to investigate molecular prognostic markers in 23 medulloblastoma patients who were registered in the Japan Pediatric Molecular Neuro-Oncology Group and treated with lower-dose CSI relative to standard treatment. A WCAS was defined as the presence of at least two of three chromosomal changes as follows: chromosome (chr) 7 gain, chr 8 loss, and chr 11 gain.Results: All patients presented with no residue or a residual tumor smaller than 1.5 cm2 after surgery without metastasis. The median age at onset was 6.9 years, and the median follow-up period was 80.6 months. CSI was delivered at a median dose of 18.0 Gy. Regarding molecular subgrouping, there were 5 WNT, 2 SHH, 1 Group 3, and 15 Group 4 medulloblastomas. Seven patients with Group 3/4 medulloblastomas showed WCASs and had significantly better prognosis than those without the alteration (5-year progression-free survival 100% vs. 63%, p = 0.046). Two late relapses occurred at 89 and 115 months after diagnosis, respectively, and one of these patients presented with a WCAS.Conclusion: WCAS may be a molecular prognostic marker not only in patients with medulloblastoma treated with standard-dose CSI but also in those treated with lower-dose irradiation.

Key words: medulloblastoma | molecular classification | whole chromosomal aberration

MPC-7

CLINICAL FEATURES OF DIFFUSE HEMISPHERIC GLIOMA, H3 G34-MUTANT IN CHILDREN AND YOUNG ADULTS

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INTRODUCTION: H3F3A G34R/V mutated gliomas are seen predominantly in children and young adults, and have been proposed as “Diffuse hemispheric glioma, H3 G34-mutant” in cIMPACT-NOW Update 6. However, the clinical features of the tumor have not been fully elucidated. METHODS: We retrospectively reviewed 4 cases with H3G34R mutation among 40 cases diagnosed as glioblastoma under 30 years old or primitive neuroectodermal tumor (PNET) in our hospital. RESULTS: There were one male and three female patients with a median age of 21.5 years (range: 17–27 years). All lesions were localized in the cerebral hemispheres, and the initial symptoms were headache in two cases and seizures in two cases. On imaging, there was one case with poor contrast, and unlike the infiltrative growth pattern of the other three contrasted cases, it showed a well-defined mass lesion. DWI showed high signal in all four cases, reflecting the high cell density in histopathology. All cases were IDH-wildtype. CONCLUSION: Although the patient background and genetic characteristics of the glioma with H3 G34R/V mutation at our institution were generally consistent with previous reports, there were some cases with atypical imaging findings. Further investigation is required for a deeper understanding of the clinical features of this tumor.

Key words: H3 G34R/V mutation | glioma | children and young adults

MPC-8

SERUM ANTI-ZINC FINGER FYVE DOMAIN-CONTAINING PROTEIN 21 (ZFYVE21) AUTOANTIBODY AS A NOVEL BIOMARKER FOR OLIGODENDROGLIOMA IDH-MUTANT AND 1P/19Q CO-DELETION

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Background: Glioma is one of the most challenging diseases to cure, and it would be beneficial to discover new serum biomarkers for early diagnosis. Moreover, zinc finger FYVE domain-containing protein 21 (ZFYVE21) was a regulator of tumor invasion and migration. In this study, we examined the levels of serum anti-ZFYVE21 antibodies in patients with glioma. Methods: This is a multicenter observational prospective study to discover a novel serum autologous antibody marker. We analyzed 286 pre-surgically collected sera of CNS tumors and compared them to healthy donors(HD). Bacterially expressed glutathione-S-transferase-fused ZFYVE21 protein was purified, and its antibody levels were measured by amplified luminescent proximity homogeneous assay-linked immunosorbent assay (AlphaLISA). Results: The anti-ZFYVE21 antibody levels were significantly elevated in patients with gliomas (P<0.001) than those in HD, instead of patients with other CNS tumors. Among gliomas, the highest sensitivity was observed for oligodendroglioma containing IDH mutation and 1p/19q co-deletion to HD (sensitivity: 72.00%, specificity: 67.71%, AUC: 0.7565, P<0.0001), while there is no significance in astrocytoma containing only IDH mutation. In comparing 1p/19q co-deleted oligodendroglioma with IDH-mutated astrocytoma, the sensitivity and specificity were 50% and 100%, respectively. Conclusion: Serum anti-ZFYVE21 antibodies might be a novel diagnostic marker distinguishing 1p/19q co-deleted oligodendroglioma from IDH-mutant astrocytoma.

Key words: 1p/19q co-deletion | glioma | serum marker

MPC-10

PROGNOSTIC ANALYSIS IN IDH MUTANT ASTROCYTOMA PATIENT WITH CDKN2A/B HOMOZYGOUS DELETION.

