Cerebral white matter integrity and executive function in adult survivors of childhood medulloblastoma.

Brinkman TM, Reddick WE, Luxton J, Glass JO, Sabin ND, Srivastava DK, Robison LL, Hudson MM, Krull KR.

Department of Epidemiology and Cancer Control, St Jude Children's Research Hospital, Memphis, Tennessee 38105-3678, USA. kevin.krull@stjude.org

Abstract

Survivors of pediatric medulloblastoma are at risk for neurocognitive dysfunction. Reduced white matter integrity has been correlated with lower intelligence in child survivors, yet associations between specific cognitive processes and white matter have not been examined in long-term adult survivors. Twenty adult survivors of medulloblastoma were randomly recruited from a larger institutional cohort of adult survivors of childhood cancer. Survivors underwent comprehensive neurocognitive evaluations and MRI. Data on brain volume and cortical thickness and diffusion tensor imaging were acquired, including measures of fractional anisotropy, apparent diffusion coefficient, and axial and radial diffusivity. Observed neurocognitive scores were compared with population norms and correlated to MRI indices. Survivors were, on average, 29 years of age and 18 years postdiagnosis. Mean full-scale intelligence quotient was nearly 1 SD below the normative mean (86.3 vs 100, P = .004). Seventy-five percent of survivors were impaired on at least one measure of executive function. Radial diffusivity in the frontal lobe of both hemispheres was correlated with shifting attention (left: r(s) = -0.67, P = .001; right: r(s) = -0.64, P = .002) and cognitive flexibility (left: r(s) = -0.56, P = .01; right: r(s) = -0.54, P = .01). Volume and cortical thickness were not correlated with neurocognitive function. Neurocognitive impairment was common and involved many domains. Reduced white matter integrity in multiple brain regions correlated with poorer performance on tasks of executive function. Future research integrating diffusion tensor imaging should be a priority to more rigorously evaluate long-term consequences of cancer treatment and to inform cognitive intervention trials in this high-risk population.