Journal of General and Emergency Medicine

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Case report

Normal Variants of Early Repolarization Pattern in Endurance Athlete

This article was published in the following Scient Open Access Journal:
Journal of General and Emergency Medicine
Received December 24, 2016; **Accepted** January 07, 2017; **Published** January 16, 2017

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Abstract

The ECG diagnosis is always a challenge for all physicians and particularly for those working in the setting of sports cardiology. With this report, the author describes an original case of a healthy marathon runner who presents equivocal ECG pattern in the setting of sports pre-participation screening. The interpretation of the ECG in the context of the individual patient presentation is mandatory. This interpretation strategy allows the clinician to discern among normal, potentially abnormal, and abnormal.

Keywords: Electrocardiography, Athletes, Early repolarization pattern, Wellens-type T waves

Introduction

The ECG diagnosis is always a challenge for all physicians and particularly for those working in the setting of sports cardiology [1,2]. For example, the natural history of the inverted T wave is variable, ranging from a normal life without pathologic issues such as normal variant T- wave inversions and the persistent juvenile T-wave inversion [3] to sudden death related to cardiac or respiratory syndromes like acute coronary ischemia, pulmonary embolism, and so on [4]. In fact, a multitude of clinical syndromes can cause T-wave inversions, so the diagnosis is not always straightforward. The interpretation of the ECG in the context of the individual patient presentation is mandatory. This interpretation strategy allows the clinician to discern among normal, potentially abnormal, and abnormal [5].

Case Report

Herewith the author wants to describe an anecdotal case of a healthy and asymptomatic middle-aged marathon runner who came to our center for sports pre-participation screening. Figure 1 shows in the resting ECG a sinus bradycardia, high

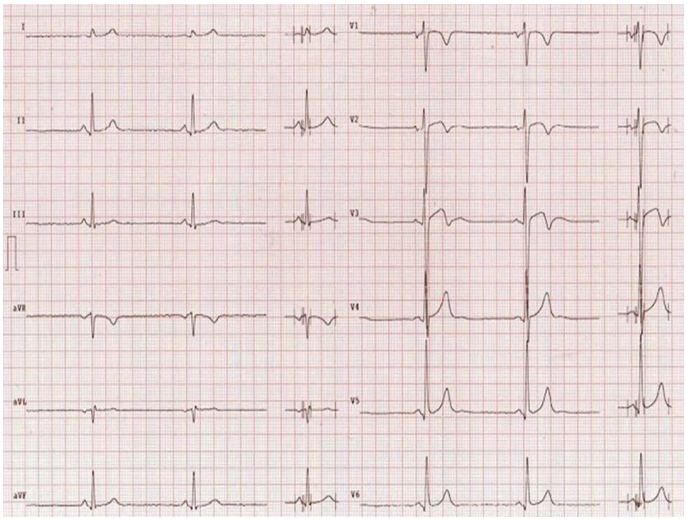

Figure 1: Resting ECG shows sinus bradycardia, high voltage, ST-segment elevation on the precordial leads V2 and V3 and inverted T-waves with prominent U-waves in the same ones.

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voltage, ST-segment elevation on precordial leads V2 and V3 and there are inverted T-waves in V2 and V3 with prominent U-waves in the same leads. A maximal exercise stress testing showed the normalization of ST-T wave findings. A subsequent echocardiography was completely normal. The athlete was considered eligible for sports competitions.

Discussion

A Scientific Statement from the American Heart Association on Electrocardiographic Early Repolarization has recently been published [6]. Other benign causes of T-wave inversion include the digitalis effect and the persistent juvenile T-wave pattern. Persistent juvenile T-wave inversions may appear in the right precordial leads (eg, V1, V2, and V3) with an accompanying early repolarization pattern (ERP) [3]. These findings may continue into adulthood, and some patients demonstrate persistent T-wave inversions in the precordial leads. ERP is more common in athletes than in the general population. Prevalence has been reported variably, depending on the definitions used and the population studied. Older reports show the prevalence to be as high as 58% in a cohort of marathon runners [7] using historical ERP definitions. Reports from Italy's national pre-participation screening program state 34% of adult elite athletes have the ERP pattern, comprising upward ST-segment elevation in ≥2 peripheral or precordial leads, beginning from an elevated J-point and continuing with an upsloping shape into the T-wave' [8]. In this case the author is absolutely sure of a normal variant of a ST elevation with T- waves inversion due to Early Repolarization Pattern in healthy athlete [9]. As literature reported [4], this pattern is most often seen in young black men, a few of whom at other times manifest the typical early repolarization pattern. These are the reasons: (I) Firstly because the author has a good eye on ECGs of endurance athletes; (II) Secondly, because the author has seen a lot of these tracings in resistance athlete; (III) Thirdly because the stress test determines the disappearance of ECG abnormalities found at rest; (IV) Fourthly because the echocardiogram is normal, and for last, the clinical presentation speaks clearly. However, many physicians could be worried about ischemic ECG pattern, including Wellen's syndrome [10,11]. But, we have to notice that the QTc is very short and also one must realize that the last wave is a U-wave, which is common in ERP. So the QT must not be measured in V2 or V3. The QT as measured in other leads is about 420 ms, with a preceding RR of 1500ms, resulting in both Bazett's and Hodges's formula corrected QT interval of 345 ms. This short QT at least makes ischemia all but impossible. ERP is, of course, associated with an increased long-term risk of sudden death, but only marginally and only if in inferior or lateral locations [12,13]. Even in the setting of ischemia, the ischemia would not be represented by this ECG. This is a classic pattern and the QT is so short as to make ischemia very unlikely. This is a typical normal variant. At first glance, it may appear to be similar to ischemic T-waves, but it is not. The large upright U-wave, this high voltage, and the short QT interval differentiate it from ischemia. Anyhow, it is important to remember that even a patient with a normal variant could have a myocardial infarction, just as patients with completely normal ECGs may have myocardial infarction, but ischemia is not represented on this ECG [14].

Conclusion

The clinical setting is key. As emphasized in the discussion the ST-T wave appearance in all 12 leads "looks like" a repolarization variant given: 1) the clinical setting; 2) the relatively short QT; and 3) normal R wave progression. Lead V1 looks peculiar in that T wave inversion is uncharacteristically deep in this lead (especially in view of much less T inversion in subsequent leads). That said, none of this changes the overall impression that this ECG shows a repolarization variant. As mentioned above, echocardiography was normal and those ST-T wave findings normalized on the performance of an exercise test. Typically, benign repolarization abnormalities normalize on Exercise Stress Testing within no more than a few minutes of exercise. Finally - even though clinical setting plus the overall ECG pattern is seen here suggest this is a benign repolarization variant - when doubt exists, prudence sometimes dictates additional testing. In the setting of an asymptomatic athletic individual - a negative family history, no personal history of syncope/presyncope during exercise plus normalization of repolarization changes early during ETT plus a normal Echo - combine to confirm beyond doubt the benign nature of these ECG findings. In the other hand, such as the setting of an Emergency department - serial tracings and obtaining an Echo at the time of chest discomfort symptoms that shows no wall motion abnormality substantially increase clinical suspicion that this ECG is benign. The take home message is as follows: the electrocardiogram of athletes is really much more interesting and complicated than that until now has been written in the literature by many authors.

Conflict of Interest

None

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