ation were retained in the BEV group. Percentages of vessels with pericytes and vascular endothelium with LAT1 expression were lower in the BEV group than in controls. Uptake of 11C-met correlated significantly with microvascular density in the BEV group, but not with LAT1expression. CONCLUSIONS: The present study showed that even one course of BEV administration induced reductions in microvessels, vascular pericytes, and LAT1 expression in glioblastomas. One course of BEV therapy also reduced 11C-met uptake, which might have been largely attributed to reductions in microvessels rather than reductions in LAT1 expression, in addition to reduction of vascular permeability.

NI-13

PREDICTION OF PROGNOSIS IN NEWLY DIAGNOSED GLIOBLASTOMA USING MACHINE LEARNING-BASED TEXTURE ANALYSIS OF PREOPERATIVE MRI

Toru Umehara[1], Manabu Kinoshita[1], Takahiro Sasaki, Hideyuki Arita[1], Ema Yoshioka, Tomoko Shofuda, Ryuichi Hirayama[1], Noriyuki Kijima[1], Naoki Kagawa[1], Yoshiko Okita, Takehiro Uda, Junnya Fukai, Kanji Mori, Haruhiko Kishima[1], Yonehiro Kanemura; [1]Departments of Neurosurgery, Osaka University Graduate School of Medicine, Osaka, Japan

INTRODUCTION: Preoperative magnetic resonance imaging (MRI) is a critical modality for the determination of glioblastoma (GBM) treatment strategy, as it is thought to reflect the biology of the tumor to some extent. The authors attempted to predict prognosis of newly diagnosed GBM (nGBM) using machine learning-based texture analysis of preoperative MRI in this study. METHOD: A total of 160 nGBMs with determined overall survival were collected from Kansai Molecular Diagnosis Network for CNS tumors. Preoperative MRI scans (T1WI, T2WI, and Gd-T1WI) from all cases were semi-quantitatively analyzed leading to acquisition of 489 texture features as explanatory variables using Matlab-based in-house software. Dichotomous overall survival (OS) with a cutoff of 15 months was regarded as the response variable (short or long OS). Lasso regression was employed for feature selection to ensure robustness of the prediction model. One hundred patients were randomly assigned as training dataset (TR), followed by predictive model construction via 5-fold cross-validation. Subsequently, the constructed model was transferred to the remaining 60 patients, which was assigned as test dataset (TD). The survival distribution between populations with predicted short and long OS was compared using log-rank test. RESULTS: Distributions of the analyzed data were as follows; 53 short OS cases in the TR (53.0%) and 27 cases in the TD (45.0%). As for the result of transfer analysis in TD, 38 cases out of 60 (63.3%) were predicted to be short OS (76.3 % of recall, 54.3% of precision, and 63.5% of F-measure). The population of predicted short OS significantly showed poorer prognosis (median OS 14.0 vs 19.1 months) (p=0.02, log-rank test). CONCLUSION: Short OS was successfully identified from preoperative MRI with high recall rates with our algorithm. The presented result ensures the potential of machine learning-based texture analysis for prognostic stratification of nGBM.

NI-14

EVALUATION OF PREOPERATIVE APPARENT DIFFUSION COEFFICIENT (ADC) OF PERITUMORAL LESION FOR PREDICTING SITE PRONE TO RECURRENCE IN PATIENTS WITH GLIOBLASTOMA

Kenichiro Matsuda[1], Kaori Sakurada[1], Takamasa Kayama[1], Yukihiko Sonoda[1]; [1]Department of Neurosurgery, Faculty of Medicine, Yamagata University, Yamagata, Japan

