is limited due to its high invasiveness, and immunotherapy utilizing self-immune mechanism is theoretically expected. An autologous formalin-fixed tumor vaccine (AFTV) is a vaccine that is prepared using formalin-fixed tumor tissue and recognizes tumor antigen peptides to induce cytotoxic T cells. We have previously conducted three clinical trials using AFTV for patients with newly diagnosed glioblastoma since 2004. The third trial was a double-blind multicenter phase IIb/III trial with 63 case registries, which did not make a significant difference in OS (study group 25 months, placebo group 31 months), the total removal group showed excellent clinical results (3-year survival rate; 65%, median survival; not reached). Since the study was designed to go to Phase III if the test group was not inferior to the placebo group, so it went on to go to Phase III. METHODS: Target patients with glioblastoma, with newly diagnosed glioblastoma underwent pathologic diagnosis, who have undergone total removal of contrast-enhanced lesions and receive standard chemoradiation therapy. STUDY DESIGN: Double-blind, 3-year enrollment period, 18-month observation period. Stratification factor: Photodynamic therapy (PDT), facility, age, KPS. Administration method: After standard chemoradiotherapy, in parallel with maintenance chemotherapy, a total of 9 times intradermal administration of vaccine. Primary endpoints: PFS of FAS patients, Secondary endpoints: 18 months PFS of the FAS patient, OS, PFS of the ITT analysis target case. Based on the results of the IIb trial, we limited the registered patients with total tumor removal, and in view of the fact that the prognosis of patients with combined PDT and AFTV were excellent, PDT was added to the stratification factor. We outline our efforts and problems aimed at clinical approval of AFTV for glioblastoma.

CLINICAL TRIAL OF A COCKTAIL WILMS’ TUMOR 1 (WT1) VACCINATION USING TWO HLA CLASS I PEPTIDES AND ONE CLASS II PEPTIDE FOR RECURRENT MALIGNANT GIOMIAS

Naoki Kagawa1, Yasuke Oji, Akihito Tsuobi, Ryuichi Hirayama2, Noriyuki Kikuma1, Masanobu Kinoshita1, Yoshiko Oka, Haruo Sugiyama, Haruhiko Kishima1, 1Department of Neurosurgery, Osaka University Graduate School of Medicine, Osaka, Japan

PURPOSE: Our clinical trials shows the safety and clinical efficacy of Wilms’ tumor 1 (WT1) human leukocyte antigen (HLA) class I (Izumoto S et al. J Neurosurg. 2008) and class II (Tsuobi A et al. Cancer Immunol Immunother. 2019) peptide vaccination for recurrent malignant gliomas have been established. We have developed a cocktail vaccine WT1 (trio) containing two class I peptides (HLA-A*24:02 and HLA-A*02:01) and one HLA-A*02:01 peptide to improve more effective immunological response and improve patient’s prognosis. Clinical trial of a cocktail vaccination using WT1 HLA class I and II peptides for recurrent malignant gliomas is planned to verify its safety, clinical efficacy and usefulness of surrogate markers. PATIENTS AND METHODS: Twenty-three patients with recurrent malignant gliomas, which showed WT1-positive in tumor samples and HLA-A*24:02 or HLA-A*02:01-positive in blood sample, were enrolled. These patients (age: 26–72 years old, average: 49.4) included 15 cases of glioblastomas and 8 of anaplastic astrocytomas. Patients received a WT1 trio vaccine intradermally, 7 times at 2-week intervals during 3 months. WT1-DTH and WT1-IgG antibody were regularly measured. Vaccine-related adverse events, best clinical response and the transfer rate of long-term administration of WT1 trio vaccination were estimated. RESULTS: WT1-DTH positive cases were 12, WT1-IgG antibody positive were in 11. In most patients, WT1-DTH positivity coincided with that of WT1-IgG antibody. 9 of 11 cases showed stable disease at 3 months and transferred long-term administration of WT1 trio vaccination. Transfer rate in GBM and AA of long-term administration was 33% and 25%, respectively. Grade I skin eruption was observed at the injection sites in 15 cases, but no significant adverse events related with vaccination were shown. CONCLUSION: the safety and clinical efficacy of WT1 trio vaccination was verified for recurrent malignant gliomas. WT1-DTH and WT1-IgG antibody may be useful surrogate markers.

