High control rate in patients with chondrosarcoma of the skull base after carbon ion therapy: first report of long-term results.

The current study was performed to evaluate the safety and effectiveness of irradiation with carbon ions using raster scanning as well as prognostic factors in patients with skull base chondrosarcomas. Between 1998 and 2008, 79 patients with chondrosarcoma of the skull base were treated using carbon ions in raster scanning. The applied median total dose was 60 gray equivalent (GyE) at 3 GyE per fraction. Local control and overall survival (OS) were evaluated using the Kaplan-Meier method. Long-term toxicity was quantitatively assessed using questionnaires. The median follow-up after irradiation was 91 months (range, 3 months-175 months). Within the follow-up, 10 patients developed local disease recurrence. The 3-year, 5-year, and 10-year local control rates were 95.9%, 88%, and 88%, respectively; the corresponding OS rates were 96.1%, 96.1%, and 78.9%, respectively. With a median follow-up of 110 months after first diagnosis, the corresponding 3-year, 5-year, and 10-year OS rates were 97.5%, 97.5%, and 91.5%, respectively. Age <= 45 years and boost volume <= 55 mL were associated with significantly better local control rates. We observed a clinically relevant improvement in cranial nerve deficits 7 to 10 years after treatment (range, 45.5%-53.3%) compared with the baseline (73.4%).
During follow-up, none of the patients in the current study developed a secondary malignancy. Carbon ion therapy is a safe and effective treatment in patients with chondrosarcoma of the skull base. For further evaluation, a prospective randomized phase 3 trial comparing protons versus carbon ions has been recruiting patients with low-grade and intermediate-grade chondrosarcoma of the skull base since 2009.