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Assessment of LV function response to incremental dynamic exercise in healthy children and adolescents using 2-D speckle tracking echocardiography

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Purpose
Standard cardio-pulmonary exercise testing (CPET) cannot directly assess ventricular adaptation to exercise and this limits its predictive value in paediatric cardiology. 2-D speckle tracking (2-D STE) is a validated tool to assess ventricular function at rest but has not been validated during exercise. This pilot study used 2-D STE, gas analysis and near-infrared spectroscopy (NIRS) to comprehensively assess cardio-pulmonary exercise response.

Methods

- 17 healthy volunteers (11 boys, 6 girls)
- Modified McMaster incremental exercise test on a recumbent cycle ergometer (25W·3min increments) to volitional exhaustion
- 2-D longitudinal LV strain using 2-D STE at rest and during each exercise stage.
- Simultaneous gas exchange analysis and NIRS were performed to determine oxygen consumption and muscle oxygen uptake.

ECHO – image acquisition and analysis

- Vivid Q, GE, transducer 4-6 MHz, 50-90 fps
- Modified LV apical 4-chamber view
- Manual contouring of endocardial borders in single cardiac cycle

Results

- There was a significant increase in O2 uptake at all exercise stages (p<0.05). Longitudinal peak systolic strain at rest, baseline, 50, 75, 100W. Rec2 and Rec10 were as follows for septal LV wall: -19±3,-23±3,-22±3,-22±6,-23±3,-19±5 and -14±5% respectively and for lateral LV wall: -18±3,-19±4,-20±4,-22±5,-21±5,-17±5 and -14±5% respectively. There was moderate positive correlation between peak systolic longitudinal global LV strain and peak work rate (r=0.650, P < 0.05).
- There was no significant correlation between resting echo parameters and exercise data.

Conclusion

This study provides novel normative data on LV contractile response during staged maximal aerobic exercise in healthy children. LV longitudinal peak systolic strain increases during exercise. This methodology can help comprehensively investigate contractile exercise response and contractility reserve, correlate exercise LV function to other CPET parameters and early detect subclinical ventricular dysfunction.

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