New Steady State Submaximal Exercise Test during Cardiovascular Magnetic Resonance – First Results in Healthy Volunteers

E Steinlechner[1], S Fratz[1], H Rieger[1], C Meierhofer[1], A Hager[1], St Martinoff[2], J Hess[1], H Stern[1]

[1] Department of Pediatric Cardiology and Congenital Heart Disease,
[2] Division of Radiology, Deutsches Herzzentrum München, Technische Universität München, Munich, Germany

Conclusions

This new exercise mode enables steady state submaximal exercise in the CMR magnet bore, resulting in a mean stress level of 24 % of maximal exercise. It gives us the possibility to make composite hemodynamic measurements under stress with acceptable motion artefacts, which has not been feasible before.

Background

Cardiovascular Magnetic Resonance (CMR) is important for the assessment of cardiac anatomy and function. It lacks, however, the opportunity of performing exercise during scanning. Therefore, we established a new method of performing steady state submaximal exercise during CMR scans.

Image 1: A volunteer performing the submaximal exercise during CMR.

Image 2a shows a CMR image under submaximal stress with very few motion artefacts
Image 2b is a typical, rather „bad“ CMR image of another patient

Methods

Ten healthy volunteers (median age 25 yrs., range 19-38) were studied by CMR and bicycle cardiopulmonary exercise test (CPET). By CMR, left ventricular (LV) volumes and stroke volume in the ascending aorta were measured under rest and submaximal exercise (Image 2 a and 2b). Heart rate (HR), systolic and diastolic blood pressure were assessed, too. Steady state submaximal exercise was defined as 144 up and down strokes of the extended legs per minute, directed by an electronic metronome. For this purpose, a simple pulley was fixed to a specially designed frame and mounted on the CMR table. The volunteers´ legs were connected by a rope, passing over the pulley.
CPET was performed at a standard symptom-limited bicycle exercise test and a second time using the steady state submaximal exercise setting from the CMR unit. During both tests oxygen uptake (Vo2) and cardiopulmonary response were assessed.
Statistical analysis was performed using paired t-test.

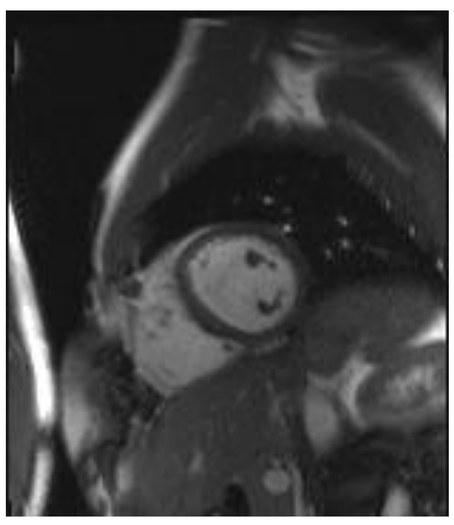


Image 2 a

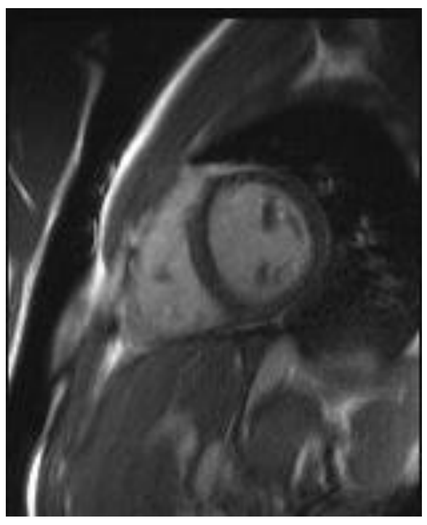
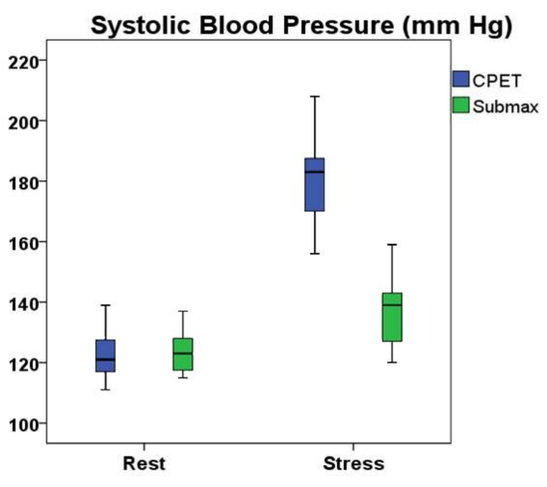
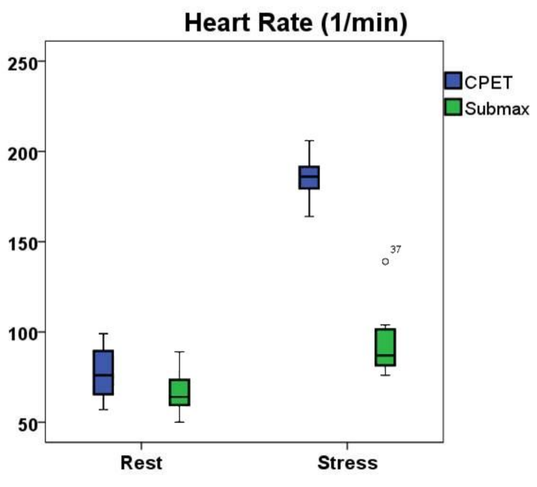


