

hydrocephalus. TAE was performed under local anesthesia in all cases, using a coil alone in two cases and liquid or particle embolization material in five cases. The day before direct surgery, TAE was performed in four cases, one of which underwent emergency decompression due to severe cerebellar edema. Three cases were intentionally embolized on the day of direct surgery. The median blood loss during direct surgery was 100 ml. Although cerebral infarction was observed in all cases, there were no cases of brain stem infarction or hemorrhagic complications. The Modified Rankin Scale at discharge was 0 in 2 cases, 1 in 3 cases, 3 in 1 case, and 4 in 1 case.

**DISCUSSION/CONCLUSION:** Preoperative TAE for hemangioblastoma reduced the blood loss for direct surgery. Same-day TAE avoided neurological deficit due to cerebral infarction and cerebellar edema. To prevent severe infarction, guiding the microcatheter to the vicinity of the tumor bed is important.

#### STMO-03

##### SURGICAL RESECTION FOR PRECENTRAL GYRUS GLIOMA

Noriyuki Kijima<sup>1</sup>, Manabu Kinoshita<sup>1,2</sup>, Ryuichi Hirayama<sup>1</sup>, Naoki Kagawa<sup>1</sup>, Haruhiko Kishima<sup>1</sup>; <sup>1</sup>Department of Neurosurgery, Osaka University Graduate School of Medicine

Primary motor cortex glioma is usually considered unresectable because of its high risk for motor deficit. However, recent reports suggest that surgical resection for primary motor cortex brain tumor is feasible for selected patients. In this study, we analyzed the neurological outcomes for 27 patients who underwent surgical resections for precentral gyrus glioma. Glioma grades for 27 patients were Grade II in 6 cases, Grade III in 7 cases, and Grade IV in 13 cases. 11 patients were recurrent glioma cases and glioma grade for those patients were Grade II in 4 cases, Grade III in 3 cases, and Grade IV in 4 cases. Extent of resection for 27 patients was biopsy in 2 cases, partial resection in 16 cases, and more than 90% of resections in 9 cases. 6 patients underwent awake surgery and glioma grade for those patients were Grade II in 3 cases, Grade III in 2 cases, and Grade IV in 1 case. Median extent of resection for patients who underwent awake surgery was 90%. Transient neurological worsening was observed in 5 patients, however, no patient exhibited permanent neurological deficit. Surgical resections for primary motor cortex glioma were feasible in selected patients without severe neurological complication. Careful intraoperative awake mapping is desirable to achieve maximum resections.

#### STMO-07

##### ADVERSE EVENTS RELATED TO THE GLIOBLASTOMA SURGERY AND THEIR PERIOPERATIVE MANAGEMENT IN OUR HOSPITAL

Hideki Kashiwagi<sup>1</sup>, Shinji Kawabata<sup>1</sup>, Seigo Kimura<sup>1</sup>, Ryokichi Yagi<sup>1</sup>, Naokado Ikeda<sup>1</sup>, Naosuke Nonoguchi<sup>1</sup>, Motomasa Furuse<sup>1</sup>, Masahiko Wanibuchi<sup>1</sup>; <sup>1</sup>Department of Neurosurgery, Osaka Medical College, Osaka, Japan

**BACKGROUND:** The standard treatment for glioblastoma is surgical resection following chemoradiation therapy. The rate of removal or the amount of residual tumor has some impact on the prognosis of patients with glioblastoma, but the highly invasive nature of this tumor makes complete removal limited to the contrast-enhanced lesions difficult due to its localization. Furthermore, when postoperative seizures and venous thrombosis are included in surgery-related complications, these perioperative adverse events can cause delays in the initiation of chemoradiotherapy and delay the return to work and home, such as prolonged hospitalization and rehabilitation time.

**METHODS:** We retrospectively reviewed the perioperative status of the recent 50 consecutive cases with histologically confirmed as glioblastoma at our hospital, the patient background, tumor localization, and perioperative treatment, and so on.

**RESULTS:** The major perioperative complications were ischemic or hemorrhagic complications, epileptic seizures, venous thrombosis, and pneumonia; CTCAE grade 2 or higher, grade 3 or higher, and grade 4 occurred in about 40%, 20%, and 10%, respectively, with some patients having multiple complications.

