Cardiac magnetic resonance assessment of left and right ventricular morphologic and functional adaptations in professional soccer players

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Abstract

Professional, long-term physical training is related to cardiac morphologic and functional changes that rely on the kind of exercise performed. So far, the particular effect of soccer training on cardiac morphology has not been investigated with cardiac resonance imaging (CMRI). We sought to use CMRI to check left ventricular (LV) and right ventricular (RV) morphologic and functional adaptations in professional soccer players.Methods: Twenty-nine male professional soccer players (mean age 24.6 +/- 3.9 years, range 18-31 years) in numerous playing positions and 29 nonathlete male controls (27.0 +/- 3.7 years, 21-34 years) underwent CMRI. Electrocardiographic-gated steady-state free-precession cine CMRI was accustomed measure myocardial mass (MM), end-diastolic volume (EDV) and end-systolic volume, stroke volume (SV), ejection fraction, and cardiac index at rest. We calculated the ventricular remodeling index (RI) to explain the pattern of cardiac hypertrophy.Results: Ventricular volume and mass indices were significantly ($P < .001$) higher in athletes. LVEDV and RVEDV on MRI was above normal in 27/29 athletes. There was a robust correlational statistics between EDV and myocardial mass ($P < .01$). The LVRI and RVRI were similar (0.73 +/- 0.1 g/mL; 0.22 +/- 0.01 g/mL) to it of controls (0.71 +/- 0.1 g/mL; 0.22 +/- 0.01 g/mL). No significant differences were observed for LV ejection fraction and cardiac index. Neither the comparison of athletes in several playing positions nor the comparison of younger and older players revealed statistically significant differences.

Conclusion: Cardiac resonance imaging measurements enable studying the mechanisms of LV and RV adaptation in professional soccer players and reflect the ventricular response to combined endurance and strength based training. Measurements of myocardial mass, end-diastolic and end-systolic volume, stroke volume and ejection fraction for left and ventricle (LV, RV) were performed. Additionally, left and right atrial (LA, RA) areas and volumes were analysed. Relative wall thickness (RWT) was calculated to explain the pattern of cardiac remodeling. Interventricular wall thickness and LV mass were significantly higher in athletes, but remained within the reference (6.9 ± 0.8 vs. 6.2 ± 0.9 mm/√m2, $p = 0.003$ and 57.1 ± 7.4 vs. 50.0 ± 7.1 g/m2, $p = 0.0006$, respectively) with no changes in LV size and performance between groups. The RWT cared-for be higher among athletes ($p = 0.09$) indicating LV concentric remodeling geometry. Soccer players had significantly larger RV size ($p < 0.04$) with similar function and mass. Also, the LA volume ($p = 0.01$), LA area ($p = 0.03$) and LA diameter ($p = 0.009$) were significantly greater in players than in controls. Cardiac adaptations in pre-adolescent soccer players are characterized by an increased LV mass with none changes in LV size and systolic function, which is typical of resistance training with tendency to concentric remodeling. this is often amid increase of l. a. and RV size. It should be taken under consideration during annual pre-participation evaluation. Regular physical activity over an extended fundamental measure ends up in a cardiac adaptation described as "athlete's heart". the aim of this study was to see the results of intensive daily training in a very specific style of sports- professional soccer, in relevancy morphological and functional left ventricular parameters assessed by cardiac resonance imaging (CMRI) and to match these with non-athletic healthy volunteers.

CMRI was performed in 17 male professional soccer players from the German Bundesliga team squad of the Hamburger SV and eight age-, sex- and weight-matched untrained controls at 1.5 T (Achieva, Philips) during the active season. For quantitative CMRI, an electrocardiographically triggered steady-state free precession (SSFP) cine sequence (TR/TE, 3.2/1.6ms; pixel-size, 1.7mm×1.7mm) was performed in short- and long-axis views. measurement included end-diastolic (EDV) and end-systolic volumes (ESV), stroke volume (SV), left ventricular ejection-fraction (EF) also as end-diastolic (EDMM) and end-systolic myocardial mass (ESMM). CMRI data were analyzed by two independent observers

using the HeAT-Software. Data are given because the mean of both observers. Structural remodeling of the proper ventricle (RV) is widely documented in athletes. However, functional adaptation, including RV pressure generation and systolic free-wall longitudinal mechanics, remains equivocal. This meta-analysis compared RV pressure and performance in athletes and controls. Functional RV adaptation, characterized by increased tricuspid annular displacement and velocity and a greater base-to-apex strain gradient, may be a normal feature of the athlete's heart, along with a rather elevated RV blood pressure. These findings contribute to our understanding of RV in athletes and highlight the importance of considering RV function together with structure within the clinical interpretation of the athlete's heart.