PURPOSE: In the surgery of glioblastoma (GBM), the maximum safe resection is desired in order to prevent recurrence. The purpose of this study is to make it possible to evaluate the site in which the recurrence after resection of the tumor occur, according to the findings in preoperative MRI, and to avoid the recurrence. METHOD: The 26 initial cases with GBM treated in our department was investigated. Preoperative MRI, postoperative MRI, and follow-up MRI during the course were analyzed in a retrospective view. In the FLAIR high-signal area around the contrast-enhanced tumor body in preoperative MRI, we investigated the relationship between the site and the ADC value, from the standpoint of whether a recurrence occurred or not. RESULTS: For preoperative MRI of 26 patients, the FLAIR high-signal region was set to a total of 54 ROI, and several values, such as the ADC values, were measured. In the preoperative images, ADC were higher in the site where the no recurrence occurred during the postoperative course and lower in the site where the recurrence occurred. CONCLUSION: In the FLAIR high-signal area around the tumor in preoperative images, ADC value is useful in evaluating whether it has tendency to develop the recurrence in the future course or not. It was suggested that significant recurrence occurs at part with low-ADC value. It is considered useful for the planning of the extent of resection in the surgery and the irradiation range in radiation treatment.

NI-15

THE USEFULNESS OF PET IMAGING IN MOLECULAR DIAGNOSIS OF GLIOMA

Tomoya Ogawa[1], Keisuke Miyake[1], Takeshi Fujimori[1], Daisuke Ogawa[1], Masaki Okada[1], Tetsuhiro Hatakeyama[1], Masanobu Okauchi[1], Atsushi Shindo[1], Masahiko Kawanishi[1], Takashi Tamiya[1]; [1]Department of Neurological Surgery, Faculty of Medicine, Kagawa University, Kagawa, Japan

OBJECTIVE: After WHO 2016 Classification of Tumors of the Central Nervous System have published, molecular diagnosis became part of the diagnostic criteria. In this study, we investigated the correlation between PET images and molecular diagnosis of glioma. METHODS: We performed retrospective review of newly diagnosed supratentorial glioma patients who preoperatively underwent all four PET examinations (^{18}F-FDG, ^{11}C-MET, ^{18}F-FLT and ^{18}F-FMISO) from April 2009 to March 2019. The standardized uptake value (SUV) from the accumulation of each PET tracers, TNR (tumor to contralateral normal tissue ratio) of ^{18}F-FDG,^{11}C-MET and ^{18}F-FLT, TBR (tumor to blood values ratio) of ^{18}F-FMISO were measured. We investigated the correlation between these PET images and molecular diagnosis of glioma. RESULTS: Data from total of 79 patients which were 42 cases of IDH wild type glioblastoma, 2 cases of IDH mutated glioblastoma, 9 cases of IDH wild type astrocytoma, 13 cases of IDH mutated astrocytoma and 13 cases of IDH mutated and 1p/19q co-deleted oligodendroglioma were included in this study. Both TNR of ^{11}C-MET($p<0.01$) and ^{18}F-FLT($p<0.01$), and also TBR of ^{18}F-FMISO($p<0.01$) in IDH wild type gliomas showed significantly higher than IDH mutated gliomas. In WHO Gr2-3 gliomas, only TNR of ^{18}F-FLT showed a significant difference between IDH wild type gliomas and IDH mutated gliomas($p<0.01$). TNR of ^{18}F-FLT($p<0.01$) and TBR of ^{18}F-FMISO($p<0.01$) in 1p/19q co-deleted gliomas were significantly lower than gliomas without 1p/19q co-deletion, but there were no significant differences in WHO Gr2-3 gliomas. Among IDH mutated gliomas, TNR of ^{11}C-MET in 1p/19q co-deleted gliomas showed significantly higher uptake than gliomas without 1p/19q co-deletion($p<0.05$). CONCLUSION: Preoperative PET evaluation of each PET tracers may be useful for the molecular diagnosis of glioma.

NI-17

T2-FLAIR MISMATCH SIGN IN DIFFUSE GLIOMA AND DYSEMBRYOPLASTIC NEUROEPITHELIAL TUMOR

Shumpei Onishi[1], Fumiyuki Yamasaki[1], Motoki Takano[1], Ushio Yonezawa[1], Kazuhiko Sugiyama, Kaoru Kurisu[1]; [1]Department of Neurosurgery, Graduate School of Biomedical and Health Sciences, Hiroshima University

