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Age modifies the risk of atrial fibrillation among athletes: A systematic literature review and meta-analysis

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ABSTRACT

Background: The relationship between competitive sports and atrial fibrillation (AF) is controversial. We aimed to systematically evaluate and summarize all published observational data on the association between competitive sports and AF.

Methods and results: We searched PubMed, EMBASE, Scopus and SportDiskus for all observational studies that assessed the risk of AF among athletes involved in competitive sports. Data were extracted and pooled odds ratios (OR) were calculated using random effects models. Six cohort studies and 2 case-control studies with a total of 9113 subjects were included in our meta-analysis. Pooled analyses showed an increased risk of incident and prevalent AF among athletes compared to the general population (OR = 1.64 [95% confidence interval (CI): 1.10–2.43]). Age-stratified analysis revealed an effect modification with age. Studies enrolling younger adults (<54 years) had an increased risk of AF among athletes compared to controls (OR = 1.96 [95% CI: 1.06–3.65]), but this association was not seen among older adults ≥54 years (OR = 1.41 [95% CI: 0.81–2.44], p = 0.23).

Conclusion: Athletes have an increased risk of AF compared to the general population. Age appears to modify the risk of AF in athletes.

1. Background

Atrial fibrillation (AF) is the most common cardiac rhythm disturbance, affecting between 2.7 and 6.1 million Americans [1]. The prevalence of AF increases from 2% in the young and middle aged to 9% in people older than 65 years [2]. AF increases the risk of stroke 5-fold and contributes to an estimated 130,000 deaths annually [1].

Large studies have shown that exercise has a U-shaped relationship with atrial fibrillation among the general population. The risk of atrial fibrillation decreases with moderate exercise but increases at the both ends of the exercise spectrum [3–5]. Nonetheless, the relationship between competitive sports and AF is controversial. A meta-analysis of small observation studies totaling 655 athletes and 895 controls showed significantly increased odds of AF in athletes compared to the general population (OR 5.29; 95% CI 3.57–7.85) [6]. However, Pelliccia et al. did not find an increased prevalence of AF among 1777 athletes without structural heart disease [7].

In light of more recent observational studies, we aim to update the findings of prior meta-analyses that have evaluated the risk of AF in athletes. Understanding the association between competitive sports participation and AF would contribute evidence to the growing field of cardiovascular care of young and middle aged athletes.

2. Methods

2.1. Search strategy

We searched Pubmed, Embase, Scopus and SportDiskus for all relevant full text articles published before August 1, 2017, without language restriction. The search keywords used in PubMed were ("atrial fibrillation" OR "auricular fibrillation") AND ("endurance" OR "exercise" OR "sports" OR "athletes"). The same search was adapted for Embase, Scopus

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and SportDiskus. References of retrieved articles were also reviewed for relevant articles.

2.2. Study eligibility

Articles initially retrieved by systematic search were screened by title. The following criteria were used to retain articles for further review: (1) Study assessed the association between competitive or semi-competitive sports and atrial fibrillation. (2) Study was a case-control or cohort study. (3) Study provided odds ratio and confidence intervals or the odds ratio could be calculated from the data provided.

We excluded studies using the following criteria: (1) Study evaluated physical activity that was not related to competitive or semi-competitive sports. (2) Study focused on valvular or postoperative atrial fibrillation. (3) Study focused on atrial flutter. When studies included both atrial flutter and atrial fibrillation, we extracted only the atrial fibrillation numbers for use in our analysis. (4) Study had control arm that was not representative of the general population. (5) Study was a case report, letter to editor or comment. (6) Study did not have sufficient data.

Our initial search retrieved 1552 articles. See Fig. 1 for PRISMA flow diagram. After exclusion by title, 125 articles were selected for detailed review. One hundred and fifteen (115) articles were further excluded. Of these, 30 were review articles, 19 did not report on incidence or prevalence of atrial fibrillation, 12 studies involved non-athletes as cases, 21 studies had inadequate or no controls, 4 were editorials or commentaries, and 29 were duplicates. Two studies were later excluded because one had controls not representative of the general population, and the other did not have controls. Eight (8) studies were included in the meta-analysis.