**DISCUSSION:** Although there was a tendency for ischemic changes around the cavity of the resection as the resection rate increased, most cases were asymptomatic and it seemed to be acceptable if residual brain function could be preserved. Residual tumors tended to show hemorrhagic changes and epileptic seizures because this is thought to be that the tumor was deliberately left in place to preserve function, based on the localization of the tumor. Postoperative FDP levels were useful in predicting the development of deep vein thrombosis and pulmonary artery thromboembolism.

**CONCLUSION:** Because glioblastoma has short survival time and patient PS before and after surgery varies greatly depending on tumor localization, it is important to consider risk-benefit strategies for each case and to establish a scheme for a seamless transition from perioperative management to the introduction of postoperative therapy and maintenance therapy.

#### STMO-08

##### VALIDATION OF THE ENDOSCOPIC 5-ALA FLUORESCENCE DIAGNOSIS FOR INTRAVENTRICULAR TUMORS

Masahiro Nonaka<sup>1</sup>, Junichi Takeda<sup>1</sup>, Tetsuo Hashiba<sup>1</sup>, Akio Asai<sup>1</sup>; <sup>1</sup>Department of Neurosurgery, Kansai Medical University

Intraoperative 5-ALA fluorescence diagnosis (PDD) has been shown to improve tumor resection rates in surgery for malignant glioma. Recently, the usefulness of PDD has been reported in tumors other than malignant glioma. However, the fluorescence of intraventricular tumors is not easy to observe under the microscope, because excitation light could not reach enough to the deepest part of the brain. Therefore, we performed endoscopic 5-ALA fluorescence diagnosis of intraventricular tumors and evaluated its usefulness. Ten cases of intraventricular tumors were included in the study. There were 3 germ cell tumors, 2 metastatic brain tumors, 2 pilocytic astrocytomas, 1 malignant lymphoma, 1 subependymoma, and 1 medulloblastoma (recurrent). The tumors were located in the third ventricle in four cases, the lateral ventricle in three cases, the lateral ventricle and the third ventricle in two cases, and the aqueduct in one case. Tumor removal was performed in 6 cases and tumor biopsy in 4 cases. Intraoperative fluorescence could be observed in eight cases: three germ cell tumors, two metastatic brain tumors, two pilocytic astrocytomas, and one malignant lymphoma. Subependymoma and medulloblastoma did not show fluorescence. Among the cases with confirmed fluorescence, the fluorescent sites were targeted for biopsies for germ cell tumors and malignant lymphomas. For metastatic brain tumors and pilocytic astrocytomas, the extent of removal was determined at the time of removal, and the presence of residual tumor was confirmed by fluorescence after removal. Endoscopic 5-ALA fluorescence diagnosis for intraventricular tumors was useful in determining the target of biopsy or the extent of excision and in assessing residual tumors.

#### STMO-09

##### RECOVERY FROM SPEECH DEFICIT AFTER INJURY TO FRONTAL ASLANI TRACT IN GLIOMA SURGERY

Kuniaki Saito<sup>1</sup>, Keiichi Kobayashi<sup>1</sup>, Daisuke Shimada<sup>1</sup>, Shohei Iijima<sup>1</sup>, Nobuyoshi Sasaki<sup>1</sup>, Yuta Sasaki<sup>1</sup>, Yoshiaki Shiokawa<sup>1</sup>, Motoo Nagane<sup>1</sup>; <sup>1</sup>Department of Neurosurgery, Kyorin University Faculty of Medicine

