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Detection of Subclinical Coronary Artery Disease and Silent Inducible Myocardial Ischemia in Master Athletes: Is it Clinically Relevant? What to do?

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Abstract

Silent ischaemic heart disease is increasing in the sports population of master and veteran athletes. The most effective method to detect the presence of inducible myocardial ischaemia in asymptomatic subjects is the ECG exercise maximum stress test. In case of a positive or doubtful stress test in an athlete who has undergone sports screening, it is necessary to perform additional cardiovascular image tests, among which the CCTA is the preferred one because of its high negative predictive value. In this manuscript the author describes an anecdotal case of subclinical coronary artery disease in a master athlete, discovered during sports screening, and its practical management in the context of Italian law.

Keywords: Silent myocardial ischemia; Subclinical CAD; Master athletes; CCTA; Ex-ECG stress test

Introduction

Sports cardiologists should know that exercise, particularly when vigorous, can put asymptomatic sportive subjects or athletes affected by unrecognized cardiac diseases at a higher risk, potentially triggering sudden cardiac death [1].

At this regard, in subjects over 35 years of age coronary artery disease (CAD) represents the most frequent cause of both cardiovascular events and sudden cardiac death related to sport activities and physical exercise [2]. Before competition or any physical activity, a sports preparticipation screening [3] may be useful to early identify the presence of a potentially harmful cardiac disease.

However, no agreement exists yet among scientists about the most correct approach to detect it [4], and some doctors are still unable to do that properly, particularly if they have never done physical activity. In any case, to evaluate the clearance of the competitive sports activities in master and veteran athletes an accurate stratification of cardiovascular risk through diagnostic screening tests is needed. In particular, the attention of sports doctors, and sports cardiologists, should focus on the detection of subclinical coronary heart disease (CAD), which is the leading cause of sudden cardiac death in this population of athletes [5].

One of the major objectives of sports cardiology is precisely to adopt effective and accurate screening methods to identify master

and veteran athletes with probable CAD. For this reason, in Italy, before giving the eligibility to participate in competitions and non-competitions, sports doctors are invested to screen athletes of any level, from professional athletes to amateurs [6]. Herewith the author describes one of the many anecdotal cases which has occurred in his centre for sports cardiology.

Case Report

An asymptomatic 45-years-old male amateur athlete came to our Centre for sports cardiology to undergo sports preparticipation screening for competitive cycling. He had no family history for ischaemic heart disease or syncope, and did not report any cardiovascular risk factors. The physical examination was normal and the resting ECG showed no abnormalities (Figure 1). Instead, the maximum ECG exercise stress test resulted positive for inducible subendocardial ischaemia due to the appearance of a marked ST-segment changes with J point depression of 3 mm in the precordial leads (Figure 2), from V4 to V6 at peak stress, at a medium to high external workload in the absence of symptoms. Then, the athlete was submitted to CCTA, which confirmed the presence of widespread coronary atherosclerosis with a significant multivessel involvement for stenosis of all the epicardial coronary arteries between 50 and 70%. This athlete was stopped, but unfortunately his follow up was missed for unexplained reasons (Figure 3).

