Atrial Fibrillation in Endurance Athletes
From Mechanism to Management

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KEYWORDS

• Atrial fibrillation • Athlete • Arrhythmia • Exercise • Cardiac

KEY POINTS

- Atrial fibrillation (AF) risk is elevated by endurance sports participation. Risk estimates range from a 3-fold to 9-fold increase, based on smaller case-control studies, to a 30% increase, based on larger cohort studies.
- Atrial remodeling seems to be a primary mechanistic promoter of AF in athletes, likely accompanied by autonomic alterations favoring re-entry.
- Despite limited data in athletes, treatment options include radiofrequency catheter ablation, which has been shown to have similar efficacy to that in nonathletic control patients. Rate control may be poorly tolerated, whereas anticoagulation should be guided by recommended guidelines using the CHA_2DS_2-VASc score.

INTRODUCTION

Exercise training exerts considerable health benefits, contributing to a substantial decline in cardiac and all-cause mortality in those who engage in regular physical activity.[1] Both measured physical activity[2] and cardiorespiratory fitness[3] strongly predict long-term health outcomes. In those who engage in more extensive endurance training, the benefits on mortality are profound,[4] although not necessarily over and above those observed with more modest exercise habits.

Despite the stream of empirical evidence supporting the benefits of exercise, the concept of exercise producing adverse effects on the heart draws considerable interest from both the medical research environment and the wider population. Traditional and social media are drawn to the stories in which an athlete experiences a cardiac disorder or worse, sudden cardiac death.

Although these events are infrequent and isolated,[5,6] there is mounting evidence to suggest that prolonged exercise training over many years

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may result in ventricular arrhythmias for a small minority of athletes.[7] Yet, more common within the endurance athlete population, with consistent data from both Europe and the United States, is the relative increase in atrial arrhythmia risk in endurance athletes compared with nonathletes.

PREVALENCE OF ATRIAL ARRHYTHMIAS IN ENDURANCE ATHLETES

Atrial fibrillation (AF) is the most common clinical arrhythmia with a growing global burden[8] leading to rising hospitalizations and health care demands.[9–11] Risk factors for AF include hypertension, obesity, and diabetes mellitus, as well as obstructive sleep apnea and alcohol intake. Recent evidence strongly supports risk factor modification, including increasing cardiorespiratory fitness, for the management of AF.[12–14] However, in the past 20 years, there has been a swell of evidence confirming that endurance sports practice also presents an independent risk factor for AF.

Based on the clinical observation that AF appeared more frequently in endurance athletes, Karjalainen and colleagues[15] compared AF prevalence in highly ranked orienteers versus age-matched healthy control participants from an earlier study. Using self-report to identify participants with AF before confirmation by medical records, AF was found to be more prevalent in athletes versus nonathletes (5.3% vs 0.9%, relative risk 5.5, 95% CI 1.3–24.4), despite lower mortality and vascular events in the athletes. In a case analysis, Mont and colleagues[16] later revealed that among lone AF patients seen in an outpatient arrhythmia clinic, the proportion of athletes among the AF group was substantially greater than that in the general population (63% v 15%, respectively). The same center subsequently published the findings of an age-matched case-control study,[17] in which 51 men with lone AF were compared against controls selected from the general population. The proportion of lone AF subjects reporting current sports practice was higher than in controls (31% v 14%; odds ratio [OR] 3.1, 95% CI 1.4–7.1). Interestingly, this study also attempted to determine a dose-risk assessment using sporting history questionnaires. Current sporting practice with greater than 1500 lifetime exercise hours increased AF risk (OR 2.9, 95% CI 1.2–6.9) compared with those who did not engage in sports. More recently, a similar case control study of subjects with lone AF has revealed a threshold of 2000 lifetime training hours, above which AF risk increases (OR 3.88, 95% CI: 1.55–9.73).[18]

Similar conclusions have been drawn from studies comparing AF prevalence within an athletic population compared with sedentary controls. Molina and colleagues[19] compared 183 amateur marathon runners with a population-based sample of 290 sedentary controls. The annual incidence rate of AF was significantly higher in athletes versus sedentary controls (0.43/100 persons vs 0.11/100 persons, adjusted hazard ratio 8.8, 95% CI: 1.3–61.3). Also in runners, Wilhelm and colleagues[20] noted an AF prevalence of 6.7% for athletes with a mean age of 42 years, considerably higher than recent estimates that suggest the prevalence for 40 to 44 year old men in Western Europe is approximately 0.2%.[8] In a comparison of former professional cyclists versus age and gender-matched golfers, Baldesberger and colleagues[21] identified 6 cases (10%) of AF or atrial flutter in the 62 cyclists, compared with 0 cases from the 62 participant control group.

One of the primary limitations with these studies is the relatively small sample size. This has been addressed recently by a series of studies from Scandinavia in which larger cohorts have been assessed to address the AF risk associated with endurance exercise. In more than 52,000 participants of the Vasaloppet 90 km cross-country ski race between 1989 and 1998, AF occurred more frequently in those who had completed greater than 5 races compared with those who had completed only 1 race, albeit with a lower risk estimate than shown previously (hazard ratio 1.29).[22] In this population, the number of completed races was taken as a surrogate measure of total training dose, although the reference group included participants who had completed 1 race, rather than a true sedentary group. This subtlety likely dampens the true risk estimate drawn from this study, although it does confirm the increased frequency of arrhythmias in athletes. Additionally, Myrstad and colleagues[23] compared a sample of cross-country skiers to a group recruited from a large population survey study. This study of more than 3500 participants (mean age ~ 65 y) found that participants with greater than 30 years of endurance training practice were at a greater risk of both atrial flutter and AF. The prevalence of self-report AF was 12.5% in athletes, with an adjusted risk increase of 26% (OR 1.26) for lone AF per each 10-year increase in training history.

Taken together, these studies provide convincing evidence that endurance exercise training leads to an elevated risk of AF that may be more pronounced in those athletes with more extensive exercise training history.

Searching for a Common Definition

Establishing a link between exercise training and AF depends strongly on the definition of what is