PREOPERATIVE FENCE-POST METHOD PLANNING WITH 3D-FUSION IMAGING

Takahiro Yamauchi1, Ryusei Kitai, Yoshinori Sibaike1, Mizuki Owa1, Shinataro Yamada1, Satoshi Kawajiri1, Makoto Izokazi1, Kenzo Tsunetoshi1, Ken Matsuda1, Hitokata Arishima1, Toshiaki Kodera1, Ken-Ichiro Kikuta1, 1Department of Neurosurgery, Yamaguchi University Hospital

The fence-post method has been used for removal of intra-axial tumors. Preoperative detailed planning with only navigation work system is sometimes difficult to identify actual brain surface, small feeding artery and passing artery. Recently, 3-dimensional imaging is well developed to integrate various anatomical findings. The purpose of this study is pursuit of perfect preoperative planning for removal intra-axial tumors with 3D-fusion imaging. From May 2017 to June 2019, 21 patients with intra-axial tumor were included. The software “AZE” was used to create 3D-fusion imaging. The brain tumor, brain surface and tractography were built from MRI, artery from digital angiography and vein from subtraction enhanced computed tomography. Then detailed preoperative planning was planned including how many fence-posts, procedure of cutting feeder, making sulcotomy or corticotomy, and finally cutting drainer. The average bleeding volume was 101±129cc, and there were no patients who had more than 200cc. All patients did not show additional neurological impairment after surgery. Detailed and perfect preoperative planning with 3D-suflon imaging should be effective for secure neurosurgery.

ROLE OF INTRAOPERATIVE COMPUTED TOMOGRAPHY IN GLIOBLASTOMA RESECTION GUIDED BY 5-ALA PDD

Hirokazu Sadahiro1, Hisaharu Goto1, Sadahiro Nomura1, Michiyasu Suzuki1, 1The department of Neurosurgery, Yamaguchi University Hospital

OBJECTIVE: To improve resection rate, multiple operative modalities have been essential for glioblastoma (GBM) surgery. Aim of this study is to clarify the impact of intraoperative computed tomography (CT) for GBM surgery with 5-aminolevulinic acid photodynamic diagnosis (PT) in GBM (5-ALA PDD). METHODS: Consecutive 24 patients newly diagnosed GBM were analyzed, retrospectively. To exclude 6 patients decided timing for i-CT based on neural monitoring, 18 patients performed i-CT after total resection of 5-ALA positive lesion were included, finally. RESULTS: The median age was 58 years old, and average preoperative tumor volume was 147.78 cm³. Tumor locations were frontal lobe 5 (27%), parietal lobe 3 (17%), temporal lobe 5 (27%), parietal lobe 3 (17%), temporal lobe 9 (50%), and corpus callosum 1 (6%). Seventeen tumors (78%) harbored in eloquent area. After i-CT performed, 7 (39%) were confirmed residual tumor, and additional patients newly were needed. Subtotal resection (STR) was 5 and partial resection (PR) was 2 on volumetry in i-CT before additional resection. After additional resection, those cases were judged as 2 gross total resection (GTR), 4 STR and 1 PR in postoperative magnetic resonance imaging (MRI). 11 cases without additional resection were judged as 4 GTR, 3 STR and 4 PR in postoperative MRI. In 18 patients confirmed
total resection of 5-ALA positive lesion, i-CT and postoperative MRI revealed 14 (78%) residual tumors. i-CT revealed 7 (50%) in all residual tumor. DISCUSSION: Hemorrhage, brain edema, air, invasive lesion, and limitation of resolution of CT might make difficult to detect residual tumor.

CONCLUSION: i-CT may be useful to detect residual tumor even with 5-ALA and improve resection rate.

STMO-04
LOCAL CONVECTION-ENHANCED DELIVERY OF CHEMOTHERAPY AS TREATMENT FOR BRAIN TUMORS Ryuta Saito1, Masayuki Kanamori1, Teiji Tominaga2; 1Department of Neurosurgery, Tohoku University, Sendai, Japan

BACKGROUND: Convection-enhanced delivery (CED) of therapeutic agents is a promising local delivery technique that has been extensively studied as a treatment for CNS diseases over the last 2 decades. Applying this technique to treat brain tumors, we have been developing novel local chemotherapy against brain tumors. In the meanwhile, clinical trial against diffuse intrinsic brain tumor aiming at Japanese “shoin” approval is recruiting patients. In this study, potential of local CED based chemotherapy against supratentorial brain tumor is discussed. METHODS: Until today, we have evaluated the safety and efficacy of local CED of nimustine hydrochloride against supratentorial malignant glioma patients in the three prospective, single instute, nonrandomized, open-label studies. Among those, one study recruited the recurrent three types malignant glioma patients whose resection can be surgically resected. After the resection of the tumor, CED of ACNU was performed targeting the surrounding brain. Temozolomide was also given for 5 days during this trial. RESULTS: Seven patients; 4 male and 3 female, age 33–71 y.o. (median 54 y.o.), were treated in this study. Five patients suffered glioblastoma and two suffered anaplastic astrocytoma. After the treatment, all seven patients lived longer than a year; one survived three years, one survived four and a half years, and one with glioblastoma is still alive after 5 years. DISCUSSION: Potential efficacy of local chemotherapy delivering nimustine hydrochloride with CED against recurrent malignant glioma was suggested. Further study is required to pave the way for this strategy against supratentorial malignant gliomas.

