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EDITORIAL COMMENT

Life-long running with calcified coronary plaques: Should we be concerned?

Correr com placas calcificadas: devemos estar preocupados?

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We read with great interest the article by Hélder Dores and colleagues in the current issue of the *Journal* entitled ''Coronary atherosclerotic burden in veteran male recreational athletes with low to intermediate cardiovascular risk''.[1] This special interest was raised by the characteristics of the population of athletes examined and the methodology used for cardiac investigation. Let us comment on these aspects.

First, the study population was comprised of asymptomatic individuals, mostly male, aged between 40 and 60 years, engaged in endurance sports. Most of them were long-distance runners, others were cyclists or weight-lifters. These individuals had been actively training for an average of more than eight hours per week for the last 17 years. This population sample embodies the model of the most physically active individuals and represents the best population cohort to assess the effects on the cardiovascular system of a lifetime devoted to exercise training.

Accordingly, we should not be surprised to learn that the majority of these subjects had very favorable risk profiles, as shown by a European Society of Cardiology SCORE of zero or one in most cases, with about half presenting only one risk factor, in most cases unrecognized (and untreated!) dyslipidemia.

Second, the comprehensive cardiac assessment included physical examination with exercise testing, as usual, but also coronary computed tomography angiography (CCTA) for assessment of calcium score and the coronary tree, focusing on the presence and morphologic features of atherosclerotic lesions. In particular, assessment of the coronary tree was meticulous, including not only the presence of plaques, but also plaque morphology, distribution, and degree of stenosis, quantified according to reliable criteria.[1–3]

Their results are of thus particular clinical relevance, since they depict the impact that life-long sport participation has on the coronary artery and atherosclerosis.

If we were expecting that regular exercise training, associated with a healthy lifestyle, might protect the coronary tree from atherosclerotic disease, our expectations will be largely disappointed. The overall picture shown by CCTA in this athlete population is quite concerning, when we consider that nearly half (44, or 42%) of these athletes had definite coronary plaques. Among these, 10 (23%) had left main disease (seven with concomitant lesions in other arteries), four (9%) had three-vessel disease, 10 (23%) had two-vessel disease and 20 (46%) had single-vessel disease.

Therefore, CCTA opens our eyes to a scenario that is anything but ideal, because, sadly, it makes clear that exercise, even if performed for life, cannot immunize the coronary arteries from being attacked and seriously damaged by atherosclerotic plaques.

This condition cannot be revealed simply by clinical assessment, even by exercise testing, as previously confirmed by the plethora of investigations in this field and the

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statements of current guidelines.[4,5] In fact, among the athletes included in this analysis with atherosclerotic lesions, only six (22%) had significant abnormal findings on exercise testing, and only three (11%) showed positive criteria for myocardial ischemia.

CCTA therefore enables us to see, in the individual athlete, the combined effects that exercise training, atherosclerotic disease and aging (among other determinants) play in determining the presence, extent, composition and possible clinical significance of atherosclerotic plaques.

This information is crucial to prevention. We believe that knowledge of coronary artery lesions (characterized as only CCTA can) represents a preliminary step for personalized intervention and treatment, enabling implementation of one-to-one precision medical care. It was noteworthy that the great majority of these athletes had just one risk factor, in most cases unrecognized dyslipidemia, which was not treated before the CCTA investigation.

In our view, CCTA is destined to play a major role in screening adult and senior athletes for primary prevention of cardiac adverse events. This concept is slowly entering in the clinical practice and is recognized in recent guidelines.[5,6]

Another consideration relates to the advice to be given concerning sport participation.

Should we be concerned by the results of this investigation and be more conservative when advising our adult and senior erase athlete patients on the intensity and duration of training and sport participation, the great majority of whom already have a serious atherosclerotic burden?

Some reassuring considerations are in order based on present and previous experiences.

Plaque characterization by CCTA showed that most coronary plaques were calcified (74%), with only a very small subset (3%) non-calcified (likely fat). Previous investigations using comparable study populations and investigation methods, such as those by Molenkamp et al., Merghani et al. and Aengevaeren et al., reported similar findings,[7–9] showing a high atherosclerotic burden with calcified plaques in a large proportion of master athletes examined with CCTA. The presence of extensive calcified plaques in senior athletes might suggest a different pathophysiological mechanism for plaque evolution in these athletes compared to sedentary individuals. The fact is that the resistant and stable nature of calcified plaques mitigates the risk of rupture, explaining the longevity of these athletes despite the high prevalence of plaques in the most active of them.

Indeed, the available evidence suggests a positive relationship between exercise intensity and duration and reduction in all-cause mortality, when middle-aged individuals exercising at strenuous workloads are compared with those exercising at a lower workload,[10] and a previous meta-analysis including more than 650 000 individuals (median age 62 years) showed that exercising up to 10 times the recommended minimum levels was not associated with increased mortality.[11] Therefore, although extensive calcified plaques are more frequently found in individuals with long athletic careers and high performance, these findings do not necessarily predict a worse clinical outcome.

While we await further data from larger athlete populations on the long-term consequences of calcified coronary plaques, we nevertheless feel sufficiently confident to reassure our erase athlete patients that exercise and sport participation are beneficial in modifying the nature (and likely the adverse consequences) of atherosclerotic lesions despite the unavoidable detrimental impact of advancing age.

Conflicts of interest

The author has no conflicts of interest to declare.

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