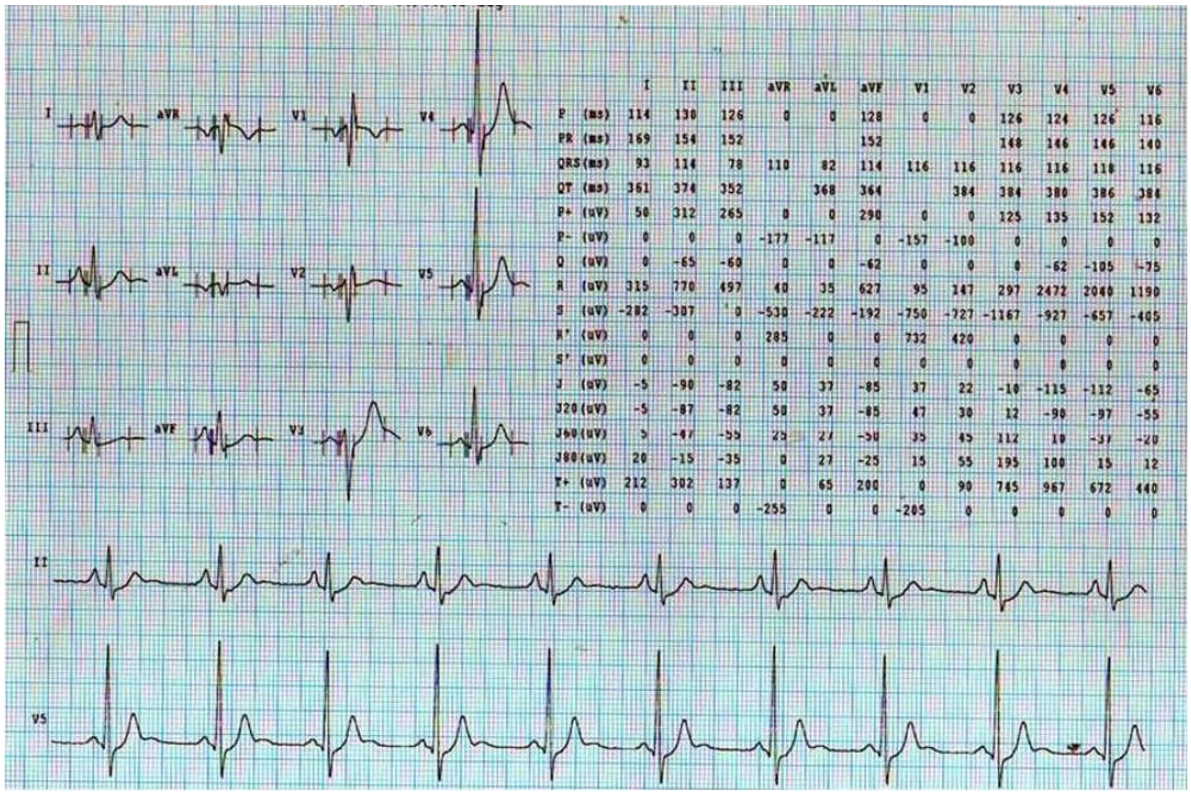
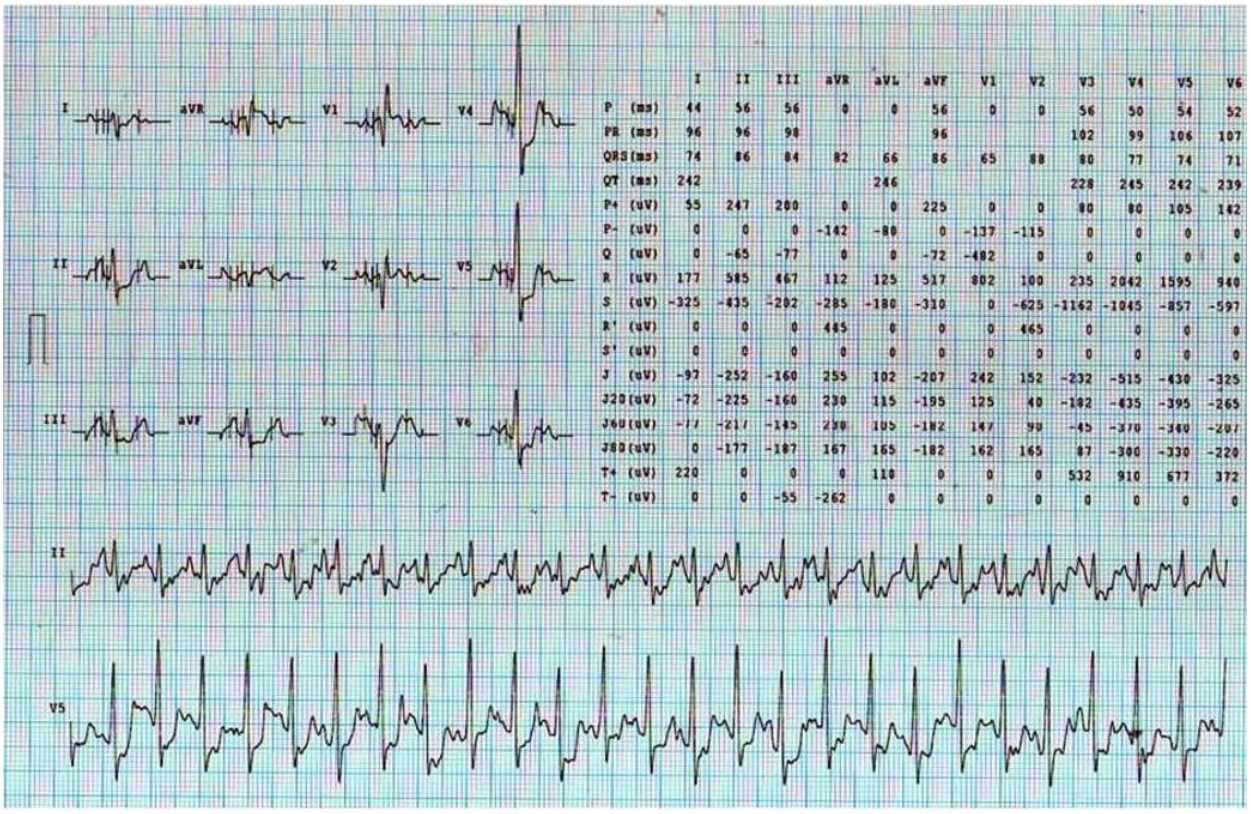


