

## Effect of cycle exercise on regional oxygen saturation in Failing-Fontan patients

Schröer S. (1), Münch F. (2), Dittich S. (1), Alkassar M. (1), Ruffer A. (2), Toka O. (1), Moosmann J. (1)  
(1) Department of pediatric cardiology; University of Erlangen-Nürnberg; Germany (2) Department of Paediatric cardiac surgery; University of Erlangen-Nürnberg; Germany

### Introduction:

Failing-Fontan patients suffer from increased morbidity and mortality, while pathophysiologic changes leading to a failing still remain unknown. We investigated differences in regional oxygen saturation (rSO<sub>2</sub>) by near infrared spectroscopy (NIRS) in Failing-, Non-Failing Fontan and biventricular (TGA) patients during ramp incremental cycle exercise, following the hypothesis that rSO<sub>2</sub> is lower in Failing-Fontan patients, which could contribute to the development of a failing.

### Methods

38 patients underwent (n=7 Failing Fontan, n=22 Non-Failing Fontan and n=9 TGA patients) incremental ramp cycle exercise under continuous blood pressure, heart rate and ECG-surveillance. The average age was 16.5y ( $\pm$  5,57). NIRS was measured with 4 electrodes (kidney, frontal cortex, quadriceps femoris and triceps brachii) during the exercise, a 5-minute recovery period and during one hour physiologic regeneration by a portable NIRS monitor. Absolute and relative (from baseline) were calculated.

### Results

Failing-Fontan had significantly shorter duration of exercise than Non-Failing or TGA patients ( $p<0.01$ ), less watts per kilogram ( $p<0.01$ ), a higher resting heart rate ( $p=0.01$ ), a lower maximum heart rate ( $p<0.01$ ) and lower resting and maximum blood pressure ( $p<0.01$ ). Failing and Non-Failing Fontan showed significantly lower baseline in cerebral oxygen saturation than biventricular patients (66.2 and 69.9 vs. 76.7  $p=0.03/p=0.04$ ) and Failing patients showed a trend of lower renal oxygen saturation than TGA patients (64.3 vs. 82.8;  $p=0.09$ ). In musculature rSO<sub>2</sub> was significantly lower in triceps brachii for Failing patients compared to TGA (61.2 vs. 72.1;  $p=0.02$ ), in quadriceps femoris absolute values of rSO<sub>2</sub> were lower in Failing ( $p=0.09$ ) and Non-Failing but didn't pass the significant threshold. Failing patients showed a significantly ( $p<0.01$ ) faster decrease of rSO<sub>2</sub> according to exercise time than Non-Failing or TGA patients. On the other side TGA patients showed a significantly faster regeneration regarding rSO<sub>2</sub>.

### Conclusions

This is the first study demonstrating regional oxygen measurements in Failing-Fontan patients under cycle ergometry, showing that Failing-patients present with significant decreased rSO<sub>2</sub> in rest and under exercise compared to Non-Failing and especially biventricular patients. Decreased rSO<sub>2</sub> univentricular patients compared to biventricular controls demonstrates low output of the single ventricle. The effects of chronic desaturation in Failing-Fontan patients need to be discussed and further evaluated.