Medical Xpress

# Congenital heart defects affects long-term development

December 2 2013

Approximately one percent of all newborns in Switzerland are diagnosed with a congenital heart defect, roughly half of them require open heart surgery. Most children, including those with the most severe heart defects, survive because of the significant advancements in surgical techniques. Therefore, the current research focuses less on survival than on long-term consequences and quality of life of these children.

Aside from cardiac complications, developmental problems may emerge after a complex cardiac surgical procedure. Children may suffer from motor, language or learning difficulties. The etiology of these problems is multifactorial and the association with the surgical procedure, which affects systemic circulation and can impair cerebral blood flow, is not clear. For the first time, researchers from the Children's Hospital Zurich demonstrate that morphological changes of the brain can be detected many years after open-heart surgery and can have a long-term impact on brain development. However, the researchers also discovered that brain changes may already exist before the cardiac surgery. This indicates that the neurological risks associated with the cardiac surgery itself are smaller than previously believed.

## Smaller brain volume with severe heart defects

Under the supervision of the pediatrician Bea Latal, the postdoctoral student Michael von Rhein studied a group of 39 14-year-old congenital heart patients who had undergone open-heart surgery during early

childhood in the late 1990s. The adolescents underwent extensive testing of cognitive and motor skills and the brain volume as well as specific brain regions, were measured using cerebral magnetic resonance imaging. "It became evident that these former cardiac patients had around 10 percent less brain volume than healthy young people," explains von Rhein. Patients with severe congenital heart defects were most affected by this volume loss.

The researchers were also able to demonstrate that adolescents with congenital heart defects were more likely to exhibit learning and motor difficulties than healthy control people.

These difficulties were more pronounced in those with smaller brain volumes. Despite these difficulties, however, most of adolescent patients were able to attend regular school and their quality of life was not impaired.

In another, recently published study, the developmental pediatrician Bea Latal and pediatric cardiologist Walter Knirsch from the Children's Hospital Zurich revealed that the development of children with a congenital heart defect can be delayed prior to surgery and that mild cerebral changes can occur- long before the life-saving heart surgery is performed. "Evidently, the changes in the brain that are detectable at such an early time persist and may influence further development into adolescence," concludes Latal from the results of the study.

**More information:** M. von Rhein, A. Buchmann, R. Huber, P. Klaver, C. Hagmann, W. Knirsch, B. Latal. Smaller brain volume correlates with neurodevelopmental function in adolescents after bypass repair for congenital heart disease. *Brain*. November 25, 2013, DOI: 10.1093/brain/awt322

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Provided by University of Zurich

Citation: Congenital heart defects affects long-term development (2013, December 2) retrieved 7 May 2024 from https://medicalxpress.com/news/2013-12-congenital-heart-defects-affects-long-term.html

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