NI-07

VALIDATION OF MACHINE LEARNING BASED HIGH GRADE GLIOMA MR SEGMENTATION VIA METHIONINE PET

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Treatment planning and lesion-follow up are generally conducted by contrast-enhanced MRI in glioma patient care. On the other hand, there are, however, substantial concerns whether MRI actually reflects the extension or activity of this neoplasm, which information should be fundamentally important at every step when treating this disease. As a matter of fact, the authors of this investigation have already shown that there is no difference in tumor cell density within areas with and without contrast enhancement (J Neurosurg. 2016,125(5):1136–1142.) and furthermore that the geometry of MRI based-radiation treatment planning is significantly altered when methionine PET is integrated for this purpose (J Neurosurg. 2018 published on-line). Regardless of these concerns, there is great interest in the research community to construct a machine learning based fully automated brain tumor segmentation tool specific for gliomas using MRI. The authors attempted to validate this method by comparing MRI-based automated brain tumor segmentation and methionine PET. Consecutively collected 45 high-grade gliomas (GBM-26, grade3-19) were analyzed. BraTumIA, an automated brain tumor segmentation tool, was used for machine learning based lesion segmentation. At the same time, lesions were segmented using various thresholds on methionine PET. The authors observed 40% of pseudo-positive and 90% of pseudo-negative error on BraTumIA based lesion segmentation when methionine PET was considered as ground truth with a cut-off of 1.3 in T/N ratio. Pseudo-negative error was as high as 60% even if the threshold was elevated to 2.0. Although machine learning based glioma segmentation is expected to expand in both research and clinical use, the observed results caution the use of MRI as ground truth of spatial extension of glioma and researchers should be reminded that this imaging modality may obscure the true behavior of the disease within the patient in some cases.

NI-08

TRIAL AND PROBLEM OF USING ASL IN INTRAOPERATIVE MRI

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INTRODUCTION: Magnetic resonance perfusion imaging is considered to be available as grading of brain tumor and follow-up of brain treatment. One of the methods, arterial spin labeling (ASL), is a test that is useful for patients with renal impairment and contrast agent allergy and has low invasiveness because it does not use a contrast agent. However, there have been no reports of ASL in intraoperative MRI (iMRI). PURPOSE: In this hospital iMRI (1.5T), it was examined whether ASL could be used to evaluate residual tumor in patients under general anesthesia. CASE STUDY: A 75-year-old woman with right temporal lobe Glioblastoma. 43-year-old man, left temporal lobe Diffuse astrocytoma. All performed ASL at the time of MRI imaging for navigation before induction of anesthesia just before surgery and iMRI. In all cases, the blood pressure at iMRI was maintained, and Post Label Delay (PLD) calculated the optimal PLD from the carotid artery velocity measured by iMRI, and defined it as 1800–2200 ms, and performed ASL. RESULTS: Actually, imaging by iMRI was almost difficult to visualize, and reflux was not recognized not only in the tumor but also in the gray matter. DISCUSSION: The blood flow velocity measurement in the internal carotid artery is performed by the phase contrast method by intraoperative MRI, and the CBF decreases because propofol used during the operation decreases the CBF and also the brain metabolism. However, it has been suggested that it is one of the factors that make evaluation with ASL difficult. Although the iMRI of our hospital is 1.5 T, which is also a subject of investigation, it is thought that there is a limit to ASL imaging in the case of general anesthesia with propofol even from the calculated PLD. CONCLUSION: ASL in iMRI at our hospital was not useful.

