

PW2-10

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

Steinlechner E., Fratz S., Rieger H., Meierhofer C., Hager A., Mueller J., Martinoff St., Hess J., Stern H.

Deutsches Herzzentrum München, Clinic for Pediatric Cardiology and Congenital Heart Disease, Germany

Cardiovascular Magnetic Resonance (CMR) is important for 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.

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. Heart rate (HR), systolic (RR_{sys}) and diastolic (RR_{dia}) 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 MR 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.

RESULTS: Maximal VO₂ at routine CPET was 40 ± 7 ml/kg/min. During steady state submaximal exercise using the CMR exercise setting the VO₂ was 9 ± 2 ml/kg/min. Thus the new exercise mode resulted in a mean stress level of 24 ± 5 % of maximal stress. During steady state submaximal exercise HR, RR_{sys} and RR_{dia} increased by 33 ± 10 %, 14 ± 7 % and 19 ± 10 %, respectively. LV enddiastolic and endsystolic volume decreased by 5 ± 12 and 14 ± 18 %, respectively. LV ejection fraction rose by 4 ± 7 %. Cardiac index, assessed by phase contrast measurement, increased by 30 ± 10 %.

CONCLUSION: 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 enables composite hemodynamic measurements under stress with acceptable motion artefacts, that has not been feasible before.