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ORIGINAL ARTICLE

Exercise-induced cardiac remodeling in athletes and in special forces soldiers[☆]

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KEYWORDS

Physical exercise;
Cardiac remodeling;
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Abstract

Introduction: Exercise-induced cardiac remodeling is frequent in athletes. This adaptation is structurally manifested by an increase in cardiac dimensions and mass. Soldiers are also subject to intense physical exercise, although with different characteristics.

Objective: To compare exercise-induced cardiac remodeling in competitive athletes and in soldiers on a special forces training course.

Methods: We studied 17 soldiers (all male and Caucasian, mean age 21±3 years) who completed a special forces course and 17 basketball players (47.3% male, 64.7% Caucasian, mean age 21±3 years). Assessment included a transthoracic echocardiogram and analysis of myocardial mechanics. This assessment was performed at the beginning and end of the military course and the sports season, respectively.

Results: Cardiac remodeling was observed in both groups. The soldiers presented a predominantly eccentric pattern, with increased left ventricular (LV) size (49.7±3.2 vs. 52.8±3.4 mm; p<0.01), increased LV mass (93.1±7.7 vs. 100.2±11.4 g/m²; p<0.01) and decreased relative wall thickness (0.40±0.1 vs. 0.36±0.1; p=0.05). The basketball players showed a concentric pattern, with decreased LV size (52.0±4.7 vs. 50.4±4.7 mm; p=0.05), and increased relative wall thickness (0.33±0.1 vs. 0.36±0.1; p=0.05). Although there was no significant difference in LV myocardial strain in the groups separately, when compared there was a significant decrease (-20.2±1.6% vs. -19.4±2.1%; p=0.03).

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PALAVRAS-CHAVE

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Conclusion: Cardiac remodeling was frequent, with an eccentric pattern in soldiers and a concentric pattern in basketball players. Myocardial deformation may represent a physiological adaptation to physical exercise.

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Remodelagem cardíaca induzida pelo exercício físico em atletas de nível competitivo e militares de forças especiais

Resumo

Introdução: A remodelagem cardíaca induzida pelo exercício físico é frequente em atletas. Esta adaptação manifesta-se a nível estrutural com o aumento das dimensões e massa cardíacas. Os militares também são sujeitos a exercício físico intenso, com especificidades distintas.

Objetivo: Comparar a remodelagem cardíaca induzida pelo exercício físico em atletas de competição e pelo treino militar em militares a frequentar um curso de forças especiais.

Metodologia: Estudámos 17 militares (género masculino e caucasianos, idade média 21 ± 3 anos) que ingressaram no curso de Comandos e 17 basquetebolistas (47,3% do género masculino, 64,7% caucasianos, idade média 21 ± 3 anos). A avaliação incluiu um ecocardiograma transtorácico com análise da mecânica miocárdica. Esta avaliação foi realizada no início e no final do curso militar e da época desportiva, respetivamente.

Resultados: A remodelagem cardíaca teve características distintas: os militares apresentaram um padrão predominantemente excêntrico, com aumento das dimensões do ventrículo esquerdo ($49,7 \pm 3,2$ versus $52,8 \pm 3,4$ mm; $p < 0,01$) e da massa ($93,1 \pm 7,7$ versus $100,2 \pm 11,4$ g/m²; $p < 0,01$) e diminuição da espessura relativa das paredes ($0,40 \pm 0,1$ versus $0,36 \pm 0,1$; $p = 0,05$); os basquetebolistas apresentaram um padrão concêntrico, com diminuição das dimensões do ventrículo esquerdo ($52,0 \pm 4,7$ versus $50,4 \pm 4,7$ mm; $p = 0,05$) e da espessura relativa das paredes ($0,33 \pm 0,1$ versus $0,36 \pm 0,1$; $p = 0,05$). Apesar da deformação miocárdica global do ventrículo esquerdo não apresentar diferenças significativas entre os grupos, quando analisados em conjunto o seu valor diminuiu ($-20,2 \pm 1,6\%$ versus $-19,4 \pm 2,1\%$; $p = 0,03$).

Conclusão: A remodelagem cardíaca foi frequente, com padrão excêntrico nos militares e concêntrico nos atletas. A mecânica miocárdica poderá representar uma adaptação fisiológica induzida pelo exercício físico.

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Introduction

Intense and prolonged physical exercise leads to changes in cardiovascular physiology known as 'athlete's heart'. Chief among these alterations are increased cardiac size, volumes and mass and improved functional parameters, particularly diastolic function.¹ Classically, two forms of cardiac remodeling have been described: concentric remodeling associated with static exercise, and eccentric remodeling associated with dynamic exercise.² For example, marathon runners present eccentric remodeling due to volume overload resulting from increased cardiac output, while weightlifters show concentric remodeling due to pressure overload.³ It should be noted that this distinction is not absolute, since most sports involve both static and dynamic exercise, and hence lead to mixed remodeling.⁴

However, athletes are not the only individuals who undergo high-intensity training. Soldiers, especially in the

special forces, also undergo physically demanding training that involves various forms of both static and dynamic exercise. Overall, the volume of exercise required of these soldiers can be compared to that of competitive athletes, and may often be even higher. However, military training is unique with regard to the methodologies used and the influence of other variables arising from military life.⁵

The manifestations of exercise-induced cardiac remodeling can overlap with those of pathological conditions, especially cardiomyopathy, and differential diagnosis is often challenging.⁶ In this context, pre-participation screening of athletes and interpretation of diagnostic exams in this population are of great importance. In the last decade, new imaging techniques have been developed that enable detailed myocardial assessment, such as analysis of myocardial mechanics by transthoracic echocardiography (TTE).⁷

The main aim of this study was to characterize and compare cardiac remodeling in professional basketball players

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