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How to detect subtle ischemic heart disease in athletes or ex-athletes: a case report with a brief review

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ABSTRACT

The identification and treatment of coronary artery disease (CAD) remain a great challenge for physicians in all the world. In this case report, the author explains how physicians can be able to detect a subtle coronary artery disease in otherwise healthy paucisymptomatic individuals, as athletes or ex-athletes, using only the exercise ECG stress (Ex-ECG) testing and clinical common sense, in the era of advanced technologies like cardiovascular imaging.

Keywords: Coronary Artery Disease, Atherosclerosis, Athletes, Electrocardiogram, Exercise ECG Stress TestingIntroduction

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The Exercise Stress Electrocardiogram (ECG) test is the most widely used tools in the world to identify coronary artery disease (CAD) in individuals, either they are symptomatic and asymptomatic. The major cause of coronary heart disease (CHD) in middle-aged and older individuals is atherosclerosis[2].

In athletes, coronary atherosclerosis is identical to that of the general population, but in athletes, ischemic heart disease (IHD) has been often silent or paucisymptomatic[3]. It follows that the only way to identify an athlete suffering from silent ischemic heart disease who is at high risk of myocardial infarction or sudden death is to subject the athlete to the Ex-ECG testing[4].

In the last 20 years, there is an exponential rise in the number of middle-aged and veteran (Master) athletes who have exercised intensely since youth and who constitute an increasing proportion of participants in endurance events[5]. Most of them may have sub-clinical CAD. Therefore, an expert physician in Ex-ECG testing should be the first actor to do and interpret this non-invasive investigation[6].

Today, Ex-ECG testing is also being combined with imaging modalities to increase sensitivity and specificity for CAD, making the Ex-ECG a flexible test that is often used first when CAD is suspected in a patient.

Although stress myocardial imaging techniques provide valuable diagnostic information, variables derived from Ex-ECG can give substantial data for risk stratification in very few time with low cost[7].

This report is a brief description of an anecdotal case of ischemic heart disease in a middle-aged amateur athlete detected thank to the only use of the maximum exercise stress test and careful reading of the ECG.

Case Report

A middle-aged amateur athlete, at the end of his sports career as a runner, presented to our center. He complained of excessive fatigue at the end of the day's work and also of chest discomfort during fast walking or at the onset of running such that it, forces him to stop. His family history was negative for coronary heart disease and he had no other coronary risk factors. He has no history of drug use. Laboratory testing was negative for hyperglycemia and dyslipidemia, but he had a slightly elevated hematocrit for which his general practitioner had prescribed aspirin (100 mg per day). The patient was considered at intermediate pre-test probability about risk stratification of patients with probable chronic stable CAD.

The examination was normal, as resting ECG (Fig. 1) showed.

At the maximum stress test for cycle-ergometer, conducted with incremental protocol until muscle exhaustion, and at a heart-rate of 160 bpm and an external load of 150 watts, with a double product of 27,200 (2.7 Mets), his exercise was interrupted due to the appearance of clear abnormal ventricular repolarization consisting of a marked down sloping segmental ST segment depression of more than 3 mm in the precordial anterior leads extending from V2 to V6 with slight ST elevation on AVR (Fig. 2).

In the active recovery phase, there was a complete restoration of a normal repolarization with the disappearance of ST-segment changes. These findings were suggestive for proximal obstructive stenosis of the left anterior descending artery.

The subject remained asymptomatic, without chest pain, dyspnoea, and/or syncope. No cardiac arrhythmias emerged. By common agreement, it was decided to proceed directly to coronary artery angiography, without further investigation.

Cardiac catheterization and coronary angiography showed severe left anterior descending coronary artery narrowing. This lesion was treated with angioplasty and stent placement, as observed in the Fig. 3. The day after the procedure the patient was fit and then discharged.

Discussion

The diagnosis of ischemic heart disease in the subclinical phase is often a real challenge for doctors when symptoms are not well defined and the resting ECG is totally normal, so diagnosis is not always straightforward.

Especially in athletes and ex-athletes, ischemic heart disease might be asymptomatic (i.e.,