BACKGROUND: T2-FLAIR mismatch sign was reported as a specific imaging marker for diffuse astrocytoma with IDH-mutant and 1p/19q non-codeletion. However, most of the previous studies for T2-FLAIR mismatch were confirmed only among low grade glioma. The purpose of this study is to assess the T2-FLAIR mismatch sign in supratentorial diffuse glioma, diffuse midline glioma and dysembryoplastic neuroepithelial tumor (DNT) to unveil the exception rules of the sign. METHODS: In total, 51 patients were included in this study; 33 supratentorial diffuse glioma (18 diffuse astrocytoma with IDH mutant (IDHmut-Noncodel), 12 oligodendroglioma with IDH-mutant and 1p19q codeletion (IDHmut-Codel), 3 diffuse astrocytoma with IDH wildtype (IDHwt)), 18 diffuse midline glioma and 11 DNT. The tumors were evaluated by 2 independent reviewers to assess presence or absence of T2-FLAIR mismatch sign. RESULT: Ten out of 18 cases of IDHmut-Noncodel presented T2-FLAIR mismatch sign. None of the other supratentorial diffuse glioma (IDHmut-Codel and IDHwt) presented T2-FLAIR mismatch. The T2-FLAIR mismatch sign for IDHmut-Noncodel presented 100% positive predictive values among supratentorial diffuse glioma. However, 8 out of 18 cases of diffuse midline glioma and 8 out of 11 cases of DNT also presented the T2-FLAIR mismatch. CONCLUSION: The T2-FLAIR mismatch sign was specific marker for IDHmut-NonCodel among supratentorial diffuse glioma. Physicians need to be aware that diffuse midline glioma and DNT could present the T2-FLAIR mismatch sign.

NI-18

INVASIONS OF WHITE MATTER AS A PROGNOSTIC FACTOR IN LOW GRADE GLIOMAS

Yukiko Nakahara[1], Hiroshi Ito[1], Motofumi Koguchi[1], Tomihiro Wakamiya[1], Jun Masuoka[1], Tatsuya Abe[1]; [1]Department of Neurosurgery, Faculty of Medicine, Saga University, Saga, Japan

INTRODUCTION: Gliomatosis cerebri (GC), which was characterized by widespread infiltration of the brain involving three lobes, was deleted in the 2016 WHO classification. However, it is known that gliomas with

GC growth pattern have a poor prognosis even in low histological grading. In this study, we focused on tumor invasion into white matter fibers. We analyzed the MRI findings focusing on white matter fibers and compared in patients with histologically proven low grade gliomas (LGGs) with GC pattern and localized LGGs. METHOD: The patients can be classified into four groups according to the range of tumor invasion in T2-weighted image as follows: group 1, more than 3 lobes (n=6); group 2, 1 or 2 lobes infiltrate the basal ganglia (n=5); group 3, multicentric (n=2) and group 4 (n=12), localized. In reference to the human brain white matter atlas, the infiltration to the major white matter fibers (uncinate fasciculus, genu &splenium of corpus callosum, inferior fronto-occipital fasciculus, superior& inferior longitudinal fasciculus) was examined. RESULTS: Twenty-five patients (median 39.5 years) were included in the study. Of these, 20 patients were histologically diagnosed with diffuse astrocytomas, and 5 patients with oligodendrogliomas. The infiltrations into ifo, slf, and ilf of white matter fibers were a poor prognostic factor. The number of infiltrating white matter fibers correlated significantly with the Kaplan-Meier survival curve. CONCLUSIONS: The 2016 WHO classification defines diagnostic entities by combining molecular and histological information and remove GC as a distinct glioma entity. LGGs with GC pattern should be considered to be detected in different types of histologically and molecularly defined gliomas. As the patient numbers analyzed here were small, and larger series reproducing these results would be desirable. MRI findings particularly focusing on infiltration of LGGs into white matter fibers might be important to estimate the prognosis of patients.

NI-19

USEFULNESS OF AMIDE PROTON TRANSFER IMAGE IN IMAGING DIAGNOSIS OF GLIOMA.

