

Abnormal Electrocardiographic (ECG) Findings Among Iranian Professional Athletes Competing In The 17th Asian Games, Incheon, 2014

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Abstract

Long-term, intense physical activity causes benign, reversible cardiac remodeling, also known as athletic heart syndrome (AHS). Physiologically, an athletes' enhanced sympathetic activity alters their usual QRS and T wave patterns. Sinus bradycardia, grade 1 and 2 heart blocks, left ventricular hypertrophy (LVH), J-point, T wave inversion (TWI), and in rare circumstances, ST-segment elevation are among the usual ECG alterations in AHS. It is important to rule out sudden cardiac death (SCD) because it can also be screened with these changes. So the aim of the current study was to determine the prevalence of abnormal ECG findings in Iranian professional athletes competing at the 17th Incheon Asian Games in 2014. This cross-sectional study was conducted on 318 athletes by the Sports Medicine department of Shahid Beheshti University of Medical Sciences, Tehran, Iran. Medical records of the participants were accessed through the Sports Medicine Federation of the Islamic Republic of Iran. Participants' ECGs were accessed from their medical records. 67 females (21.1%) and 251 males (78.9%) were enrolled. The mean age of the participants was 20.2 years (range: 15-44). Long QT was found in 7 athletes (2.2%), while long QT syndrome was found in 2 athletes (0.32%). In total, 2 athletes (0.6%) had TWI in their ECG. Anterior TWI was not observed in any of the participants. Three participants (0.9%) had atrial premature complexes (APC), 43 participants (13.2%) had sinus arrhythmias, and 272 participants (85.8%) did not have any arrhythmias. Although ECG is an inexpensive and useful tool for screening any potential cardiac abnormalities in the population, it's informing benefit in limited.

Keywords: sudden cardiac death; athlete; arrhythmia; electrocardiogram; athletic heart

INTRODUCTION

Long-term, intense physical activity causes benign, reversible cardiac remodeling, also known as athletic heart syndrome (AHS) (1, 2). This includes hypertrophy of the ventricles, a lower pulse rate at rest, and electrophysiological changes (2, 3). Despite the fact that these changes may be hard to distinguish from cardiomyopathies due to their similarities, it is important to distinguish them from one another (3, 4). Because one is a benign physiologic condition and the other is the leading cause of sudden cardiac death (SCD) among young professional athletes (5, 6). SCD is an uncommon cause of mortality among athletes. However, due to the sudden nature of this condition and the popularity of a professional athlete, more attention is being diverted towards this condition and its screening techniques (5, 6). We may use the electrocardiogram (ECG), a straightforward, low-cost technology, to our advantage in this way (7). Physiologically, an athletes' enhanced sympathetic activity alters their usual QRS and T wave patterns. Sinus bradycardia, grade 1 and 2 heart blocks, left ventricular hypertrophy (LVH), J-point, T wave inversion (TWI), and in rare circumstances, ST-segment

elevation are among the usual ECG alterations in AHS (7). TWI in the V1-V4 precordial leads is a common finding in African-American athletes and young athletes under the age of 15 (8). However, the incidence of arrhythmogenic right ventricular cardiomyopathy (ARVC), a known cause of SCD, rises in Caucasian athletes with persistent TWI (8). Currently, the status of ECG findings in Iranian ethnicity athletes has not been clarified yet. Furthermore, hypertrophic cardiomyopathy, the main cause of SCD, may be indicated by TWI in lateral leads (9). Arrhythmias and Long QT syndrome are two additional abnormal ECG alterations that are known to raise the risk of SCD in the athletic population (10, 11). The sudden death of an athlete is a tragic event with wide-ranging social effects. Therefore, the risk of mortality and its social burden can be significantly decreased in this population with a proper screening using an ECG (7, 10, 11). A clinician would certainly benefit from being informed of the prevalence of ECG anomalies in this population in order to effectively facilitate this procedure. So the aim of the current study was to determine the prevalence of abnormal ECG findings in Iranian professional athletes competing at the 17th Incheon Asian Games in 2014.

MATERIALS AND METHODS

This cross-sectional study was conducted on 318 international-level Iranian professional athletes competing in the 17th Asian Games, Incheon, 2014, by the Sports Medicine department of Shahid Beheshti University of Medical Sciences, Tehran, Iran. Medical records of the participants were accessed through the Sports Medicine Federation of the Islamic Republic of Iran. Participants without an ECG in their medical records were excluded. Written informed consent was obtained from the participants to include their clinical details. All procedures conformed to the Declaration of Helsinki's ethical guidelines.

Participants' ECGs (CONTEC Medical Systems Co., ECG 600G) were accessed from their medical records. The QT interval was measured using Bazett's correction formula. A QT interval between 320 ms and 460 ms (in men) or 470ms (in women) was considered normal. A QT interval between 460 (in male) or 470 (in female) and 500 was considered long, and a QT interval over 500 ms was considered long QT syndrome. TWI was assessed using SEATTLE criteria. More than 1 mm TWI was considered abnormal in V2-V6 precordial leads and I, II, aVL, and aVF limb leads. In addition, any existing arrhythmias in the ECGs were documented.