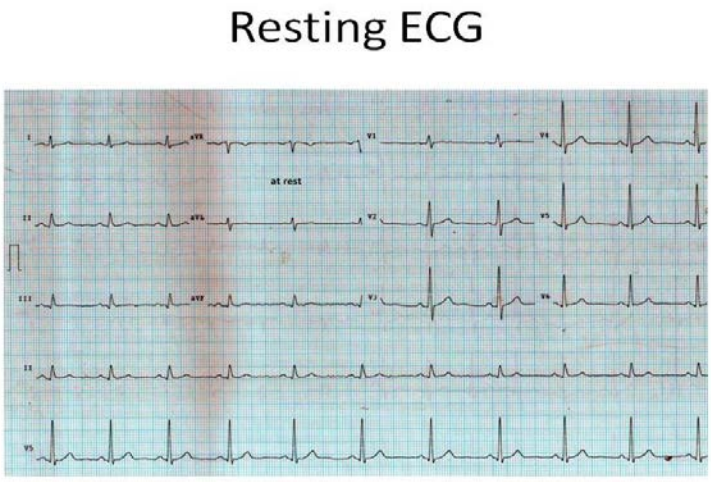

Fig. 1 showing a resting ECG with normal ventricular repolarization

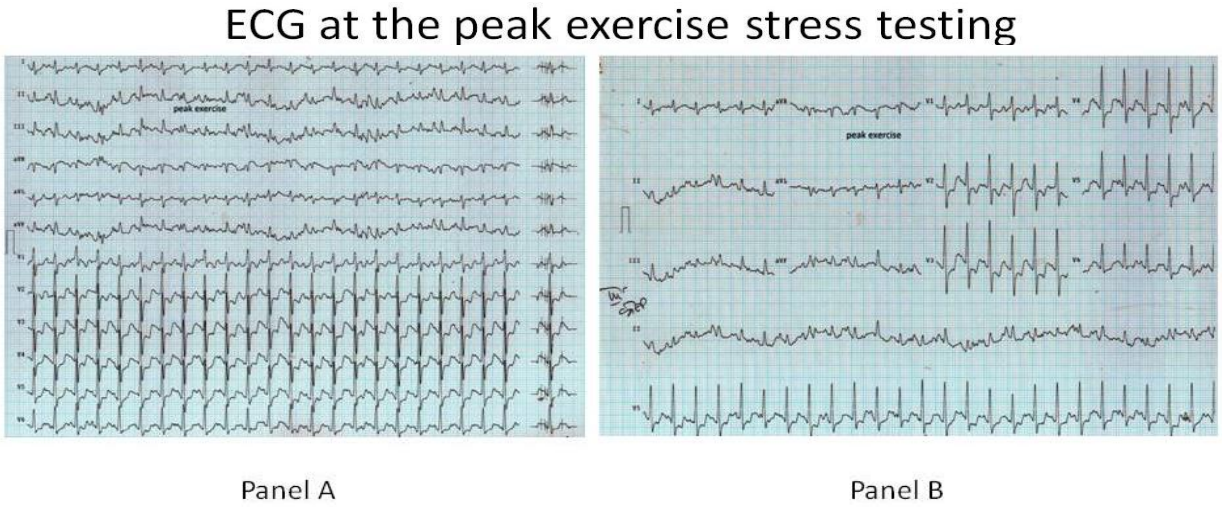

Fig. 2 showing in both panel ST-segment downsloping depression on anterior precordial leads at peak ECG exercise

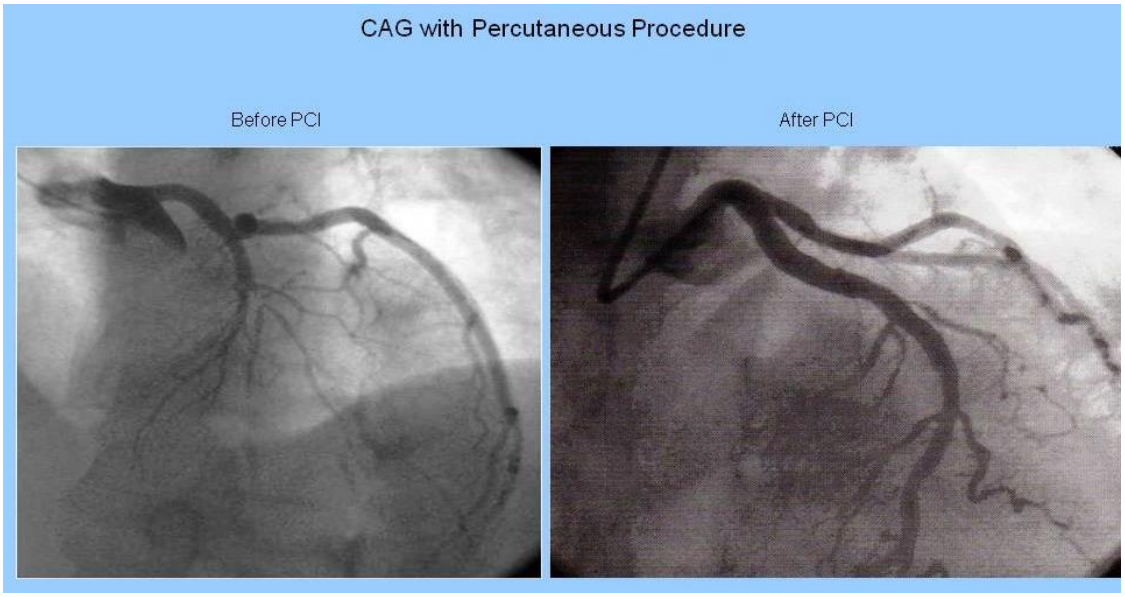

Fig. 3 showing a coronary angiography visualizing left anterior descending coronary artery stenosis respectively before and after angioplasty procedure