Masami Shirota[1], Masayuki Nitta, Takashi Maruyama, Taiichi Saitou, Syunsuke Tsuduki, Souko Ikuta, Ayako Yoshida, Kayoko Abe, Kouichirou Abe, Yoshihiro Muragaki, Takakazu Kawamata; [1]Tokyo Women's Medical University Yachiyo Medical Center Chiba, Japan

INTRODUCTION: APT image is one of the imaging methods in MRI, and it is a molecular image that images the concentration of an amide group having an amino acid increasing in a tumor, and is expected to be clinically applied in the imaging diagnosis of glioma. on the other hand, MET-PET is useful for diagnosis of glioma because it is well accumulated in tumor cells. Based on the results of pathological diagnosis, we compared the two and verified that APT image is useful. METHOD: The study included 36 patients who underwent APT image and MET-PET. (Glioma WHO2016 Grade:GII/III/IV,and Pseudoprogression). MET-PET was administered 370MBq/kg, and the accumulation ratio (TNR) of the tumor part to the normal part was measured. APT image measured APT signal with the region of interest at the tumor site. RESULTS: APT signal in all 36 cases was correlated with 2.19±0.94 and TNR with 2.61±1.55 ($r=0.67, p<0.001$). The discrimination accuracy between GII/III/IV and Pseudoprogression by APT signal was 84% sensitivity and 100% specificity at threshold 2.0.GII APT signal 2.30±0.43, TNR 4.02±2.12, GIII APT signal 2.67±0.69, TNR 2.81±0.72, GIV APT signal 2.78±0.61, TNR 3.37±1.28 in grade diagnosis At high grade, APT signal and TNR were high. The APT signal of the oligodendroglioma line (GII/III) was 2.44±0.7, the TNR was 3.78±1.51, the APT signal of the astrocytoma line (GII/III) was 2.69±0.51, and the TNR was 2.43±0.98.The oligodendroglioma lineage was lower in APT signal than the astrocytoma lineage, and the TNR was higher. DISCUSSION: APT images are non-invasive, can easily provide important information, and have the same diagnostic potential as MET-PET. Although TNR of oligodendroglioma (GII/III) tends to be high, the APT signal which is not affected by the blood-brain barrier is consistent in measurement value and is useful for diagnostic imaging of glioma.

NI-20

IS GLIOMATOSIS CEREBRI DIAGNOSED AS GRADEII IN NEUROIMAGING A POTENTIALLY GRADEII GLIOMA?

Etsuko Owashi[1], Hiroaki Takei[1], Yuka Ikegame[1], Yoshitaka Asano[1], Kazuhiro Miwa, Takeshi Ito, Kazutoshi Yokoyama, Jun Shinoda[1], Takashi Maruyama, Yoshihiro Muragaki, Hirohito Yano, Toru Iwama; [1]Kizawa Memorial Hospital,Chubu Medical Center For Prolonged Traumatic Brain Dysfunction, Minokamo, Gifu, Japan

The 2007 World Health Organization (WHO) classification defined gliomatosis cerebri (GC) as a rare entity and an extensively infiltrating diffuse glioma involving three or more cerebral lobes. Although the revised 2016 WHO classification removed GC as a separate glioma entity due to the common histopathological findings shared with other gliomas, GC exhibits a distinct growth pattern and worse prognosis compared with other grade-matched gliomas. We retrospectively reviewed five patients with GC and five patients with insulo-opercular diffuse astrocytoma (IODA) who underwent both proton magnetic resonance spectroscopy (MRS) and [^{11}C]-methionine positron emission tomography (MET-PET).

The patients were diagnosed with GC or IODA by T2-weighted magnetic resonance imaging /fluid-attenuated inversion recovery from April 2014 to August 2019 at our institution. The locations of lesions where single-voxel MRS to measure the N-acetylaspartate (NAA)/choline (Cho) ratio and MET-PET to measure the tumor/normal (T/N) ratio were performed were the same in every patient.

The mean age of all patients was 46.3±13.7 years. The mean ages of the GC (three males and two females) and IODA (two males and three females) groups were 54.0±14.0 and 38.6±8.7 years, respectively. The mean NAA/Cho ratios in the GC and IODA groups were 1.010±0.441 and 0.594±0.449, respectively. The mean T/N ratios in the GC and IODA groups were 1.201±0.050 and 1.169±0.009, respectively.