NI-09

CLINICAL SIGNIFICANCE OF T2-FLAIR MISMATCH SIGN IN LOWER GRADE GLIOMAS

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Lower grade glioma is classified based on genetic information of mutation of IDH1/2 gene and co-deletion of chromosome 1p19q. Knowledge of these genetic information preoperatively is useful for making surgical planning, treatment strategy and prognostication. Recently, T2-FLAIR mismatch sign has been reported to be specific for astrocytoma with IDH mutation (mut) / non-1p19q co-deletion (co-del). This study aims to verify it in our patients. We retrospectively analyzed 152 patients aged over 15 years who were pathologically diagnosed with WHO grade 2 or 3 gliomas from April 2003 to December 2018. We excluded 88 patients without genetic information or without T2-weighted and FLAIR images. T2-FLAIR mismatch sign was defined as in the original description, namely, with homogeneously hyperintense signal on T2-weighted image and a peripheral hyperintense signal with central hypointensity signal on FLAIR image. Among 22 patients with IDH mut / non-1p19q codel, 10 were positive for T2-FLAIR mismatch sign. On the other hand, only one patient was positive for T2-FLAIR mismatch sign respectively in 19 with IDH mut / 1p19q codel and 23 patients with IDH wild-type. Sensitivity, specificity, positive predictive value, and negative predictive value of T2-FLAIR mismatch for the patients with IDH mut / non-1p19q codel are 0.46 (95% confidence interval: 0.24–0.68), 0.95 (0.84–0.99), 0.83 (0.52–0.98). and 0.77 (0.63–0.88), respectively. In 22 patients with IDH mut / non-1p19q codel, we compared 10 patients with and 12 without T2-FLAIR mismatch sign. Median age was 35 and 39 years old. WHO grade 3 was 3 patients each. Tumor location was frontal lobe in 9 (90%) and 10 patients (83%). A statistically significant difference was not found in these factors. PFS and OS were not reached in both groups. The specificity of the T2-FLAIR mismatch sign for astrocytoma with IDH mut / non-1p19q codel was very high, which may be helpful as preoperative imaging marker.

NI-10

AVAILABILITY OF AMIDE PROTON TRANSFER-WEIGHTED MRI METRICS IN GLIOMA

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OBJECTIVE: Chemical exchange saturation transfer (CEST) is a novel MR imaging contrast technique that relies on the molecular characteristics of the sample. Amide proton transfer (APT) imaging is an emerging CEST-based MR imaging technique that is sensitive to mobile proteins and peptides in the tissue. APT imaging has become increasingly recognized as a promising imaging modality for glioma. Several reports suggest that APT signals are a promising imaging biomarker for glioma grading and prediction of molecular marker status. In this study, we assessed the utility of APT imaging in glioma by evaluating the relationship between APT signals and clinical parameters in glioma. METHODS: We enrolled 23 glioma patients (25 lesions) who underwent preoperative MRI with APT imaging and surgery at our institution between May 2018 and July 2019. The median age of patients was 64 years old (range, 14–84). 2 patients had Grade 2, 1 patient had Grade 3, and 22 patients had Grade 4. APT signals were measured inside the ROI that was manually placed in the solid portion of tumor that best represented the entire tumor signal on raw APT images. RESULTS: We could see that the high APT signals seemed to be related to IDH wild status and high glioma grading (IDH status; p=0.171, Grade; p=0.113). Moreover, the high APT signals were significantly strong related to high Mib-1 LI (p=0.0068, cutoff: 3.295%, sensitivity: 83%, specificity: 71%). CONCLUSIONS: APT imaging might be associated with IDH mutation status and glioma grading. Especially, high APT signal was a great predictor of high MIB-1 LI in glioma.

NI-11

PATHOLOGICAL ASSESSMENT IN THE IMPACT OF ONE-SHOT BEVACIZUMAB ON UPTAKE OF ^{11}C-METHIONINE

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BACKGROUND: This study aimed to clarify how one-time administration of bevacizumab (BEV) changes histological features in glioblastoma, and how histological changes affect the uptake of 11C-methyl-L-methionine (11C-met) as an amino-acid tracer. MATERIALS AND METHODS: Subjects were 18 patients with newly diagnosed glioblastoma who were assigned to 2 groups: BEV group, single intravenous administration of BEV before surgical tumor removal; and control group, surgical tumor removal alone. After surgery, we compared the densities of tumor cells and microvessels, and microvascular structures including vascular pericytes and L-type amino acid transporter-1 (LAT1), between the BEV and control groups. Correlations between 11C-met uptake on positron emission tomography before surgery, microvascular density, and LAT1 expression were assessed in each group. RESULTS: BEV induced significant reductions in microvascular density, while tumor cell density and prolifer-