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Background: IDH mutant astrocytoma has good prognosis compared with IDH wildtype one. In IDH mutant astrocytoma, However, patients with CDKN2A/B homozygous deletion (HD) are worse prognosis than non CDKN2A/B HD. Here we analyzed the prognosis of glioma patients identified with CDKN2A/B HD in our hospital. Method: There were 62 cases, and female was 26. Mean age of all cases was 41.2 and median age was 38. In IDH gene status, R132H was 59 cases (95.2%), R172K 2 (3.2%) and R132S 1 (1.6%). All 62 cases were TERT wildtype. CDKN2A/B HD were 12 cases (19.4%). In log-rank test, the group of CDKN2A/B HD was poor prognosis than non HD. In astrocytoma grade 3, CDKN2A/B HD had significantly poor prognosis (p=0.002). In Cox proportional hazard model analysis, CDKN2A/B HD was effective predictive prognostic factor as well as age and grading (p=0.03). Discussion/Conclusion: We showed that CDKN2A/B HD was good predictive prognostic factor in IDH mutant astrocytoma.

Key words: astrocytoma | IDH mutation | CDKN2A/B homozygous deletion

MPC-13

THE EVALUATION OF THE SHIFT OF TREND IN LOWER GRADE GLIOMA DIAGNOSES BASED ON EACH ERA`S CRITERIA

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It is found that molecular characteristics in lower grade gliomas (LrGGs) such as codeletion of 1p/19q and IDH mutation was found to be more accurate to predict the patient`s clinical outcome compared to morphological diagnoses alone. Since the revision WHO2016 classification of LrGGs, molecular characteristics were implemented as diagnostic standard for LrGGs diagnoses. In the other hand, morphological diagnostic standard before WHO2016 classification era was determined by different considerations and therapeutic strategies. The malignancy grades were also majorly determined by morphological diagnoses only. This study re-evaluated 20 years of LrGG cases in single institution based on WHO2007 morphological criteria and compared them to the original institutional diagnoses from each era. The study samples were originally grade II-III diffuse glioma-diagnosed cases resected from 1990 to 2016. Biopsy cases were excluded. IDH mutation was analyzed by Sanger sequence and 1p/19 codeletion status was analyzed by Comparative Genome Hybridization (CGH). As the result 93 cases were collected and based on original diagnoses, more than 50% cases are astrocytomas. Compared to re-assessment by morphological diagnoses (WHO 2007), case numbers of astrocytoma diagnoses are decreased whereas oligodendroglioma and oligoastrocytoma case numbers are increased. But, based on WHO2016 criteria, the case number of astrocytomas is again found to be increased. From comparison between original institutional diagnoses and re-assessment results, it is found that there is a shift of trend from astrocytoma to oligodendroglioma and from grade II to grade III. Comparison between morphological diagnoses (WHO2007) and molecular (WHO2016) found that astrocytoma diagnoses remain unchanged meanwhile 45% of oligodendroglioma diagnoses were shifted into astrocytomas. There is a probability that there are high frequency of morphologically diag-

nosed oligodendroglioma tumors which are having molecular characteristics of astrocytoma. There is a trend that diagnosed grade II LrGGs are actually grade III based on re-assessment diagnosis.

Key words: Neuropathology | WHO2016 criteria | Molecular diagnosis

MPC-17

2021 WHO CLASSIFICATION OF TUMORS OF THE CNS, 5TH ED.

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The grading of gliomas based on histological features has been a subject of debate for several decades. While the traditional grading system has failed to stratify the risk of IDH-mutant astrocytoma, canonical histological and proliferative markers may be applicable to the risk stratification of IDH-wildtype astrocytoma. Numerous studies have examined molecular markers to obtain more clinically relevant information that will improve the risk stratification of gliomas. The CDKN2A/B homozygous deletion for IDH-mutant astrocytoma and the following three criteria for IDH-wildtype astrocytoma: the concurrent gain of whole chromosome 7 and loss of whole chromosome 10, TERT promoter mutations, and EGFR amplification, were identified as independent molecular markers of the worst clinical outcomes. Therefore, the 2021 World Health Organization (WHO) Classification of Tumors of the Central Nervous System adopted these molecular markers into the revised grading criteria of IDH-mutant and -wildtype astrocytoma respectively, as a grading system within tumor types. For diffuse gliomas in children, molecular alteration-based classification was adopted, dividing low-grade and high-grade subcategories. New tumor types and subtypes were introduced, some based on DNA methylation profiling. To achieve this novel classification in a resource-limited setting, an integrated diagnosis combining clinical, histological, and molecular information became more important.

Key words: WHO classification | genetics | patholgy

NEUROIMAGING (NI)

NI-2

USE OF NEURITE ORIENTATION DISPERSION AND DENSITY IMAGING(NODDI)FOR EARLY DISTINCTION BETWEEN INFILTRATING TUMOR AND VASOGENIC EDEMA IN NON-ENHANCING LESIONS WITH GLIOBLASTOMA PATIENTS

