Post-marathon decline in right ventricular radial motion component among amateur sportsmen

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Introduction: Running the marathon may be followed by post-exercise “cardiac fatigue” manifesting as transient right ventricular (RV) systolic and diastolic impairment. It is the thin-walled RV that is predominantly affected by the exercise-induced overload, with little if any, impact on the left ventricle (LV) [1]. The 2-D echocardiographic (ECHO) assessment of RV is challenging and may be incomplete since conventional measures reflect only the longitudinal motion (displacement of tricuspid annulus towards the apex) [2]. The mechanics of RV can be separated into two more components, anteroposterior (stretching RV wall by contracting septum) and radial (internal relocation of the RV free wall) [2]. The significance and relative contribution of motion components to global RV function may not be equal, and their interplay can vary depending on concomitant diseases [3].

Purpose: We aimed to analyse the pathophysiology of RV exhaustion as-sociated with a marathon run with 3-D ECHO, which allows precise estimation of all RV motion components and their contribution to RV global function.

Methods: The study included 34 healthy males (mean age of 40±8 years), amateurs, who finished the marathon in northern Poland. The 3-D ECHO was performed 2 weeks before (stage I), at the marathon finish line (stage II) and 2 weeks after the competition (stage III). According to the ReVISION method (Right ventricular separate wall motion quantification) the global RV function was decomposed to longitudinal (L_), anteroposterior (AP_) and radial (R_) [3]. By dividing componental ejection fractions (EF) with global RV EF, L_EF, AP_EF, and R_EF ratios were obtained.

Results: When comparing results from stage I and III there were no significant differences (Table 1). The analysis revealed post-run decline in RV EF with no changes in LV EF. The quantification of the RV motion components showed reduction in R_EF after the marathon with no changes in AP_EF or L_EF. The relative contribution of componental EF to global RV function were permanent and was not influenced by the competition.

Conclusions: Marathon run resulted in transient RV dysfunction arising from decline in radial shortening. Noteworthy, the componental interplay between wall motion compartments was preserved in pre- and post-run assessment. The ReVISION method enables the comprehensive analysis of the competing RV.

Table 1. 3-D ECHO parameters obtained in amateur marathon runners

| Parameter | Stage I (mean ± SD) | Stage II (mean ± SD) | Stage III (mean ± SD) | ANOVA p-Value | Post Hoc p-Value |
|-----------|---------------------|----------------------|----------------------|---------------|-----------------|
| LV EF [%] | 56.4 ± 3.5          | 55.0 ± 4.5           | 56.4 ± 3.4           | > 0.05        | -               |
| RV EF [%] | 51.3 ± 3.3          | 45.8 ± 4.0           | 50.6 ± 4.3           | < 0.05        | < 0.05          |
| R_EF [%]  | 23.0 ± 4.5          | 19.3 ± 2.2           | 21.2 ± 4.5           | < 0.05        | < 0.05          |
| AP_EF [%] | 17.3 ± 3.5          | 16.4 ± 4.2           | 17.3 ± 3.5           | > 0.05        | -               |
| L_EF [%]  | 22.9 ± 3.2          | 20.4 ± 3.8           | 22.2 ± 3.7           | > 0.05        | -               |
| R_EFi    | 0.46 ± 0.06         | 0.42 ± 0.08          | 0.44 ± 0.07          | > 0.05        | -               |
| AP_EFi   | 0.35 ± 0.06         | 0.36 ± 0.07          | 0.36 ± 0.06          | > 0.05        | -               |
| L_EFi    | 0.46 ± 0.05         | 0.45 ± 0.08          | 0.46 ± 0.07          | > 0.05        | -               |