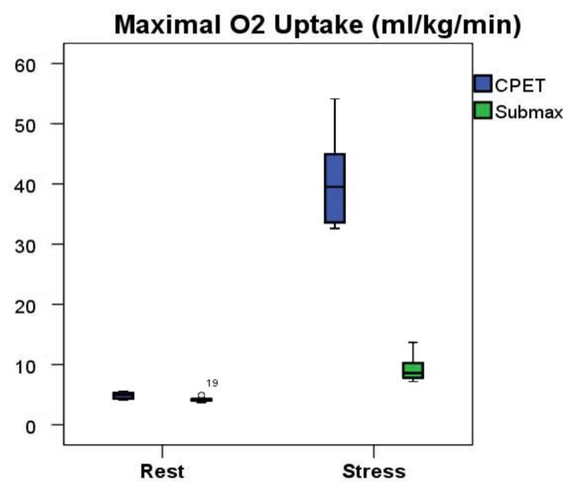
Image 2b

Results

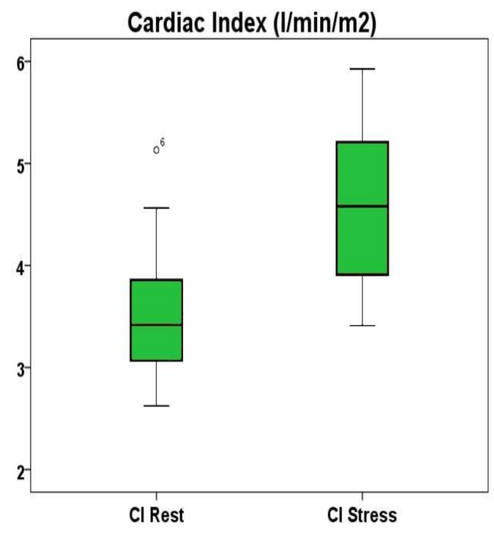
CPET vs. Submaximal exercise in the CMR







Hemodynamic changes during submaximal exercise



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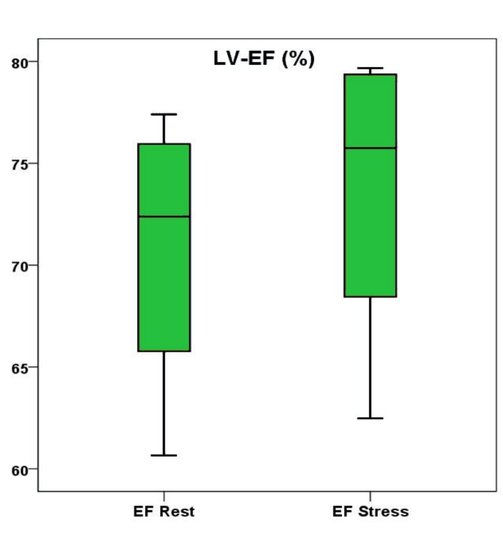

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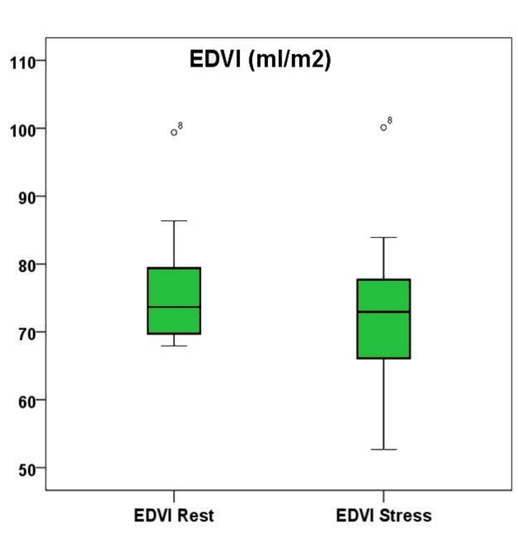

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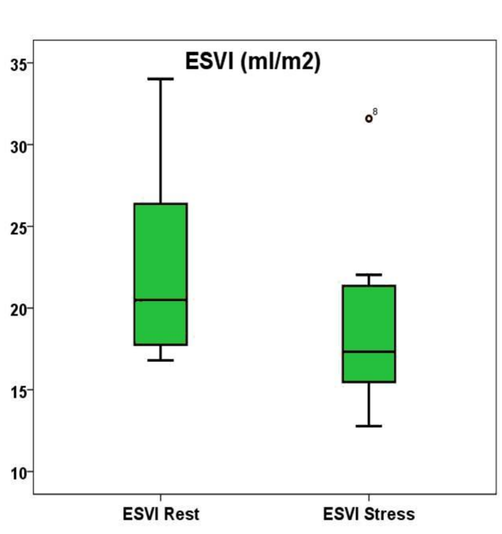

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