avoidance of feeder injury. When using Tissue Select mode, the power of the CUSA was elevated by 10 or 20 to aspirate the tumor effectively. CONCLUSION: CUSA Clarity contributes to safe resection of glioma due to selective tumor aspiration by Tissue Select.

RADIATION THERAPY (RT)

RT-01
TREATMENT RESULTS OF SALVAGE GAMMA KNIFE STEREOTACTIC RADIOSURGERY AND BEVACIZUMAB (AVAGAMMA THERAPY) FOR RECURRENT GLOBLASTOMA
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PURPOSE: We report the treatment results of AVAgamma therapy combining gamma knife (GK) and bevacizumab for recurrent glioblastoma.

SUBJECTS: From August 2013 to April 2018, 42 patients (183 lesions) with recurrent glioblastoma treated with AVAgamma therapy as salvage therapy at the time of relapse after initial treatment. The average age is 61.1 years, with 25 men and 17 women. The tumor volume is 100 ml or less, KPS is 60% or more as the indication of AVAgamma therapy. When the irradiation volume of GK is 15 ml or less, a single irradiation with a boundary dose of 20 Gy was performed, and when the irradiation volume was 15 ml or more, a single irradiation boundary dose was divided into two divided irradiations of 12 to 15 Gy. The mean therapeutic borderline dose was 24 Gy. Bevacizumab was administered 10 mg / kg or 15 mg / kg 1 to 10 times after GK. METHODS: Median progression-free survival (mPFS), 6-month progression-free survival (PFS-6m), 6-month survival (OS-6m), median survival (mOS) from treatment with AVAgamma Considered mOS from initial treatment. [Results]: The mPFS from AVAgamma therapy was 5 months, PFS-6m was 37%, OS-6m was 84%, and mOS was 9 months. The mOS from initial treatment were 2.5 months. In relapsing glioma RPA classification, NAB T CNC class 5 mOS is 5.6 months, class 6 mOS is 6.4 months, but mOS from AVAgamma therapy is 9 months in class 5, 9 months in class 6. The survival time has been extended. DISCUSSION: By AVAgamma therapy, it was thought that recurrent lesions were locally controlled and life prognosis was prolonged. CONCLUSION: AVAgamma therapy is thought to prolong the survival of recurrent glioblastoma and play an important role as salvage treatment.

RT-02
POTENTIAL OF PROTON BEAM THERAPY FOR THE TREATMENT OF GLOBLASTOMA
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INTRODUCTION: Recently, proton beam therapy has attracted increasing interest in the Japanese neuro-oncological field because of the insurance approval for pediatric brain tumor, chordoma, and chondrosarcoma. We have developed the high dose radiotherapeutic strategy using proton beam for malignant glioma in our institution since long before. Here we retrospectively analyzed the efficacy of this treatment strategy. METHODS: Thirty-four patients with newly diagnosed GBM who underwent high dose proton beam therapy were investigated. All patients received hyperfractionated concomitant radiotherapy consisting of X-ray radiotherapy (50.4 Gy in 28 fractions) and proton beam therapy (46.2 Gy [RBE] in 28 fractions). Concurrent chemotherapy consisted of ACNU in the early 6 cases or TMZ in the late 28 cases. The survival outcome and adverse events were analyzed. RESULTS: The median overall survival time and progression free survival time for all 34 patients were 35.7 months (95%CI, 28.1–43.4) and 11.2 months (95%CI, 6.8–15.7), respectively. No significant survival difference according to the chemotherapy regimen was shown. Failure patterns after proton beam therapy include 19 cases of local recurrence, 3 cases of distant recurrence, and 5 cases of dissemination. Although there was no significant difference in time to recurrence according to the failure pattern, there was a tendency of longer survival in the local recurrence group. As for adverse events, symptomatic radiation necrosis was observed in 9 cases. The median time to onset of necrosis after radiation was 18.2 months (95%CI, 10.2–26.2). There were 8 cases of long survivors over 3 years out of 34 cases (23.5%). Of these, 6 cases developed symptomatic radiation necrosis. CONCLUSIONS: Our results indicate that high dose proton beam therapy of 96.6Gy (RBE) prolonged survival in selected GBM patients. With appropriate patient selection and potent treatment for radiation necrosis, high dose proton beam therapy has a great potential to improve survival in GBM patients.

