Supratentorial neurometabolic alterations in pediatric survivors of posterior fossa tumors.

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Abstract

PURPOSE: Therapy and tumor-related effects such as hypoperfusion, internal hydrocephalus, chemotherapy, and irradiation lead to significant motor and cognitive sequelae in pediatric posterior fossa tumor survivors. A distinct proportion of those factors related to the resulting late effects is hitherto poorly understood. This study aimed at separating the effects of neurotoxic factors on central nervous system metabolism by using H-1 MR spectroscopy to quantify cerebral metabolite concentrations in these patients in comparison to those in age-matched healthy peers.

METHODS AND MATERIALS: Fifteen patients with World Health Organization (WHO) I pilocytic astrocytoma (PA) treated by resection only, 24 patients with WHO IV medulloblastoma (MB), who additionally received chemotherapy and craniospinal irradiation, and 43 healthy peers were investigated using single-volume H-1 MR spectroscopy of parietal white matter and gray matter.

RESULTS: Concentrations of N-acetylaspartate (NAA) were significantly decreased in white matter (p < 0.0001) and gray matter (p < 0.0001) of MB patients and in gray matter (p = 0.005) of PA patients, compared to healthy peers. Decreased creatine concentrations in parietal gray matter correlated significantly with older age at diagnosis in both patient groups (MB patients, p = 0.009, r = 0.52; PA patients, p = 0.006, r = 0.7). Longer time periods since diagnosis were associated with lower NAA levels in white matter of PA patients (p = 0.008, r = 0.66).

CONCLUSIONS: Differently decreased NAA concentrations were observed in both PA and MB groups of posterior fossa tumor patients. We conclude that this reflects a disturbance of the neurometabolic steady state of normal-appearing brain tissue due to the tumor itself and to the impact of surgery in both patient groups. Further incremental decreases of metabolite concentrations in MB patients may point to additional harm caused by irradiation and chemotherapy. The stronger decrease of NAA in MB patients may correspond to the additional damage of combined irradiation and chemotherapy on neuroaxonal cell viability and number.

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