Figure 1: Resting ECG, shows a normal ECG recorded at rest.



	I	II	III	aVR	aVL	aVF	V1	V2	V3	V4	V5	V6
P (ms)	44	56	56	0	0	56	0	0	56	50	54	52
PR (ms)	96	96	98			96			102	99	106	107
QRS(ms)	74	86	84	82	66	86	65	88	80	77	74	71
QT (ms)	242				246				228	245	242	239
P+ (uV)	55	247	200	0	0	225	0	0	80	80	105	142
P- (uV)	0	0	0	-142	-80	0	-137	-115	0	0	0	0
Q (uV)	0	-65	-77	0	0	-72	-482	0	0	0	0	0
R (uV)	177	585	467	112	125	517	802	100	235	2042	1595	940
S (uV)	-325	-435	-282	-285	-180	-310	0	-625	-1162	-1045	-857	-597
R' (uV)	0	0	0	485	0	0	0	465	0	0	0	0
S' (uV)	0	0	0	0	0	0	0	0	0	0	0	0
J (uV)	-97	-252	-160	255	102	-207	242	152	-232	-515	-430	-325
J20(uV)	-72	-225	-160	230	115	-195	125	40	-182	-435	-395	-265
J60(uV)	-77	-217	-145	230	105	-182	147	99	-45	-370	-340	-207
J80(uV)	0	-177	-107	167	165	-182	162	165	87	-300	-330	-220
T+ (uV)	220	0	0	0	110	0	0	0	532	910	677	372
T- (uV)	0	0	-55	-262	0	0	0	0	0	0	0	0

Figure 2: ECG at peak exercise, shows the ST-segment changes (marked J point depression) at the peak of exercise stress test.

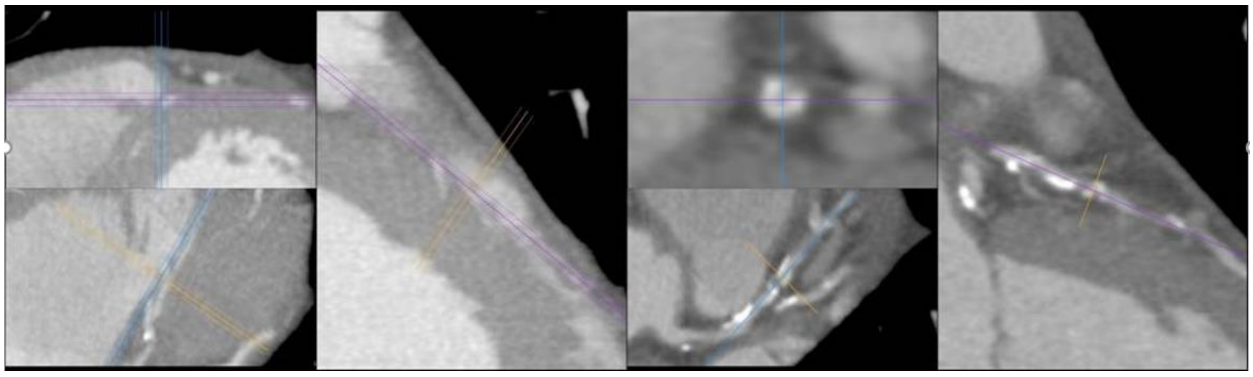


Figure 3: CTCA findings, CCTA shows multivessel significant CAD with multiple stenosis >50% (principally of the proximal LAD artery.