silent), therefore, is needed much experience and expertise to discover the disease. Ex-ECG testing is recommended as a first-line test for the diagnosis of coronary heart disease (CHD) in patients with interpretable electrocardiograms who are able to exercise[8]. Routine exercise testing is not currently recommended for detection of CHD in asymptomatic adults, although guidelines do allow for exercise testing in individuals with risk factors prior to starting a vigorous exercise program other than walking and in individuals in certain high-risk occupations. While stress-induced imaging abnormalities in this population demonstrate additional prognostic value in some, but not all, studies, absolute event rates were consistently low (even in subjects with abnormal tests) and the sensitivity was too low to justify the cost-effective use of these tests for screening[9].

Anyway, the exercise stress test known as the Bruce protocol or cyclo-ergometer protocol continues to play an important role in diagnosing coronary artery disease in intermediate-risk patients[10]. The Ex-ECG test can reveal cardiovascular abnormalities that are not seen at rest by taking measurements that unmask these during aerobic exercise when the heart responds to the body's demand for more oxygen by increasing heart rate, stroke volume, and cardiac output. Much of this oxygen demand is from skeletal muscle, where oxygen extraction increases by up to threefold. As of exercise intensity increases, the increase in cardiac output by up to sixfold is due mainly to an increased heart rate as stroke volume plateaus. In addition, total peripheral resistance and diastolic blood pressure (DBP) decreases, while systolic blood pressure (SBP) and pulse pressure increase[11].

As literature reported, the diagnostic accuracy of exercise stress testing varies, depending upon the age, gender and clinical characteristics of the patient, prevalence of CAD and particularly from modality of test used. Doctors have concentrated on individualizing the treatment of CAD, but there is great scope for individualizing the diagnosis of CAD using only exercise testing and making sense of clinical diagnosis[12].

This anecdotal case explains how in the age of modern technology of cardiovascular imaging is often enough a good knowledge of the clinical science and the doctor's ability to do a good Ex-ECG testing to have a high probability of CAD diagnosis. In order to increase the accuracy of the stress test, which it was always been considered with sensitivity of 68% and specificity of 77% for detection of CAD[13], a specific protocol should be adopted, which is certainly must led to muscle exhaustion but that particularly it has to lead the subject examined beyond its anaerobe ventilatory threshold in short time.

This author says that only by performing the Ex-ECG test in this way the abnormalities of ventricular repolarization come evident. In summary, the depression of the ST-segment on the precordial leads depends primarily on the fact that the metabolic acidosis caused by the oxygen debt induced by the specific protocol of the test results in significant subendocardial ischemia, as can be seen from the figures as this case reported. As a result, the simple stress test assumes a greater functional meaning that increases the accuracy of the test itself.

Furthermore, readers can see here the presence of electrocardiographic manifestations of exercise-induced myocardial ischemia focused on ST segment deviation measured relative to the P-Q junction. Ischemic ST segment depression is clearly down sloping ≥ 0.30 mV (3 mm) in magnitude, and lasts for ≥ 80 msec, as well describes on literature where was reported that downsloping ST segment depression is more specific for ischemia than horizontal or upsloping ST segment depression[14-15]. Furthermore, not only expert doctors can detect inducible myocardial ischemia, but they can suppose how many vessel diseases are present. It depends on how many minutes ST-segment changes come back normal in the recovery phase. In addition, the sensitivity and specificity of the cyclo-Ergometer stress test were greatly increased applying an incremental maximum exercise protocol that involves overcoming the ventilatory anaerobic threshold with muscular exhaustion as a result of a high rate of revolutions per minute.

The rationale for using Ex-ECG test alone as an initial test for CAD detection, particularly in patients with good exercise tolerance, has become more compelling with the publication of new medical data[16].

Conclusion

In conclusion the author would like to say that exercise stress testing still play a major role in the noninvasive evaluation of patients with probable ischemic heart disease and it should be performed in centers with trained personnel with knowledge of the indications, contraindications, risks, and complications of this non-invasive method, including the normal and abnormal hemodynamic and electrocardiographic responses to exercise, to making a good clinical sense of diagnosis.

Conflict of Interest: None

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