MP3-4

Impact of higher central venous pressure on brain development and neurocognitive outcome in children before Fontan procedure at 2 to 3 years of age

Knirsch W. (1,2), Mayer K. (1,2,3), Scheer I. (2,3), Tuura R. (2,3), Beck I. (2,4), Wetterling K. (5), Schranz D. (6), Hahn A. (7), Latal B. (2,4), Reich B. (6)
Pediatric Cardiology, Pediatric Heart Center (1), Children's Research Center (2), Diagnostic Imaging, MR Center (3), Child Development Center (4), University Children's Hospital Zurich, Switzerland; Child Development Center, Frankfurt/Main, Germany (5); Pediatric Heart Center (6), Pediatric Neurology (7), University Hospital Giessen, Germany

Objectives: After bidirectional cavopulmonary anastomosis central venous pressure (CVP) increases and may influence further brain development in children with single ventricle until Fontan procedure. Therefore, we analysed hemodynamic impact on brain development before Fontan procedure.
Methods: In a prospective two-center study we analysed 32 children with single ventricle (59.4% male, 25 with Giessen Hybrid approach, seven with classical Norwood approach) at a mean age of 27.4 ± 4.0 months (range 18.2 to 34.8). Children with genetic comorbidities were excluded. We evaluated hemodynamic values before Fontan procedure during routine cardiac catheterization and used semi-automated segmentation of cerebral MRI scans and neurodevelopmental assessment with Bayley-III Scales.
Results: Elevated CVP (measured in superior caval vein) and pulmonary artery pressure (PAP) correlated with smaller deep grey matter volume (CVP: r=-.40, p=.03; PAP: r=-.38, p=.04). Elevated pulmonary capillary wedge pressure (PCWP) was associated with both, smaller grey matter (r=-.42, p=.03) and white matter (r=-.42, p=.03) volumes. Increased CVP, PAP and PCWP were associated with greater cerebrospinal fluid (CSF) volumes (CVP: r=.59, p=0.001; PAP: r =.43, p=.02; PCWP: r=.43, p=.03). Larger CSF volumes correlated negatively with Bayley-III Scales: Cognitive Composite Scale (r=-.45, p<0.001), and Language Composite Scale (r=-.46, p<0.001), whereas total brain volumes did not.
Conclusions: Hemodynamics in children after establishing bidirectional cavopulmonary anastomosis may influence brain growth and cerebrospinal fluid volume. Of note, these MRI findings are correlated with adverse outcome. Further studies are needed to clarify the etiologic mechanisms responsible for this association.