SPSS software version 24 was utilized for data analysis. Descriptive data are presented as mean, standard deviation, and range, or frequency and percent.

RESULTS

In total, 318 professional athletes, including 67 females (21.1%) and 251 males (78.9%), in 19 different branches, were enrolled. Table 1 shows a brief report of the participant's professional sports branches. The mean age of the participants was 20.2 years (range: 15-44). 197 participants (62.3%) were between 15 and 25 years old, 106 (33.2%) were between 26 and 35, and 15 (4.4%) were between 36 and 45.

Long QT was found in 7 athletes (2.2%) (6 male and 1 female), while long QT syndrome was found in 2 athletes (0.32%) (Both male). In total, 2 athletes (0.6%) (Both male) had TWI in their ECG. One of them was a 26 year-old wrestler with TWI in aVF and II. He also had a RAD and a pulse rate of 65. The other one was a 37-year-old handball player with TWI in V4-V6. He also had ST-segment elevation in V5-V6 and a pulse rate of 60. Anterior TWI was not observed in any of the participants. Also, none of the female athletes had TWI in their ECG. Three participants (0.9%) had atrial premature complexes (APC), 43 participants (13.2%) had sinus arrhythmias, and 272 participants (85.8%) did not have any arrhythmias. There was no statistically significant relationship between arrhythmia and gender (P value = 0.062). There was no statistically significant relationship between arrhythmia and age groups (P value = 0.207). There was no statistically significant relationship between the athlete's sport branches and arrhythmia (P value = 0.332).

DISCUSSION

The sudden death of an athlete is a tragic event with wide-ranging social effects. Therefore, the risk of mortality and its social burden can be significantly decreased in this population with a proper screening using an ECG. A clinician would certainly benefit from being informed of the prevalence of ECG anomalies in this population in order to effectively facilitate this procedure. So the aim of the current study was to determine the prevalence of abnormal ECG findings in Iranian professional athletes competing at the 17th Incheon Asian Games in 2014.

Farahani et al. (12) assessed the ECGs of 239 Iranian athletes in 2012 and found long QT in 1.7% of the participants. In the present study, we found long QT in 2.2% and long QT syndrome in 0.38%. Basavarajiah et al. (13) assessed the prevalence of long QT among 2000 English athletes. In contrast to the present study, they found 0.4% long QT. Another study by Maron et al. (14) in the United States on 1866 athletes found only 0.3% long QT.

Farahni et al. (12) and Salehi et al. (15) found 1.5% and 3.1% TWI among Iranian athletes, respectively. However, in this study, only 0.6% of the participants had TWI, and none of them were anterior. TWI in the lateral and inferior leads of the ECG should be considered pathologic as most of the SCD causes, hypertrophic cardiomyopathies (HCM) and arrhythmogenic right ventricular cardiomyopathy (ARVC), present with these types of TWIs (16). However, other significant abnormalities in ECG such as RBBB and ST-segment elevation can be a presentation of AHS (11).

Previous studies have measured the prevalence of atrial fibrillation among professional athletes. It has been estimated that 5 to 10% of professional athletes suffer from AF. The prevalence of AF among athletes is 2 to 10 times greater than general population and it is associated with 2 times higher risk of mortality (17-19). A systematic review by Newman et al. (20) found a significantly higher risk of developing AF in professional athletes (P < 0.001, OR: 2.46). However, no case of AF was found in this study. Another study by Zorzid et al. (21) assessed premature ventricular complexes (PVC)

among 134 professional athletes. In their study, 26% of the participants had PVC. They found no relationship between PVC occurrence and length of training or years of experience. In the present study, no PVC was observed, however, 0.9% of the participants showed APC.

CONCLUSION

Although ECG is an inexpensive and useful tool for screening any potential cardiac abnormalities in the population, its informing benefit is limited. This study was conducted with a descriptive design, and it was not possible to follow up and carry out intervention; therefore, it is suggested to conduct interventional studies that follow up the athletes.

Availability of data and materials: The data are available with the correspondence author and can be reached on request.

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Tables

Table 1. Professional sport branches of the participants.

Branch	Number (Percent)	Branch	Number (Percent)
Weightlifting	3 (0.9%)	Fencing	13 (4.1%)
Boating	43 (13.6%)	Gymnastics	7 (2.2%)
Boxing	5 (1.6%)	Trap shooting	11 (3.4%)
Bicycling	8 (2.5%)	Karate	22 (6.9%)
Basketball	28 (8.8%)	Wrestling	7 (2.2%)
Shooting	13 (4.1%)	Taekwondo	28 (8.8%)
Handball	20 (6.3%)	Wushu	15 (4.7%)
Water polo-Swimming	18 (5.7%)	Judo	10 (3.2%)
Kabaddi	19 (5.9%)	Track and field	13 (4.1%)
Archery	21 (6.6%)	Total	318 (100%)