The Burden of Silent Myocardial Ischemia in Master Athletes

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ABSTRACT
Myocardial ischemia, be it silent or asymptomatic, is defined as an objective documentation of myocardial ischemia in the absence of angina or its equivalents. Among the subjects who can be asymptomatic coronary heart disease carriers, also athletes come into this category, i.e. individuals who regularly practice and compete in sports events at highly competitive athletic levels. Most of the patients with silent myocardial ischemia due to coronary artery disease are athletes. Silent myocardial ischemia is different from silent coronary artery disease. Angina pectoris is the tip of the ischemic iceberg and in athletes it is less frequent than in non-athletes. Athletes are normally considered individuals in good or excellent health, thus when one of them is struck by sudden death, it creates uproar and consternation. For such reasons the purpose of the pre-participation screening program of athletes is to early identify previously unsuspected cardiovascular diseases in the hope that these strategies will reduce the incidence of sudden cardiac death.

Keywords — Myocardial ischemia

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I. BACKGROUND

The advances made in the last 30 years have dramatically changed the attitude of the medical community towards the relationship between physical activity and ageing. Regular physical activity is a prerequisite for a healthy life and postpones age-related disability. Regular physical exercise contributes to the primary and secondary prevention of cardiovascular disease, diabetes, and dyslipidemias that are closely interrelated and negatively affected by sedentary lifestyle. Sports physicians and cardiologists should have an unconditionally supportive attitude towards “competitive sports activity” programs.

In middle-aged or elderly individuals, competitive sports are an irreplaceable stimulus to continue or pursue a lifestyle that promotes health and particularly physical fitness. This is exemplified in the master games participants, an ever-growing category of athletes which accounts for 50% of sports federation membership in Italy.

Master athletes are typically 35-40 years or older, and are engaged in competitive games organized by the sports federations affiliated to the Italian Olympic Committee (CONI). Master athletes compete in 5-years age group in many sports (triathlon, rowing, skiing, tennis, etc.), but most frequently in athletics (track & field) (long distance running), cycling and swimming.

In an ever-growing number of master athletes, trainability does not differ from that of younger high-level athletes, pointing to an outstanding physiological model for the understanding of the aging process. For example, master marathon runner at the top of the world and national ranking show a 30-50% increase in VO2 max compared to aged-matched sedentary subjects.

Despite the high, or sometimes outstanding, performance, the determination of eligibility to competitive sports is a delicate issue in these athletes. There is a fundamental difference between regular moderate-intensity of physical activity and competitive sports, in that the documented benefits of low-to-moderate intensity exercise are not associated with any additional risk, whereas competitive performance may create maximal physical and psychological burden with increased risk of cardiovascular complications, including exercise-induced sudden cardiac death.

The higher prevalence of coronary heart disease (CHD) with aging, even among asymptomatic patients, accounts for this phenomenon.

The most prevalent complication of sports activity is represented by the musculoskeletal injuries, while the most dangerous and deleterious is the sudden cardiac death.

Intense physical activity does raise a small risk of cardiac death, particularly for sedentary persons with a genetic
predisposition on sudden death and in athletes with underlying cardiopathy, such as silent ischemic heart disease. Nonetheless, the longer term reduction in overall death risk from regular exercise outweighs any small potential for acute cardiovascular complications.

The physical activity has beneficial effects in all sectors of life, enhancing cardiac, pulmonary and muscular function. Therefore, physical activity must be encouraged from the early years of life mainly in the youth population.

However, the effects of physical exercise on the cardiovascular system, when it is very competitive, may be dangerous.

Also, strenuous exercise can resulted “paradoxically” harmful in time. For this reason the pre-participation screening program of athletes has the goal of the early identification if previously unsuspected cardiovascular disease and the disqualifications of the athletes with the hope that these strategies will reduce the incidence of sudden cardiac death.

Most patients with silent myocardial ischemia due to coronary artery disease are athletes. For the physicians is important to know that the most common symptom of myocardial ischemia is the absence of symptoms.

Silent myocardial ischemia is different from silent coronary artery disease. The symptomatic angina is the tip of the iceberg in athletes and in athletes it is less frequent than in non-athletes. The athletes change their perception of ischemic stimulus and increasing pain threshold from increased circulating endorphin levels. Silent myocardial ischemia is more prevalent than angina in patients with coronary artery disease, and athletes are not immune to this disease.

Screening participation in order to discover early stages of malignant neoplasia (e.g. breast and colon cancer) in asymptomatic stage and thus prevent reaching final stages of the disease has been widely accepted. Vice versa, although atherosclerotic cardiovascular disease causes more deaths and disabilities than all the causes of death correlated to cancer, there are no precise guidelines concerning the screening of asymptomatic elements suffering from atherosclerosis, and even fewer recommendations, apart from the recent Shape program, which presents practical recommendations concerning cardiovascular screening for asymptomatic people at cardiovascular risk. Shape guidelines propose screening via non-invasive investigation for all asymptomatic males aged between 45 and 75 years, and for all asymptomatic females between the ages of 55 and 75 (except those persons clearly defined as being low-risk), in order to discover and treat those subjects struck by sub-clinical atherosclerosis. Coronary atherosclerosis is the main cause of death in developed countries and is becoming the main cause of death in the rest of the world too.