**BACKGROUND:** The frontal aslant tract (FAT) is a white matter fiber connecting the superior frontal gyrus to the lateral inferior frontal gyrus. Damage to FAT in dominant hemisphere can lead to speech deficits which, in most cases, resolve within weeks to months. However, little is known about mechanisms of recovery and factors for predicting permanent language deficits. **METHODS:** Eighteen patients with glioma (age ranged 24 to 78, 10 glioblastomas and 8 lower grade gliomas) located in the medial frontal lobe in the dominant hemisphere involving the supplementary motor area (SMA) and FAT were included. FAT was visualized using diffusion tensor imaging tractography in pre- and postoperative MRI. Postoperative language deficit, resected area of FAT and surrounding brain regions including the cingulate gyrus and corpus callosum (CC) were retrospectively reviewed. **RESULTS:** In 17 of 18 cases, postoperative language deficits were observed. Speech deficits resolved within a month in 12 cases, while recovery was incomplete in five cases. In two patients without complete recovery, CC located beneath SMA was removed because of tumor infiltration. Other two patients had substantial injury of middle third portion of FAT. The last case had preceding infarction in the contralateral frontal white matter including FAT. In cases with complete language recovery, transcallosal fibers connecting the contralateral SMA to the ipsilateral inferior frontal gyrus were detected by postoperative DTI-tractography. These fibers were damaged anywhere along its length in patients without complete language recovery, indicating that they may play an important role in recovery after FAT injury. **CONCLUSION:** Injury to CC or middle third portion of FAT can cause permanent language disorder. Transcallosal fibers from contralateral SMA seems to be involved in the recovery from language deficit after injury to FAT. In glioma surgery involving dominant SMA or FAT, these fibers should be preserved to avoid permanent speech deficit.

#### STMO-11

##### SUPRATOTAL RESECTION OF GLIOBLASTOMA WITH METHIONINE PET

Ozaki Ko<sup>1</sup>, Seiichiro Hirono<sup>1</sup>, Tomoo Matsutani<sup>1</sup>, Yasuo Iwadate<sup>1</sup>; <sup>1</sup>Department of Neurological Surgery, Chiba University School of Medicine, Chiba, Japan

**OBJECTIVE:** To assess the resection of both of contrast-enhanced (CE) and methionine-uptake (MU) and the oncological outcome in newly diagnosed glioblastoma. **METHODS:** This retrospective study included a glioblastoma cohort from Chiba University who met the two criteria, i) total resection of CE tumor, ii) preoperative evaluation with methionine positron

emission tomography (Met-PET). Data regarding the pattern of recurrence and overall survival were collected. RESULTS: Among 247 cases with glioblastoma, total resection of CE was achieved in 112. Preoperative Met-PET was performed in 30 out of 112. The median age at operation, a period of follow-up, and the preoperative tumor volume in 30 patients were 56 year-old, 17.9 months, and 18.8 cc respectively. The promoter region of the O6-methylguanine-DNA methyltransferase was methylated in 37%. Radiological comparison revealed that Met uptake was detected beyond the CE area in 13 out of 30, and the Met uptake was also resected with awake mapping technique in 7 patients (supratotal resection group; STR). The median progression-free survival (PFS) in STR was 23 months, and all the patterns of recurrence were distant recurrence. In contrast, the PFS in total resection group (TRG) was 9 months ( $p=0.09$ , Wilcoxon). Furthermore, 14 out of 17 recurrence were local in TRG subgroup. While the median OS in TRG was 18 months, it has not reached in STR ( $p=0.04$ , Wilcoxon). CONCLUSIONS: The resection of both of CE and MU was associated with better PFS and OS. This finding must be validated in a larger cohort with a multicenter study.

## RADIATION THERAPY (RT)

### RT-01

#### TREATMENT RESULTS OF SALVAGE GAMMA KNIFE AND BEVACIZUMAB (AVAGAMMA THERAPY) FOR RECURRENT GLIOBLASTOMA

Kenichi Sato<sup>1</sup>, Taku Asanome<sup>1</sup>, Yuuki Ishida<sup>1</sup>, Hironori Sugio<sup>1</sup>, Yoshimaru Ozaki<sup>1</sup>, Masami Takanashi<sup>1</sup>, Hirohiko Nakamura<sup>1</sup>;  
<sup>1</sup>Department of neurosurgery, Brain tumor center, Gammaknife center, Nakamura Memorial Hospital

**PURPOSE:** We report the treatment results of AVAgamma therapy combining gamma knife (GK) and bevacizumab for recurrent glioblastoma. **Subjects:** From August 2013 to April 2020, 44 patients (88 lesions) with recurrent glioblastoma treated with AVAgamma therapy as salvage therapy at the time of relapse after initial treatment. The average age is 61.5 years, with 26 men and 18 women. The tumor volume is 150 ml or less, and KPS is 40% 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 to 26 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 79%, and mOS was 9 months. The mOS from initial treatment were 25 months. In relapsing glioma RPA classification, NABTT 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.

