Impact of a 246 km ultra-marathon race on global and segmental longitudinal deformation of all cardiac chambers and on inter-chamber relationships.

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Topic(s):
Athlete’s Heart

Background: It is well documented that prolonged intense exercise such as a marathon, transitorily alters cardiac function. However, the impact of ultra-endurance (UE) exercise on global and segmental longitudinal deformation of all cardiac chambers and on inter-chamber functional relationships has not yet been thoroughly investigated.

Purpose: The aim of the study was the evaluation of the acute effects of UE exercise on longitudinal deformation of all cardiac chambers and on intra-, inter- and atrioventricular functional relationships.

Methods: Echocardiographic assessment was performed the day before and at the finish line of "Spartathlon": a 246 Km ultra-marathon. 2D speckle-tracking echocardiography was performed in all 4 chambers during the same cardiac cycle, allowing a simultaneous strain-time data display of all cardiac chambers (Figure). Peak global deformation values and temporal parameters adjusted for the heart rate were extracted from the derived curves, while a segmental analysis for left (LV) and right ventricle (RV) was also performed.

Results: Out of 60 participants initially screened, 27 athletes (17 male, age 45±7 years) finished the race in 33:34±1:59 hours. Both LV (-20.9±2.3 pre- to -18.8±2% post-, p=0.009) and RV global strains (-22.9±3.6 pre- to -21.2±3% post-, p=0.04) decreased post-race, even though remained within normal range for the 85% of the participants. Peak atrial strains [right (RA) and left (LA)] did not change (p=0.12 and 0.95). Basal and mid segmental strain values significantly decreased post-race, while both LV and RV apical strain values remained unaffected (p=0.899 and p=0.46, accordingly) (Figure). Concerning interchamber relationships, RV and RA strain curves were constantly larger in magnitude than those of the LV and LA, with RV/LV, LV/LA, RV/RA and RA/LA peak values’ ratios remaining unchanged from pre- to post-race. Finally, although right chambers’ time-to-peak values were shorter compared to the left ones, all chambers’ strain curves peaked later post-race (p<0.001 for all).

Conclusions: Despite subtle changes in LV and RV strain, 4-chamber deformation values remained within normal range even after running a 246 km ultra-marathon. Following a segmental analysis, this finding could be explained for both ventricles by a preservation of apical deformation. Additionally, inter- and atrioventricular concordance was also maintained.
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