Cardiac output during exercise in young adults operated for ventricular septal defect in early childhood

Arlander B.A. (1), Heiberg J. (1), Ringgaard S. (2), Hjortdal V.E. (1)
Department of Cardiothoracic and Vascular Surgery, Aarhus University Hospital, Denmark (1), MR Center, Institute of Experimental Clinical Research, Aarhus University Hospital, Denmark (2)

Introduction
Recent studies are challenging the general perception of the long-term outcome after surgical closure of ventricular septal defect (VSD) in childhood. It has been demonstrated that surgical VSD-closure is associated with markedly reduced functional capacity and disruption of the right ventricular force-frequency relationship during exercise in adulthood. In order to describe the late cardiac morbidity, we performed a non-invasive assessment of cardiac output during exercise in adults operated for VSD in early childhood.

Methods
We conducted a prospective study at a tertiary referral center. Patients (n=20) and healthy age- and gender matched controls (n=20) underwent continuous supine bicycle ergometry during real-time phase-contrast magnetic resonance imaging (MRI) using a Philips 1.5 Tesla Intera scanner. The cycling workload was automatically incremented by 25 watt every 75 seconds during the test session, until reaching submaximal heart rate of 75-80% of maximum (220bpm - age). The ascending aorta and pulmonary trunk were imaged in a transversal view and real-time flow in each of the vessels was recorded at each exercise level. The cardiac output was determined by blinded, post hoc segmentation using dedicated software. The International Physical Activity Questionnaire and the SF-36 were applied for Health-Related Quality-of-Life assessment.

Results (Preliminary)
In the VSD-group the mean age at surgery was 2.1 (SD± 1.4) years and the age at the time of examination was 22.4 (SD± 2.2) years in the VSD-group vs. 23.1 (SD± 2.1) in the control group. The VSD-group had a lower mean cardiac index (CI) during the test session: 5.19 (SD ±1.70 L/min/m2) versus 5.65 (SD ±1.78 L/min/m2) in controls, p<0.05. Cardiac index was related to heart rate during exercise and the VSD-group had lower mean cardiac indices during the entire session although statistically insignificant at predefined heart rates.

Conclusions
Young adults with a surgically closed ventricular septal defect had a slightly reduced cardiac output during supine exercise compared with healthy age- and gender matched controls. Our findings may importantly contribute to the previously demonstrated reduction in peak exercise capacity.