### 10031-RT-02

#### RESULTS OF REACTOR-BASED BNCT FOR 44 CASES OF RECURRENT AND REFRACTORY HIGH-GRADE MENINGIOMAS AND ROAD TO ACCELERATOR BASED BNCT

Shin-Ichi Miyatake<sup>1,2</sup>, Shinji Kawabata<sup>2</sup>, Masahiko Wanibuchi<sup>1,2</sup>, Satoshi Takai<sup>2</sup>, Koji Takeuchi<sup>2</sup>, Koji Ono<sup>1</sup>, Naonori Ko<sup>1</sup>, Yoshinori Sakurai<sup>3</sup>, Hiroki Tanaka<sup>3</sup>, Minoru Suzuki<sup>3</sup>; <sup>1</sup>Kansai BNCT Medical Center, Osaka Medical College, Takatsuki, Japan

**INTRODUCTION:** High-grade meningioma (HGM) is difficult clinical entity to treat. Especially recurrent HGM after some radiotherapy has very miserable prognosis. For example median overall survival (mOS) of recurrent HGM after radiotherapy is reported as 2 years. We applied tumor-selective particle radiation BNCT using nuclear reactor for 44 recurrent HGMs. **METHODS:** From 2005 to 2019, we treated 44 recurrent and refractory HGMs by reactor-based BNCT. The patients' WHO grades are grade 2:20 cases, grade 3:24 cases. Prior to BNCT, totally 114 times operations and 72 times SRS and 14 times external beam radiotherapy were applied for them. OS, tumor shrinkage, causes of treatment failure were analyzed. **RESULTS:** Median follow-up was 26.0 months. MOS after BNCT was 29.6 (95% CI:16.1–40.4) months. Grade 2 and 3 showed mOS as 44.4 (27.4–) and 21.55 (10.6–30.6) months, respectively and there is statistically significance ( $p=0.0009$ ). All treated tumor showed rapid shrinkage on

MRI. Treatment failure patterns are local recurrence, out of field recurrence, systemic metastasis, CSF dissemination, as 35.5%, 20.6%, 17.6%, 8.8 %, respectively. These results showed good local tumor control and prolonged survival for recurrent HGM cases. **CONCLUSIONS:** Our cases were heavily treated with repetitive surgeries and repetitive radiotherapy. In addition the rate of grade 3 patients was extremely high. In a word our cases seemed to have poor prognosis. In spite of these poor condition, reactor-based BNCT exerted good local control and prolonged survival for recurrent and refractory HGMs. Depending on the clinical results, PMDA gave us the permission to apply investigator-lead clinical trial for recurrent and refractory HGMs using accelerator-based BNCT with financial support from AMED (one of the agency of Japanese government). In our talk, let us open some results from this trial.

### RT-04

#### STEREOTACTIC IRRADIATION FOR 2 - 3 CM BRAIN METASTASES: A MULTICENTER RETROSPECTIVE COHORT STUDY

Takeo Hirata<sup>1,2</sup>, Ken Harada<sup>3,4</sup>, Shigetoshi Shimamoto<sup>5</sup>, Hiroki Kawaguchi<sup>6</sup>, Hiroshi Igaki<sup>4</sup>, Yusuke Ito<sup>7</sup>, Kazunari Yamada<sup>8</sup>, Hisao Kakuha<sup>9</sup>, Katsuya Maebayashi<sup>10</sup>, Hidefumi Aoyama<sup>11</sup>;  
<sup>1</sup>Department of Radiation Oncology, Osaka University Graduate School of Medicine

