

Decreased exercise tolerance in children after aortic coarctation repair: relationship with changes in cerebral and muscle oxygenation

Vandekerckhove K. (1), Coomans I.(1), Moerman A.(2), Panzer J.(1), De Groot K.(1), De Wilde H.(1), Bove T.(3), François K.(3), De Wolf D.(1), Boone J.(4)

Department of Pediatric Cardiology, Ghent University Hospital, Ghent, Belgium (1); Department of Anesthesiology, Ghent University Hospital, Ghent, Belgium (2); Department of Cardiac Surgery, Ghent University Hospital, Ghent, Belgium(3); Department of Movement and Sports Sciences, Ghent University, Ghent, Belgium (4)

Introduction: Children after coarctation repair have lower exercise performance compared to their healthy peers. It is unknown whether there are differences in oxygen transportation and extraction at the local cerebral and muscular level during exercise in this patient group.

Methods: 16 children after coarctation repair were compared with 20 healthy peers. Near infrared spectroscopy was used to assess oxygenation at the left M. Vastus medialis and at the prefrontal lobe. Changes of HHb and O₂Hb in relation to load were compared in both groups; correlation between residual continuous wave Doppler gradient and local oxygenation was evaluated.

Results: Age, length and weight was similar in both groups. Patients with aortic coarctation had lower %P_{peak} (72.3±20.2% vs. 106±18.7%, P<0.001), VO₂/kg (37.3±9.1 vs. 44.2±7.6 ml/kg, P=0.019) and %VO₂/kg (85.7±21.9 vs. 112.1±15.5, P< 0.001). Cerebral O₂Hb and HHb had a higher increase in both curves during exercise, with significant differences from 60% (O₂Hb) and 80% (HHb) of the peak exercise compared to controls. Muscle O₂Hb was not different between both groups, but muscle HHb had a significantly steeper increase, with Δmuscle HHb/ ΔP significantly different from 10% of the exercise onwards. There was a weak but significant correlation between residual Doppler gradient measured by echocardiography and changes in muscle HHb at 10-20% and 20-30% of peak exercise (r=0.37, P=0.42 and r=0.38, P=0.40)

Conclusion: Children after coarctation repair have different patterns of oxygenated and deoxygenated hemoglobin at the level of the brains and a different pattern of deoxygenated hemoglobin at the muscular level. The increased muscular deoxygenation is more pronounced in children with higher residual coarctation gradient on echocardiography.