The higher NAA/Cho ratio in the GC lesions may reflect the abundance of normal neural tissue in GC compared with IODA. Nonetheless, the T/N ratios of the two groups were comparable. The discrepancy suggests that GC cells have higher tumor metabolic activity than IODA cells. Therefore, when GC is simply classified as grade II glioma based on neuroimaging diagnosis, the possibility of underestimating its malignant potential at the single-cell level should be considered.

NI-22

IMPROVED DELINEATION OF THE SUPERFICIAL CEREBRAL VENOUS SYSTEM IN BRAIN CT ANGIOGRAPHY BY ULTRAHIGH-RESOLUTION CT FOR ASSISTING BRAIN TUMOR SURGERY

Masamichi Koyanagi[1], Mitsuru Suzuki[1], Satoshi Kikuyama[1], Akihito Nakanishi[1], Miho Gomyou, Haruhiko Machida, Kenichi Yokoyama, Kazuhiro Tsuchiya, Keiichi Kobayashi, Yoshiaki Shiokawa, Motoo Nagane; [1]Department of Radiology, Kyorin University Hospital,Tokyo,Japan

BACKGROUND: In brain CT angiography (CTA) for assisting brain tumor surgery, delineation of the superficial cerebral venous system is critical for selecting the optimal surgical approach. This delineation is, however, limited using conventional CT scanners, including an area-detector CT (ADCT) scanner, due to their insufficient spatial resolution. Since March 2017, a state-of-the-art ultrahigh-resolution CT (UHRCT) scanner has been clinically available to improve in- and through-plane spatial resolution compared with conventional CT scanners, mainly due to smaller slice thickness from 0.5 mm to 0.25 mm, larger channel number from 896 to 1792, and smaller x-ray focus from 0.9 x 0.8 mm to 0.4 x 0.5 mm.PurposeWe assessed usefulness of UHRCT to improve delineation of the superficial cerebral venous system in brain CTA for assisting brain tumor surgery compared with conventional ADCT. METHODS: We retrospectively enrolled patients with intra- and/or extra-axial brain tumors who underwent preoperative brain CTA for assisting brain tumor surgery by UHRCT or ADCT using our routine technique and generated the CTA to delineate the superficial cerebral venous system using the same technique. Two reviewers by consensus subjectively counted the number of the superficial sylvian veins and the cortical veins draining into these veins and the maximal bifurcation order of the cortical veins draining into the superior sagittal sinus. We compared these numbers and the maximal bifurcation order in the CTA between the UHRCT and ADCT groups using the intraoperative findings as the reference. RESULTS: The numbers and the maximal bifurcation order in the UHRCT group were significantly greater and more accurate than those in the ADCT group. CONCLUSIONS: Use of UHRCT can be clinically useful for better delineating the superficial cerebral venous system in brain CTA and assisting brain tumor surgery.

NI-23

ULTRA-HIGH-RESOLUTION CT ANGIOGRAPHY FOR BRAIN TUMOR SURGERY

Kuniaki Saito[1], Keiichi Kobayashi[1], Shohei Iijima[1], Yoshie Matsumoto[1], Daisuke Shimada[1], Masamichi Koyanagi, Miho Gomyo, Yoshiaki Shiokawa[1], Motoo Nagane[1]; [1]Department of Neurosurgery, Kyorin University Faculty of Medicine

BACKGROUND: Preoperative accurate evaluation of arteries and veins can help avoid ischemic complication of brain tumor surgery. The latest ultra-high-resolution CT (UHRCT) angiography (Aquilion Precision^{TM}; Canon Medical Systems) has recently become available for clinical testing of the main arteries and critical perforating arteries by brain CTA, compared to conventional CT. METHODS: UHRCT provides slice collimation of 0.25 mm x 160 and matrix size of 1024 x 1024 or 2048 x 2048. Major features of this CT scanner include an improved detector system (the minimal slice thickness, 0.25 mm; the maximal channel number, 1792) and a small x-ray focus (the smallest size, 0.4 x 0.5 mm) compared to a standard multi-detector CT (MDCT) scanner (the minimal slice thickness, 0.5 mm;