Adults with congenital heart disease have impaired calf muscle oxygenation compared to control subjects

Authors:
C Sandberg¹, AG Crenshaw², GH Elcadi², C Christersson³, J Hlebowicz⁴, U Thilen⁴, B Johansson¹, ¹Umeå University, Heart centre and Department of Public Health and Clinical Medicine - Umeå - Sweden, ²Gävle University, Department of Occupational and Public Health Sciences - Gävle - Sweden, ³Uppsala University, Department of Medical Sciences - Uppsala - Sweden, ⁴Lund University, Department of Cardiology, Clinical Sciences - Lund - Sweden,

Topic(s):
Adult Congenital Heart Disease, Clinical

Citation:
Background: Peripheral muscle factors are presumed to be important contributors to the reduced exercise capacity in congenital heart disease (CHD), but the mechanisms are poorly understood.

Purpose: To investigate if muscle oxygenation in the calf muscle is impaired in adults with complex CHD in comparison to controls.

Method: Seventy-four adults with complex CHD (35.6±14.3 years, females n=22) were recruited from centers specialized in adult CHD. Seventy-four age and gender matched subjects were recruited as controls. Muscle oxygenation was successfully determined using near-infrared spectroscopy on the medial portion of m. gastrocnemius in 63 patients and 67 controls. Measurements were made at rest, during venous occlusion to estimate blood flow (BF – indicated by the slope increase of total haemoglobin, HbT), at the start of isotonic unilateral heel-lifts to exhaustion, and immediately after exercise.

Results: In comparison to controls, patients had a lower muscle saturation (StO2) at rest, albeit not statistically significant, (66±17% vs.60±19%, p=0.07), and a lower BF (0.38±0.21 vs. 0.31±0.21 HbT x 3.5 sec⁻¹, p=0.07). For exercise, compared to the controls, patients had a slower desaturation rate at exercise onset (-11.7±5.8%vs.-7.7±4.3%. StO2 x 3.5 sec⁻¹, p<0.001), and both a slower resaturation rate (6.1±3.8%vs.3.9±3.7%StO2 x 3.5 sec⁻¹,p=0.002) and a slower half recovery time (16.8±11.1 vs. 28.6±21.2 sec, p<0.001) post exercise.

Conclusion: The lower muscle oxygenation and blood flow at rest, and the slower oxygenation kinetics during exercise may give insight to the mechanism for the reduced exercise capacity commonly found in adults with complex CHD. This finding may also provide implications for design of rehabilitation programs for these patients.