Impact of Cardiopulmonary Bypass Time on Motor Development in Children and Adolescents with Congenital Heart Disease

Häcker A.-L. (1,2), Reiner B. (1,2), Weberruss H. (1), Hager A. (2), Oberhoffer R. (1,2), Ewert P. (2), Müller J. (1,2)
Chair of Preventive Pediatrics, Technical University of Munich, Munich, Germany (1); Department of Pediatric Cardiology and Congenital Heart Disease, German Heart Centre Munich, Technical University of Munich, Munich, Germany (2)

Introduction: Heart surgeries requiring low-flow cardiopulmonary bypass increase the risk of long-term brain impairments and foster neurologic and fine motor deficits in children with congenital heart disease (CHD). This study analyzes the association between the accumulated cardiopulmonary bypass time (CPB) and the motor development in children with CHD.

Patients and Methods: From July 2014 to July 2016 motor development of 504 children with various CHD (190 females, 13.1 ± 3.1 years old) was assessed by five tasks (FITNESSGRAM®), converted to a motor score and compared to a recent healthy reference cohort. 161 (31.9%) children with CHD exhibit impaired motor development defined by a score lower than one standard deviation compared to the reference.

Results: 276 of those children had 1.9 ± 1.1 cardiopulmonary bypass surgeries with an accumulated CPB time of 179 ± 115 minutes. In multivariable logistic regression, every increase by 10 minutes of CPB time resulted in a 6% (OR=1.006, 95% CI=1.002 – 1.010, p=.002) increase in risk for impaired motor development. Dividing the accumulated CPB time into several shorter surgeries decreased the risk (OR=0.602, 95% CI=0.376 – 0.964, p=.008). Moreover, compared to patients with left heart obstruction, patients with isolated shunt had a 1.9-fold (p=.037), right heart obstruction 2.1-fold (p=.024), and Fontan circulation 4.0-fold (p<.001) increased risk.

Conclusion: Longer accumulated CPB time increased the risk of an impairment in motor development, especially when long CPB time results from fewer surgeries. To minimize potential impairment, shortening of CPB time or usage of alternative procedures is recommended.