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Original Article

White Matter Microstructure and Cognition in Adolescents with Congenital Heart Disease

Portions of this study were presented as a poster at the Child Neurology Society Meeting, Huntington Beach, CA, October 31-November 3, 2012.

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Objective

To describe the relationship between altered white matter microstructure and neurodevelopment in children with dextro-transposition of the great arteries (d-TGA).

Study design

We report correlations between regional white matter microstructure as measured by fractional anisotropy (FA) and cognitive outcome in a homogeneous group of adolescents with d-TGA. Subjects with d-TGA ($n = 49$) and controls ($n = 29$) underwent diffusion tensor imaging and neurocognitive testing. In the group with d-TGA, we correlated neurocognitive scores with FA in 14 composite regions of interest in which subjects with d-TGA had lower FA than controls.

Results

Among the patients with d-TGA, mathematics achievement correlated with left parietal FA ($r = 0.39$; $P = .006$), inattention/hyperactivity symptoms correlated with right precentral FA ($r = 0.39$; $P = .006$) and left parietal FA ($r = 0.30$; $P = .04$), executive function correlated with right precentral FA ($r = 0.30$; $P = .04$), and visual-spatial skills correlated with right frontal FA ($r = 0.30$; $P = .04$). We also found an unanticipated correlation between memory and right posterior limb of the internal capsule FA ($r = 0.29$; $P = .047$).

Conclusion

Within the group with d-TGA, regions of reduced white matter microstructure are associated with cognitive performance in a pattern similar to that seen in healthy adolescents and adults. Diminished white matter microstructure may contribute to cognitive compromise in adolescents who underwent open-heart surgery in infancy.



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ACC, Anterior corpus callosum; ACT, Anterior cingulate tract; ADHD, Attention deficit hyperactivity disorder; CADS-P, Conners Rating Scales-Revised, Parent Version; CHD, Congenital heart disease; d-TGA, Dextro-transposition of the great arteries; DTI, Diffusion tensor imaging; FA, Fractional anisotropy; MRI, Magnetic resonance imaging; PLIC, Posterior limb of the internal capsule; ROI, Region of interest; TVPS, Test of Visual-Perceptual Skills; WIAT, Wechsler Individual Achievement Test

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