However, many patients with predictable coronary disease are asymptomatic. As it is well known, clinically significant coronary sclerosis is uncommon in subjects, particularly males, under 40 years of age and in pre-menopause females, but the risk grows as age increases and also in the presence of factors of classic risk such as smoking, hypertension, diabetes, hypercholesterolemia, and ischemic cardiopathic familiarity. Silent ischemic cardiopathy is, by definition, present in asymptomatic subjects, and particularly in those subjects who present underlying factors of cardiovascular risk. Silent myocardial ischemia is a major component of the total ischemic burden for patients with coronary artery disease (CAD); it is estimated that between 2 and 3 million persons with stable CAD have evidence of silent ischemia.

This is very important for those doctors who have to identify the existence of silent ischemic cardiopathy in consideration of the fact that this situation is predictive of an increase in the risk of even fatal, cardiac events. In studies, albeit not recent, which assessed a broad spectrum of the population, the prevalence of silent ischemic cardiopathy was estimated at around 4 – 4.5% in middle-aged men (in their fifties) with accompanying asymptomatic coronary heart disease and the presence of myocardial ischemia emphasized by ergometric test on the treadmill.

Consequently, there has been great interest in recent years in developing screening strategies through which severe asymptomatic coronary heart disease could be diagnosed prematurely.

Coronary disease can be considered an ‘iceberg’ where a small part of the subjects are symptomatic for angina pectoris, whilst the majority of individuals suffering from coronary heart disease have no symptoms at all.

The most common symptom in ischemic cardiopathy to appear first, is angina pectoris, due to coronary atherosclerosis, although in a few subjects the first sign may be myocardial infarction, or even, sudden death.

It has been calculated that from one to two million middle aged males in the United States of America (i.e. around 5% of the population) are suffering from asymptomatic coronary heart disease, also known as, “silent myocardial ischemia”.

Myocardial ischemia, be it silent or asymptomatic, is defined as an objective documentation of myocardial ischemia, in the absence of angina or its equivalents.

Among the subjects who can be asymptomatic coronary heart disease carriers, athletes also come into this category, i.e. individuals who regularly practice and compete in sports events at highly competitive athletic levels. As atherosclerosis disease is an evolutive, degenerative process, as well as being inflammatory, increasing and worsening as time passes, it is clear that older individuals, thus, athletes too, have a higher probability of running or cycling into silent ischemic coronary heart disease.

Athletes are normally considered individuals in good or excellent health, thus when one of them is struck by sudden death, it creates uproar and consternation. However, just as what happens among the population on a whole, athletes too can harbor unrecognized cardiac diseases, just like asymptomatic atherosclerotic coronary heart disease, of congenital abnormalities which can place them in the sights of high risk sudden death.

Competitive sport at high cardiovascular impact is dangerous for fatal arrhythmia in subjects predisposed to and suffering
from coronary atherosclerosis disease\textsuperscript{21}.

Male athletes are hit by coronary disease much more than females (at a rate of 10 to 1)\textsuperscript{21}.

This can be attributed to the fact that more male athletes take part in competitive sports and there is a tendency to a greater intensity in the training of male athletes. The male sex is in itself a risk factor in coronary heart disease, and that is because of the higher rate of cardiac abnormalities and premature atherosclerotic coronary heart disease in male athletes as opposed to females\textsuperscript{22}.

Even though the advantages and benefits gained through the practice of physical exercise exceed the risks connected to it, master athletes are warned and encouraged to undergo accurate medical screening in order to identify any problem of a cardiac nature before participating in competitive sport activities\textsuperscript{23}.

II. CONCLUSION

The relationship, both positive and negative, between cardiac ischemic disease and physical activity remains a central issue. Incidence and severity of ischemic heart disease increases linearly with aging, reaching maximal levels around age 50 in men and postmenopausal women. Silent myocardial ischemia due to coronary atherosclerosis is the most common form of heart disease relevant to the Master population, such as veteran athletes, as a cause of sudden cardiac death.

In addition, although several studies have consistently demonstrated that regular physical activity protects patients from coronary events, strenuous exertion may trigger myocardial infarction as a result of acute thrombotic occlusion, following intimal bleeding and/or plaque rupture in coronary arteries that were not previously critical narrowed. The relative risk of myocardial infarction increases exponentially in sedentary individuals not accustomed to high intensity exercise.

Therefore, further diagnostic non-invasive testing is mandatory for asymptomatic athletes who present ventricular repolarization abnormalities (i.e. significant ST-segment depression on the precordial leads) during a maximal exercise stress testing suggesting inducible ischemia.

The author, on the basis of personal experience, takes the liberty of observing the following:

1) maximal exercise ECG stress testing is the main tool to screen ischemic heart disease in Master athletes;
2) further cardiac imaging tests are myocardial scintigraphy or stress echocardiography; 3) recently, coronary computed tomography angiography has been shown to be capable of well visualizing not only the coronary arteries (epi-intramycocardial course and lumen), but also the cardiac muscle, with high spatial resolution.

The author also considers that coronary cardiac tomographic angiography (CCTA) is the best choice in the presence of inducible myocardial ischemia of asymptomatic Master athletes.

CCTA is the ideal cardiovascular imaging test to deepen the suspicion of coronary artery disease in athletes showing a positive exercise test during sports pre-participation screening, both for its ability to highlight significant coronary stenosis and for its high negative predictive value.

However, coronary angiography remains the gold standard in the diagnosis of silent ischemic cardiopathy, even though the evidence of free coronary arteries from the obstructive atherosclerosis process does not eliminate the doubt of an ischemic genesis of the electrocardiographic aspects of subendocardial ischemia, which could be explained by the presence of a deep myocardial bridge.

As above reported, silent myocardial ischemia is a major challenge for physicians, especially for sport physicians and sport cardiologists, because ischemic heart disease is known to everyone, but its detection is a true state of the art.

References