Proton and carbon ion radiotherapy for primary brain tumors delivered with active raster scanning at the Heidelberg Ion Therapy Center (HIT): early treatment results and study concepts.

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Abstract

ABSTRACT:

BACKGROUND: Particle irradiation was established at the University of Heidelberg 2 years ago. To date, more than 400 patients have been treated including patients with primary brain tumors. In malignant glioma (WHO degrees IV) patients, two clinical trials have been set up—one investigating the benefit of a carbon ion (18 GyE) vs. a proton boost (10 GyE) in addition to photon radiotherapy (50 Gy), the other one investigating reirradiation with escalating total dose schedules starting at 30 GyE. In atypical meningioma patients (WHO degrees II), a carbon ion boost of 18 GyE is applied to macroscopic tumor residues following previous photon irradiation with 50 Gy. This study was set up in order to investigate toxicity and response after proton and carbon ion therapy for gliomas and meningiomas.

METHODS: 33 patients with gliomas (n = 26) and meningiomas (n = 7) were treated with carbon ion (n = 26) and proton (n = 7) radiotherapy. In 22 patients, particle irradiation was combined with photon therapy. Temozolomide-based chemotherapy was combined with particle therapy in 17 patients with gliomas. Particle therapy as reirradiation was conducted in 7 patients. Target volume definition was based upon CT, MRI and PET imaging. Response was assessed by MRI examinations, and progression was diagnosed according to the Macdonald criteria. Toxicity was classified according to CTCAE v4.0.

RESULTS: Treatment was completed and tolerated well in all patients. Toxicity was moderate and included fatigue (24.2%), intermittent cranial nerve symptoms (6%) and single episodes of seizures (6%). At first and second follow-up examinations, mean maximum tumor diameters had slightly decreased from 29.7 mm to 27.1 mm and 24.9 mm respectively. Nine glioma patients suffered from tumor relapse, among these 5 with infield relapses, causing death in 8 patients. There was no progression in any meningioma patient.

CONCLUSIONS: Particle radiotherapy is safe and feasible in patients with primary brain tumors. It is associated with little toxicity. A positive response of both gliomas and meningiomas, which is suggested in these preliminary data, must be evaluated in further clinical trials.

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