The Preliminarily Results of Carbon Ion Radiotherapy in 60 Patients

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Purpose: This study summarizes the experience with carbon ion radiation therapy (RT) at the Heavy Ion Research Facility in Lanzhou since 2009.

Methods and Materials: From December 2009 to June 2013, 60 patients joined into the clinical study as volunteers. 14 patients with brain tumor (cerebral glioma(n=6), metastatic brain tumor (n=8)) , 8 patients with head and neck tumor, 15 patients with chest tumor (primary lung cancer (n=8), metastatic mediastinal carcinoma(n=1), metastatic lung cancer(n=6)) ,13 patients with abdominal carcinoma (primary liver cancer(n=4), pancreatic cancer(n=1), abdominal soft tissue malignant tumor (n=3), metastatic liver cancer(n=4), abdominal lymph node metastasis carcinoma(n=1)) , 5 patients with pelvic tumor (rectal cancer(n=1), anal cancer (n=1), ovarian carcinoma(n=1), chordoma(n=1), soft tissue tumor(n=1)) , 5 patients with limbs tumor (skin cancer(n=2), soft tissue malignant tumor(n=3)) were treated with carbon ions beams. The beams energy was 230~350Mev / u and RBE value was 2.5. A median dose of 60 GyE (range, 20–66 GyE) was delivered to the planning target volume (PTV) in 4-12 fractions with a median daily dose of 5 GyE (range, 4.68–5.5 GyE). Short-term effect was evaluated by tumor change in three months after treatment with RESIST criteria and adverse reactions were determined by criteria of acute radiation injury from Radiation Therapy Oncology Group. Treatment outcome was analyzed in terms of local control rate (LCR), survival rate.

Results: Until December 2014, median follow-up period was 18 months (2-40ms). Objective response rate was 98.3% to evaluate short-term effect (9CR, 37PR, 13NC, 1PD) . The 1-year LCR and overall survival of the treated patients were 80.2% and 62.8%. The local control and overall survival rates were not correlated with tumor location and pathological types, the main cause of death was distant metastasis. All treatment related complications were 1-2 grade acute skin reaction (incidence rate = 66.7%) and self-limited, without any grade 4–5 toxicity.

Conclusions: Carbon ion therapy is safe with respect to toxicity, offers high tumor local control rates and significantly shorten the treatment time. But this study has limitations: a group of cancer patients in advanced stage and short survival and follow up time, small sample size and high heterogeneity because of tumor location, clinical stage and pathological type. More homogeneous prospective data, large multicentric and randomized trials are needed to evaluate the efficacy of heavy ion tumor therapy.

Key Words: Carbon ion; radiotherapy; tumor

Acknowledgments: This study was supported by grants from the National Basic Research Program of China (973 Program) (2010CB834202)