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Impact of Sport and High Intensity Training on Global and Regional Myocardial Deformation in Elite High School Athletes

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Background: Cardiac adaptation to high intensity athletic training is characterized by increases in left ventricular (LV) chamber dimension, wall thickness & mass. The physiologic impact of training on myocardial deformation in highly trained elite high school athletes has not been extensively reported. The purpose of this study was to assess the impact of the type of sport participation & long-term training on parameters of LV systolic & diastolic function including newer modalities of tissue Doppler and myocardial deformation in highly trained high school athletes compared to sedentary controls. ***Methods:*** Standard two-dimensional (2D), spectral Doppler, & tissue Doppler were prospectively performed utilizing a GE Vivid 7 to evaluate LV systolic & diastolic function in 78 elite high school athletes (45 males) compared to controls. Longitudinal 2D strain was performed to evaluate 17 regional (apical, mid, & basal segments) & global longitudinal LV myocardial strain. The impact of the type of sport & training (figure skating, ice hockey, soccer) on LV systolic & diastolic function were assessed. ***Results:*** Data are summarized in the table. Heart rate, LV dimensions, and LV mass were significantly different in athletes compared to healthy controls ($p<0.001$). Traditional measures of LV systolic and diastolic function as well as tissue Doppler and global longitudinal 2D strain were not different between groups. However, regional differences in strain were identified, with apical deformation increased relative to basal function in athletes compared to controls ($p<0.001$). Similar regional changes were seen in all athletes, the most prominent differences in skaters and hockey players. ***Conclusions:*** While global longitudinal myocardial velocity and deformation were not significantly different in athletes compared to healthy controls, regionally increased apical deformation compared to basal function was consistently demonstrated in all athletic groups. Ongoing assessment of radial and circumferential deformation as well as LV torsion may add novel insights into whether this represents a compensatory adaptation or augmented contractile reserve with training in athletes. This information may also assist in distinguishing athletic from myopathic increases in LV mass.

Table 1

	Athletes	Controls	
N	78	25	
Age	15.9+/-1.3	15.6+/-1.9	p=NS
BSA	1.8+/-0.2	1.7+/-0.2	p=NS
HR	62+/-11	71+/-13	p<0.001
LV Mass	147+/-34	131+/-38	p<0.001
LV EDD	5.1+/-0.4	4.8+/-0.5	p<0.001
LV ESD	3.2+/-0.4	3.0+/-0.3	p<0.01
LV EF %	61+/-6	60+/-5	p=NS
TDI Septal E	0.15+/-0.02	0.14+/-0.02	p=NS
TDI Septal A	0.06+/-0.01	0.06+/-0.01	p=NS
TDI Septal S	0.09+/-0.01	0.09+/-0.01	p=NS
TDI Mitral E	0.19+/-0.03	0.20+/-0.03	p=NS
TDI Mitral S	0.11+/-0.02	0.11+/-0.03	p=NS
Global 2D Strain	-20.3+/-1.8	-20.7+/-1.9	p=NS
Apical 2D Strain	-21.9+/-3.4	-20.0+/-2.8	p<0.001
Mid 2D Strain	-20.1+/-1.7	-20.4+/-2.0	p=NS
Basal 2D Strain	-19.0+/-1.8	-21.9+/-2.7	p<0.001