RT-03
POSTOPERATIVE CYBERKNIFE HYPOFRACTIONATED RADIOTHERAPY FOR THE ELDERLY PATIENTS WITH GLOBLASTOMA
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INTRODUCTION: In recent years, hypofractionated radiotherapy (HRT) 40Gy in 15 fractions with concomitant temozolomide(TMZ) has come to be used as standard treatment for elderly glioblastoma. However, the treatment duration of 3–4 weeks for radiation is not enough short, and there is also a problem of radiation sickness. We performed hypofractionated stereotactic radiotherapy with CyberKnife (CK) for less than 2 weeks. We retrospectively analyzed eight newly diagnosed elderly patients with glioblastoma treated by CK. METHODS: Surgical cavity, contrast enhanced lesion, FLAIR high signal intensity area were set as gross tumor volume (GTV). To planned target volume (PTV) as GTV + 2 mm. In total dose (DT) of 5 fractions [Fr] of CK was prescribed. The dose prescription and number of fractions were adjusted taking into consideration dose distribution, dose-limiting for important organs such as optic chiasm and brainstem. RESULTS: The eight patients consisted of 3 men and 5 women. The median age was 78 (range 68–84) years old. All patients were pathologically diagnosed as glioblastoma. Two of 8 cases had undergone gross total removal of contrast area. Median postoperative KPS was 70 (40–80). Thirty three (28–33.3) Gy was administered in 5 (3–10) Fr to PTV 117 (44–243) ml. TMZ was used in 7 patients, Bevacizumab (BEV) was used together from 4 weeks after surgery in 5 patients. Progression-free survival was 6.5 (2.9–10.6) months and overall survival was 17.5 (7.1–28.5) months. 7 patients had experienced controllable hypertension without antihypertensive agents, Two patients had suffered from deep vein thrombosis, and antiembolization therapy was used. One patient had nausea and malaise due to TMZ and had continue BEV alone. Asymptomatic cerebral infarction in the radiation field was observed in a patient. CONCLUSION: CK treated in less than half duration of conventional HRT is expected to be less invasive treatment.

RT-05
THE RESULTS OF GAMMA KNIFE RADIOSURGERY WITH BEVACIZUMAB (AVAGAMMA THERAPY) FOR RECURRENT GRADE II/III GLIOMAS
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BACKGROUND: For primary grade II/III glioma, we usually combine radiation therapy and chemotherapy after surgical resection. However, the treatment of recurrent grade II/III glioma is controversial. For lesions that can be safely resected, the surgical approach may be optimal, but grade II/III glioma often occurs in or near the eloquent areas, so partial resection is often performed. In such cases, if a second surgery for the recurrent tumor is performed, total resection is often difficult. We have performed gamma knife radiosurgery with concurrent bevacizumab (GKRS with Bev) as salvage therapy for recurrent grade II/III gliomas, which were considered difficult to resect. OBJECTIVE: To investigate the outcome of GKRS with Bev for recurrent grade II/III gliomas. METHODS: We retrospectively reviewed initial pathological findings, PFS/OS from GKRS with Bev, and OS from initial treatment for 23 cases receiving GKRS with concurrent bevacizumab at our institution between August 2013 and March 2019. RESULTS: In the initial pathological findings, grade II were 8 cases (DA: 7, OD: 1), and grade III were 15 cases (AA: 14, AO: 1). Regarding IDH mutations, in grade II, 3 cases were mutant type, 2 cases were wild type, and 3 cases were unknown. Similarly, in grade III, 5, 6, and 4 cases were mutant type, 2 cases were wild type, and 3 cases were unknown. Bevacizumab was administered 10 mg / kg 1 to 10 times after GK. CONCLUSION: The median overall survival time for all 34 patients was 35.7 months (95%CI, 28.1–43.4) and 11.2 months (95%CI, 6.8–15.7), respectively. No significant survival difference according to the chemotherapy regimen was shown. Failure patterns after proton beam therapy include 19 cases of local recurrence, 3 cases of distant recurrence, and 5 cases of dissemination. Although there was no significant difference in time to recurrence according to the failure pattern, there was a tendency of longer survival in the local recurrence group. As for adverse events, symptomatic radiation necrosis was observed in 9 cases. The median time to onset of necrosis after radiation was 18.2 months (95%CI, 10.2–26.2). There were 8 cases of long survivors over 3 years out of 34 cases (23.5%). Of these, 6 cases developed symptomatic radiation necrosis. CONCLUSIONS: Our results indicate that high dose proton beam therapy of 96.6Gy (RBE) prolonged survival in selected GBM patients. With appropriate patient selection and potent treatment for radiation necrosis, high dose proton beam therapy has a great potential to improve survival in GBM patients.

NEURO-ONCOLOGY ADVANCES • December 2019 i21