**PURPOSE:** We retrospectively analyzed the treatment outcomes of Stereotactic irradiation (STI) for large size (2–3 cm) brain metastasis. **Materials and METHODS:** One hundred and sixty-nine lesions with 156 patients who underwent STI from January 1, 2013 to December 31, 2015 at 21 institutions participating in the Japanese Radiation Oncology Study Group were included in the study. Patients who had a history of whole-brain irradiation in the past and those who received whole-brain irradiation sequentially with STI were excluded. RANO-BM was used to evaluate the effect on each lesion, and the survival time or time to occurrence of local failure was defined as the number of months from the initial day of STI to the day of the events. **RESULTS:** The median age was 66 (33–87) years. The median follow-up time was 14 (1–52) months. Male/female = 95/61 cases. The number of brain metastases was 1/2/3/4 or more = 93/35/14/14 cases. The median doses and fraction size were 30 Gy in 3 fractions. The primary site was lung/breast/colon or rectum/others = 95/14/14/33 cases. The median survival time was 16 months. A 1-year overall survival rate was 62% and a 1-year local control rate was 77%. Comparing the 1-year local control rate by the fraction size, single/3 or 4/5 or more = 66/86/75%, the rate was better in the 3–4 fractions group (Log-rank test,  $p = 0.069$ ). Cerebral necrosis (Grade 1/2/3/unknown = 9/10/8/3 cases) was observed in 39 lesions (18%), and the median time to diagnosis of brain necrosis was 9 (1–41) months. The incidence of necrosis in the single fraction cases was 29%, which was significantly higher than that in the fractionated irradiation cases (15%) ( $p = 0.039$ ). **CONCLUSION:** Fractionated STI seems to be more favorable than single fraction STI for large brain metastases.

## MOLECULAR PATHOLOGY/CLASSIFICATION (MPC)

### MPC-02

#### PROGNOSTIC EFFECTS OF MOLECULAR FACTORS IN ELDERLY PATIENTS WITH IDH-WILDTYPE GLIOBLASTOMAS

Junya Fukai<sup>1,2</sup>, Nobuhide Hayashi<sup>2</sup>, Hideyuki Arita<sup>2,3</sup>, Toru Umehara<sup>2,4</sup>, Ema Yoshioka<sup>2,5</sup>, Tomoko Shofuda<sup>2,5</sup>, Daisuke Kanematsu<sup>2,5</sup>, Yoshinori Kodama<sup>2,6</sup>, Manabu Kinoshita<sup>2,8</sup>, Yoshiko Okita<sup>2,9</sup>, Masahiro Nonaka<sup>2,10</sup>, Takehiro Uda<sup>2,11</sup>, Daisuke Sakamoto<sup>2,12</sup>, Takahiro Sasaki<sup>1,2</sup>, Yuji Uematsu<sup>1,2</sup>, Naoyuki Nakao<sup>1,2</sup>, Kanji Mori<sup>2,13</sup>, Yonehiro Kanemura<sup>2,14</sup>; <sup>1</sup>Department of Neurological Surgery, Wakayama Medical University School of Medicine, Wakayama, Japan

**BACKGROUND:** Geriatric neuro-oncology is an important research field, because the elderly patients is growing at a very rapid rate. This study investigates molecular features and their prognostic effects in the elderly glioblastomas (GBM). **METHODS:** We collected adult cases diagnosed with IDH-wildtype GBM and enrolled in Kansai Molecular Diagnosis Network for CNS Tumors (212 cases). Clinical and molecular features were analyzed retrospectively and independent prognostic factors were identified statistically. Focusing on the elderly ( $\geq 70$  years) cases, the association between molecular factors and overall survivals (OS) was examined. **RESULTS:** Included in the study were 92 elderly cases (43.4%) and median OS was 12.8 months. MGMT promoter was methylated in 50 (54.3%). Triple CNA (EGFR amplification/gain & PTEN deletion & CDKN2A deletion) was detected in 23 (25.0%). NFKBIA was deleted in 23 (25.0%). In the elderly cases, adjuvant radiation and temozolomide (RT+TMZ) was performed in 39 (42.4%) (mOS = 17.1 months). Statistical analyses of the elderly plus non-elderly cases treated with RT+TMZ (148 cases), MGMT promoter, triple CNA and NFKBIA were identified as independent