STMO-06
SMART CYBER OPERATING THEATER REALIZED BY INTERNET OF THINGS - STATUS OF CLINICAL FOR 56 CASES - Muragaki Satoshi, Hongo Yu, Hiraga Hiroshi, Saito Takashi, Ishioka Teiji, Div. of Neurosurgery, Institute of Biomedical Engineering and Science, Tokyo Women's Medical University

PURPOSE: Unlike conventional operating rooms that provide a sterile environment, we have developed a “hyper SCOT” in which the room itself performs treatment as a single medical device. We report the clinical results of 3 types of SCOT. METHODS: Basic SCOT packaged with intraoperative MRI (0.4Tesla) was introduced in Hiroshima University in 2016. Standard SCOT networked with middleware OPeLNK was introduced to Shunshu University in 2018, and Hyper SCOT introduced to Tokyo Women's Medical University in 2019. RESULTS: The average of all 56 patients was 44 years old. There were 38 brain tumors (68%), 11 functional diseases (19%), and 7 orthopedic diseases (13%). Basic SCOT is used for 41 cases (56%; 73%) with 22 gliomas, 10 epilepsyes, 7 bone tumors, and 2 benign brain tumors. Standard SCOT with 20 networked devices is used for 14 cases (56%; 32%) with 6 gliomas including brain stem and thalamos, 6 pituitary tumors and 2 benign brain tumors. The strategy desk can display a variety of digital data synchronized in time, and the review and comment functions also operate. It is useful for remote advice through mutual communication via strategy desk. Hyper SCOT was used in February 2019 for the first case (56 cases; 2%). MRI images were taken with an average of 1.3 shots with good image quality. For 46/56 neoplastic lesions (82%), additional removal of residual tumor was performed in 31/46 cases (67%), and 26/46 cases (57%) were totally removed, with an average removal rate of 89.2%. There was no reoperation (0%) within 1 month in all cases. CONCLUSIONS: Hyper SCOT contributed to planned surgical outcome including maximal tumor resection without serious related complications. We will proceed with verification of clinical effects, and develop robotized devices, and utilize AI for strategy desk at Hyper SCOT.

STMO-08
INFLUENCE OF WIDE OPENING OF THE LATERAL VENTRICLE ON SURVIVAL FOR SUPRATENTORIAL GliOBlastOma PATIENTS WITH RADIOTHERAPY AND CONCOMITANT TEMOZOLOMIDE-BASED CHEMOTHERAPY Tanichi Saito, Yoshihiro Muragaki, Takashi Maruyama, Takashi Komori, Masayuki Nitta, Shunsuke Morita, Atsushi Fukui, Takakazu Kawamata; 1Department of Neurosurgery, Tokyo Women's Medical University, Tokyo, Japan

BACKGROUND: The prognosis for glioblastoma (GBM) varies among patients. Ventricular opening during surgery has been reported as a prognostic factor for GBM patients, but the influence of ventricular opening itself on patient prognosis remains controversial. OBJECTIVE: Accumulative evidence has suggested that the subventricular zone (SVZ) harbors a neural stem cell niche and is associated with gliomagenesis. Several reports have hypothesized that aggressive characteristics of GBM in contact with the SVZ may be associated with the recruitment of neural stem cells from the SVZ that have abilities associated with invasion and leading to poor prognosis. We presumed that the degree of ventricular opening would correlate with the degree of SVZ resection and with prognosis in GBM patients. This study therefore investigated whether the degree of ventricular opening correlates with prognosis in GBM patients treated with the standard protocol of chemo-radiotherapy. METHODS: Participants comprised 111 patients with newly diagnosed GBM who underwent surgery and postoperative radiotherapy and TMZ-based chemotherapy from 2005 to 2018. We classified 111 patients into “No Ventricular opening” (NVO), “Ventricular opening, small” (VOS; distance < 21 mm) and “Ventricular opening, wide” (VOW; distance ≥ 21 mm) groups. We evaluated the relationship between degree of ventricular opening and prognosis using survival analyses that included other clinicopathological factors. RESULTS: Log-rank testing revealed age, KPS, extent of resection, MGMT status, IDH mutation, and degree of ventricular opening correlated significantly with overall survival. Multivariate analysis identified the degree of ventricular opening (small vs. wide) as the most significant prognostic factor (hazard ratio = 3.674; p < 0.0001). CONCLUSIONS: We demonstrated that wide opening of the lateral ventricle (LV) contributes to longer survival compared with small opening among GBM patients. Our results indicate that wide opening of the LV may correlate with the removal of a larger proportion of tumor stem cells from the SVZ.