Long-term athletic remodelling study



Editorial

May 2018

Moving From Big Data to Deep Learning—The Case of Atrial Fibrillation

Mintu P. Turakhia, MD, MAS[1,2,3,4]

Author Affiliations

JAMA Cardiol. 2018;3(5):371-372. doi:10.1001/jamacardio.2018.0207

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