Discussion

The main document developed in Italy [7] are the guidelines of Italian sports cardiologists who identify subjects according to cardiovascular risk score. For the purpose of formulating the judgement of suitability for competitive sports, in sportsmen and sportswomen aged ≥ 40 years (≥ 50 years in women) the next step is to perform a maximum TE, whose indication takes into account the cardiovascular risk and the cardiovascular commitment of the sport practiced. In fact, in addition to changes in the electrocardiographic signal, the TE also allows the assessment of working ability, chronotropic and pressure response to exercise,

the double product, the trend of heart rate in recovery and the possible presence of ventricular arrhythmias induced by dynamic muscle exercise. Numerous clinical studies have shown that these ergometric variables provide independent prognostic information in normal subjects, in patients with heart disease and in survivors of myocardial infarction. The stress test must always be performed according to the recommendations in force. In particular, regardless of the ergometer chosen, the effort protocol must be incremental (step or ramp), aiming to reach the maximum heart rate theoretical and be interrupted exclusively because of the athlete's inability to sustain the effort (i.e., muscle exhaustion), or for cardiac symptoms or any other specific clinical reasons of the case with monitored recovery phase.

In the case of high intensity sports, doctors are required to submit asymptomatic athletes who present an abnormal ECG for a positive or doubtful stress test for inducible myocardial ischaemia to additional instrumental evaluations. These are myocardial perfusion scintigraphy or stress echocardiography and angiography with coronary computer tomography (CT) (CCTA) to assess coronary anatomy [coronary angiography or multislice CT (no fewer than 64 slices)].

Even though it does not have a clear functional significance, the CCTA allows the exclusion or morphological confirmation of a significant CAD with greater diagnostic accuracy than myocardial scintigraphy perfusion scintigraphy. In particular, most studies [8-9] have shown a negative predictive value greater than 95%, supporting its high reliability to exclude the presence of a significant CAD. In addition, CCTA is particularly useful for documenting the presence of congenital abnormalities of coronary arteries or myocardial bridges, i.e. all those conditions that may induce ischemic ventricular repolarization abnormalities during ET and may contraindicate the practice of competitive sports at high activity intensity. As the literature reports the combination of positive EX-ECG stress test and CCTA grant doctors the best accuracy for the detection of subclinical CAD in Master/Veteran athletes [10-11]. However, even if a lot of literature indicates the constant evidence of subclinical CAD in Master athletes, with low or medium cardiovascular risk, the meaning of the evidence of inducible myocardial ischaemia is questioned by some authors who wonder if in fact this evidence is clinically relevant [12].
Furthermore, the Italian Sport guidelines recommend to disqualify athletes or issue a temporary sporting suitability when a diagnostic doubt persists even after these examinations.

This anecdotal case is emblematic both because it shows the increasing presence of significant asymptomatic coronary artery disease in the master athlete, and because it illustrates how the management of these cases is complicated. First of all, it is necessary not to underestimate the classical ST-segment changes during exercise stress test that suggest the presence of an inducible ischemia, which must not be interpreted as a false positive in the athlete who does not present symptoms of chest pain, dyspnea, and decline in physical fitness. Then, it is necessary to proceed to further investigations of cardiovascular imaging, particularly CCTA, that confirm the presence of atherosclerotic coronary disease both from a morphological and qualitative point of view. And finally, close cooperation is required not only between doctors, but also between the sports doctor and the athlete, who can escape the follow up for many reasons, including turning elsewhere to obtain the certificate of sports eligibility.

Conclusions

It is quite clear that sports preparticipation screening in master/veteran athletes based only on the evaluation of clinical CV risk factors and on the Ex-ECG stress test, often not maximal, is not totally able to identify significant subclinical CAD. Therefore, it is quite obvious that the use of diagnostic cardiovascular imaging that is both morphological and functional at the same time,

particularly objective data derived from cardiac CT, is certainly promising for a more accurate stratification of the CV risk of these athletes.

Teaching points

1. CAD is a silent growing disease in Master Athletes.
2. Ex-ECG maximal stress test must be performed and interpreted well.
3. CCTA is the best choice to evaluate CAD in athletes in addition to Ex-ECG stress test.
4. Master athletes are difficult patients.

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