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NON-INVASIVE ASSESSMENT OF THE PULMONARY AND SYSTEMIC VASCULAR DISTENSIBILITY AT EXERCISE IN SEDENTARY VS. ATHLETIC SUBJECTS

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INTRODUCTION:
Physical activity improves cardio-vascular health condition. However, it remains uncertain how much training affects the vascular distensibility (α) of the pulmonary circulation, in regard to the systemic vascular distensibility. This is of particular interest as the right ventricle (RV) function is under heavy stress during exercise (1) at high cardiac output (Q). We hypothesized that a more distensible circulation (after physical training) would smoothen the RV afterload during exercise. We therefore compared the RV and pulmonary circulation response at exercise among athletes and sedentary subjects, in contrast with the exercise systemic vascular response.
METHODS:
17 international professional football players (24±3 years) matched by age and body mass index with 17 sedentary volunteers, performed an incremental cyclo-ergometric exercise echocardiography for right ventricular (RV) and pulmonary circulation evaluation. Gas exchanges and systemic arterial blood pressure were measured continuously during exercise. Q was calculated from the left ventricular outflow tract flow velocity-time integral, mean pulmonary arterial pressure (PAPm) was calculated from the peak tricuspid regurgitation velocity and right atrial pressure. The coupling of RV function to the pulmonary circulation was evaluated by the tricuspid annular plane systolic excursion (TAPSE) to systolic PAP (PAPs) ratio. Pulmonary and systemic vascular distensibility, αpulm and αsys, were determined from multi-point mPAP/atrial pressure vs Q relationships, from an established equation.
RESULTS:
While athletes displayed smoothened chronotropic ($p<0.001$) and enhanced inotropic ($p=0.006$) responses to exercise as compared to sedentary subjects, the exercise-induced increase in PAPm or the decrease in TAPSE/PAPs did not differ between the two groups. However, αpulm was higher in athletes than in sedentary people (1.37±0.41 vs 0.88±0.42%/mmHg, $p=0.002$) and correlated with the TAPSE/PAPs ratio (football players: $p=0.006$, $r=0.63$, sedentary: $p<0.001$, $r=0.79$). αsys was correlated to αpulm ($p<0.05$, $r=0.33$) suggesting a global (systemic and pulmonary) vascular training adaptation. Indeed, even if αsys was not different between the two groups, it was positively correlated to cardio-respiratory fitness indexes such as the VO2peak ($p=0.02$, $r=0.37$) and the stroke volume at maximal common effort ($p=0.02$, $r=0.37$).
CONCLUSION:
Similar exercise-induced mPAP and TAPSE/PAPs response was observable in athletes and sedentary subjects, suggesting a preserved RV function in both populations. However, athletes present a higher vascular pulmonary distensibility, αpulm associated with better preserved RV-arterial coupling. How much this smoothened RV afterload and coupling changes are advantageous during long or intense exercise remains to be defined. The advantageous vascular distensibility effect seems to affect the exercise-induced response of both circulations systemic and pulmonary in relation to the aerobic capacity.

1. La Gerche (2014)

Topic: **Physiology**

Presentation **Oral**