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Background: Glioblastoma is a highly infiltrative tumor. In the non-enhancing T2-weighted hyperintense area, differentiating between non-enhancing tumors (NETs) and vasogenic edema is challenging. Neurite orientation dispersion and density imaging (NODDI) is a new diffusion MRI technique that reveals the inhomogeneity of the brain microstructure. The aim of this study is to differentiate between NETs and edema in glioblastomas using NODDI. Methods: Data were collected from 20 patients with glioblastoma as well as three patients with metastasis and two with meningioma (control), who underwent MRI as part of pre-surgical examination. The MRI data included T2- and T1-weighted contrast-enhanced images and NODDI images. Three neurosurgeons manually placed the volume of interest (VOI) on the NETs and edema based on the previous reports. ICVF, ODI, ISOVF, FA, and ADC were calculated for each VOI. Results: Fifteen and 13 VOIs were placed on NETs and edema, respectively. Each parameter was measured and the unpaired t-test revealed a significant difference between NETs and edema ($p < 0.0001$). The ROC curve analysis revealed a large difference in the ADC, FA, and ISOVF between NETs and edema compared to ICVF and ODI. Principal component analysis of the five parameters showed that ADC, ISOVF, and FA contributed to the differentiation between NETs and edema. Multiple logistic regression analysis was performed with the three aforementioned parameters. A predictive formula could be created to discriminate between NETs and edema, following the use of which, the ROC curve revealed an AUC value of 0.8891. Furthermore, this formula was applied to the edematous regions of the images of the negative control group, and the prediction degree of the tumor was well below 0.5, thus enabling differentiation as edema.Conclusions: NODDI may prove to be a useful tool to discriminate between NETs and edema in the non-contrast T2 hyperintensity region of glioblastoma.

Key words: glioblastoma | non-enhancing tumor | NODDI

NI-3

MAGNETIC RESONANCE RELAXOMETRY FOR TUMOR CELL DENSITY IMAGING FOR GLIOMA: AN EXPLORATORY STUDY VIA 11C-METHIONINE PET AND ITS VALIDATION VIA STEREOTACTIC TISSUE SAMPLING

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Objective: While visualization of non-enhancing tumors for glioma is crucial for planning the most appropriate surgical or non-surgical treatment of the disease, current MRI cannot achieve this goal. This study aims to test the hypothesis that quantitative and diffusion MRI can estimate tumor burden with the brain. Materials and Methods: Study 1: Ten patients who have undergone Methionine PET (Met-PET), quantitative MRI (qMRI), and diffusion MRI (DWI) were included for analysis. A cut-off of a tumor-to-normal ratio (T/Nr) 1.5 was set on Met-PET, and the values from qMRI and DWI were compared. Study 2: Seventy-nine stereo-tactically sampled tissues from 22 glioma patients were correlated with Met-PET, qMRI, and DWI measurements regarding tumor cell density. qMRI acquisition: Imaging was performed on either a 1.5 or 3 T MR scanner (Prisma or Aera; Siemens Healthcare, Erlangen, Germany). T1-relaxometry was achieved by first acquiring MP2RAGE images, then converting those images into T1-relaxation time maps. At the same time, T2-relaxometry was achieved by first acquiring multi-echo T2-weighted images and then converting those images into T2-relaxation time maps, with both relaxometries performed via Bayesian inference modeling (Olea Nova+; Canon Medical Systems, Tochigi, Japan). **Results:** Study 1 revealed that regions of 1850ms < T1-relaxation time < 3200ms and 115ms < T2-relaxation time < 225ms tended to be Met-PET T/Nr > 1.5. DWI was not useful to separate areas between low and high Met-PET. Study 2 showed that regions of 1850ms < T1-relaxation time < 3200ms showed high tumor cell density than other areas ($p=0.04$). **Conclusions:** Our results supported the hypothesis that qMRI is useful for predicting the tumor load within the brain among glioma patients. T1-relaxation time was notably useful for this means. On the other hand, ADC measured from DWI was limited for tumor load prediction.

Key words: glioma | MRI | tumor cell density

NI-6

PREOPERATIVE DIFFERENTIAL DIAGNOSIS OF GRADE II AND GRADE III IN CASES WITH ASTROCYTOMA, IDH MUTANT

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Purpose: We attempted to differentiate between IDH-mutant astrocytoma Grade II and grade III by using methionine (MET) positron emission tomography (PET) and magnetic resonance spectroscopy (MRS). Subjects and Methods: We retrospectively analyzed 41 adult supratentorial glioma cases with confirmed histological diagnosis and IDH status from June 2015 to June 2020. These included 21 males, with an average age of 38.5 years (19–59 years), including seven astrocytoma grade II (A-II) and 34 grade III (A-III) cases. We determined the accumulation value rate of the maximum tumor to normal cortex accumulation value (T/N ratio) in MET-PET. We obtained the peak ratios of N-acetyl aspartate (NAA)/ creatine (Cr), choline (Cho)/ Cr, and Cho/NAA. We investigated the correlation between the T/N ratios and MRS parameters and examined the contrast effects on MRI. Results: There were no significant differences in the T/N ratio and MRS parameters between A-IIs and A-IIIs. Only Cho/NAA ratios were significantly correlated with the T/N ratios ($r = 0.443$, $P = 0.0037$). We divided the distribution map into four areas with the highest T/N ratio of AII (1.59) and the highest Cho/NAA ratio (3.66). That is, 1) T/N ratio ≤ 1.59 & Cho/NAA ≤ 3.66,