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Radiotherapy-induced vascular cognitive impairment 20 years after childhood brain tumor

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Abstract

Background: Studies have established that radiotherapy for childhood brain tumors (BTs) increases the risk of cerebrovascular disease (CVD); however, it is unclear how this will affect cognitive function. This study aimed to investigate the associations between radiotherapy-induced CVD, white matter hyperintensities (WMHs), and neurocognitive outcomes in adult survivors of childhood BTs.

Methods: In a cross-sectional setting, we conducted a national cohort that included 68 radiotherapy-treated survivors of childhood BTs after a median follow-up of 20 years. Markers of CVD and WMHs were evaluated using brain magnetic resonance imaging (MRI), and the sum of CVD-related findings was calculated. Additionally, the associations among CVD findings, WMHs, and neuropsychological test results were analyzed.

Results: Of the 68 childhood BT survivors, 54 (79%) were diagnosed with CVD and/or WMHs at a median age of 27 years. CVD and/or WMHs were associated with lower scores for verbal intelligence quotient, performance intelligence quotient (PIQ), executive function, memory, and visuospatial ability ($p < 0.05$). Additionally, survivors with microbleeds had greater impairments in the PIQ, processing speed, executive function, and visuospatial ability ($p < 0.05$). WMHs and CVD burden were associated with greater difficulties in memory function and visuospatial ability ($p < 0.05$). Small-vessel disease burden was associated with PIQ scores, processing speed, working memory, and visuospatial ability.

Conclusions: The study results suggest that markers of radiotherapy-induced CVD, the additive effect of CVD markers, and risk factors of dementia are associated with cognitive impairment, which may suggest that the survivors are at a high risk of developing early-onset dementia.

Keywords: Brain tumor; cerebrovascular disease; childhood; cognitive impairment; radiotherapy.