

MP3-6

Smaller regional brain volumes are correlated with adverse neurodevelopmental outcome at one year of age in complex congenital heart disease

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Objectives: The purpose of this ongoing prospective cohort study is to analyse, if pre- and postoperatively measured brain volumes in neonates suffering from severe congenital heart disease (CHD) predict one- year- neurodevelopmental outcome.

Methods: Infants with severe CHD undergoing neonatal cardiopulmonary bypass surgery were examined with a pre- and postoperative cerebral MRI. Neurodevelopmental testing at 1 year was performed using the Bayley III.

Results: 78 neonates with CHD and 43 term controls were included (mean gestational age at birth was 39.2 weeks for the CHD children and 39.6 weeks in the control group). The CHD infants had lower total and regional brain volumes in all regions compared to healthy controls (mean whole brain volume CHD infants postoperatively 395.2 cm³, controls 434.7 cm³, p<0.001). Female CHD infants had lower total brain volumes compared to males (p< 0.05). The Bayley-III composite standard scores were lower in CHD infants compared to healthy controls in all three domains: cognition: 104 (55-140) versus 117 (85-135) (p<0.01), language; 92 (56-132) versus 97 (79-124) (p<0.05), motor: 92 (46-135) versus 103 (73-121) (p<0.01). Logistic regression analyses correcting for gender, postmenstrual age at time of MRI and protocol group showed that postoperative brain volumes (whole brain, cortex, white matter, lobes (except temporal lobe), cerebellum) predicted cognitive outcome in CHD (see table 1) but not in control children.

	Cognitive			Language			Motor		
	Beta	P	R ²	Beta	P	R ²	Beta	p	R ²
Whole brain	0.145	0.025*	0.125	0.130	0.024*	0.132	0.111	0.051	0.192
Cortex	0.206	0.017*	0.137	0.173	0.025*	0.131	0.159	0.037*	0.200
White matter	0.275	0.022*	0.129	0.238	0.025*	0.131	0.218	0.039*	0.199
Frontal lobe	0.498	0.019*	0.133	0.447	0.018*	0.142	0.381	0.042*	0.196
Parietal lobe	0.624	0.03*	0.120	0.433	0.092	0.089	0.515	0.041*	0.197
Occipital lobe	1.202	0.039*	0.112	1.133	0.028*	0.127	1.035	0.042*	0.197
Temporal lobe	0.5	0.123	0.08	0.499	0.102	0.115	0.076	0.799	0.132
Cerebellum	1.247	0.019*	0.133	0.825	0.086	0.091	0.889	0.059	0.187

*= p <0.05

Conclusion: Our findings confirm that there is a global reduction of cerebral volume in newborns with severe CHD. Further, the data shows that postoperative brain volumes are a predictor for the cognitive outcome in CHD infants. Children with low cerebral volume could be detected early on which would allow for early therapeutic interventions.