2.3. Data extraction and quality assessment

Two reviewers (HA and VC) extracted all data. Data extracted include study location, sample size, baseline demographic and clinical data, type of sport, criteria for AF diagnosis, counts for AF and controls, and adjusted/unadjusted odds ratios (OR) and confidence intervals (CI). Differences in data between the 2 reviewers were resolved by a 3rd reviewer. Study quality was assessed by the Newcastle Ottawa Scale [8]. This assessed three domains, including risk of bias in selection, comparability and exposure assessment. We classified studies with quality scores of 6 or greater as high quality (maximum score on the scale is 9). Otherwise, studies were classified as low quality.

2.4. Definition of atrial fibrillation

Four of the selected studies assessed lone AF. This was defined as atrial fibrillation in the absence of structural heart disease or identifiable etiology such as hyperthyroidism, diabetes, hypertension, etc. [1]. The remainder of the selected studies (with the exception of one) did not specify AF type, but controlled for known AF risk factors.

2.5. Data synthesis and analysis

We extracted OR and 95% CI, or calculated them from raw outcome data obtained from the studies. Microsoft Excel 2013 and Review

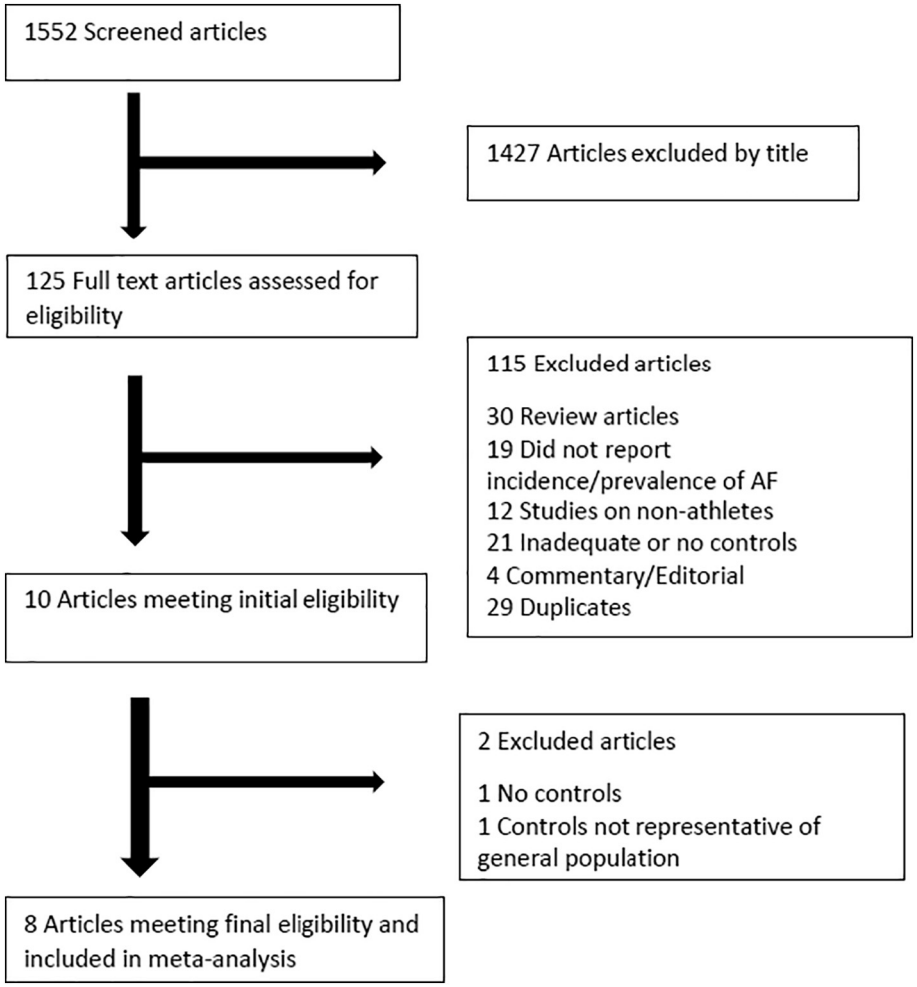

Fig. 1. PRISMA flow chart describing study selection.