Title

NIMG-64. THE POTENTIAL OF 7T ANATOMICAL IMAGING FOR CLINICAL ASSESSMENT OF CONTRAST-ENHANCING AND T2-HYPERINTENSE LESIONS IN PATIENTS WITH GLIOMA

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ANOVA P<0.01), thereby highlighting the complementary value of imaging to the established WHO classifications for patient's prognosis. **CONCLUSIONS:** Advanced pattern analysis of multi-parametric MRI reveals radiological subtypes of glioblastoma that are predictive of an individual patient's prognosis, substantially beyond the current IDH1-based WHO classifications and which therefore might assist in personalized treatment.

NIMG-61. USE OF TEXTURAL RADIOMIC MAPS IN A 3D CONVOLUTIONAL NEURAL NETWORK FRAMEWORK CAN AUGMENT GLIOMA LESION SEGMENTATION

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OBJECTIVE: Gliomas, one of the most common primary brain malignancies, exhibit phenotypically heterogeneous histological sub-regions (edema ED, necrotic core N, enhancing E, non-enhancing NE), each containing relevant diagnostic and prognostic information. Segmentation of these subregions in multimodal MRI is a major challenge, and usually performed manually. In this work, we hypothesize that radiomic features capturing sub-visual heterogeneity information on routine MRI (T1c, T2w, FLAIR), in conjunction with a Convolutional Neural Network (CNN) classifier will improve identification of lesion boundaries and hence improve segmentation, as compared to using intensity alone. **METHODS:** 221 high grade glioma studies were acquired from the BraTS 2016 challenge. After sequence co-registration, all cases were skull-stripped and normalized to correct for intensity inhomogeneity. Ground truth sub-compartment delineations were obtained from clinical experts. Four gray-level co-occurrence features were extracted from each MRI protocol. A 3D CNN was trained on N=154, validated on N=33, and tested on N=34 using original intensities and extracted feature maps. The architecture comprised eleven layers: eight convolutional-pooling layers followed by two fully connected layers and one classification layer. Both fully connected layers had 150 neurons connected to the two final neurons to determine voxel sub-type. We compared the performance of our model against a standard intensity-trained model and other similar intensity-trained pipelines from the challenge. Dice Similarity Coefficient (DSC) scores were used to evaluate segmentation performance. **RESULTS:** Using radiomic-CNN, there was an improvement in the DSC scores (0.82 and 0.80) for non-enhancing and enhancing tumor respectively as compared to the intensity-only CNN (0.79 and 0.79). In comparison to 18 segmentation methods, our method performed better (0.90 vs. 0.84-0.87) in segmenting tumor core (N+E+NE) and enhancing region (0.80 vs. 0.72-0.76), and comparable in segmenting whole tumor (ED+N+E+NE). **CONCLUSION:** Our results suggest that radiomic features in conjunction with 3D CNNs can augment lesion segmentation performance.

NIMG-62. RADIOLOGIC RESPONSE RATE OF *IDH* MUTANT GLIOMA FOLLOWING RADIATION TREATMENT: A RETROSPECTIVE ANALYSIS

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INTRODUCTION: IDH mutant gliomas are typically slow-growing and non-contrast enhancing on MRI. Standard-of-care treatment of high risk IDH mutant tumors involves radiation followed by chemotherapy. At present, there are no large studies that have formally characterized the radiologic response of IDH mutant tumors to radiation treatment. **METHODS:** We performed a retrospective review of 160 cases of IDH mutant glioma who received post-operative radiation treatment (RT) +/- chemotherapy and had follow-up MRI with T1, T1 post-contrast, T2 and FLAIR sequences available for review. We determined the mean tumor diameter, defined as the cubic root of the three largest tumor diameters, at post-surgical baseline and at 6, 12 and 24 months following RT completion. Radiologic response rate at each of these timepoints was determined using Radiologic Assessment in Neuro-Oncology-Low Grade Glioma criteria (RANO-LGG). **RESULTS:** Complete analysis has been performed on a subset of cases (N = 99) and suggests that during the follow-up period of up to 2 years post-RT, the vast majority of patients with IDH mutant gliomas experience a stable disease (SD) response as defined by RANO-LGG. No minor responses (MR), defined as a 25% or less decrease in tumor area, have been observed at 1 and 2 years. Further quantitative analyses are ongoing. **CONCLUSIONS:** These data indicate that RT +/- chemotherapy for IDH mutant glioma rarely results in tumor shrinkage, as measured by RANO-LGG criteria. Appropriate power for surrogate endpoints such as radiologic response rate will be critical in the design of future clinical trials examining novel therapies for newly diagnosed IDH mutant gliomas. This dataset provides a cohort that can serve as a historical comparator for future studies of novel therapeutic approaches.

NIMG-63. SPATIAL CHARACTERIZATION OF ^{11}C-METHIONINE PET AND HIGH B-VALUE DW-MRI TUMOR SUBREGIONS IN PATIENTS UNDERGOING BIOLOGICALLY-BASED DOSE-INTENSIFIED CHEMORADIATION ON A PHASE II CLINICAL TRIAL

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BACKGROUND: Advanced imaging modalities including 11C-methionine PET (MET-PET) and high b-value diffusion MRI (DW-MRI) identify hypermetabolic and hypercellular tumor subregions and are prognostic for progression in patients undergoing chemoradiation for newly diagnosed glioblastoma (GBM)(1,2). We sought to characterize the relationship between these imaging modalities and conventional MRI. **METHODS:** The initial 11 patients enrolled on a prospective phase II study (NCT02805179) of dose-intensified chemoradiation based on advanced imaging in patients with newly diagnosed GBM who underwent post-operative, pre-radiotherapy MET-PET and multiparametric MRI including high b-value DW-MRI (b=3000 s/mm2) were included in this study. Standard treatment volumes including Gd-enhanced tumor and surgical cavity (TVGd) and T2/FLAIR tumor volume (TVFLAIR) were outlined and compared with tumor subregions with abnormal uptake on MET PET (TVMET) and high b-value DW-MRI (TVHCV) using DICE correlation coefficient, defined using previously published methods. **RESULTS:** Median age was 65 years (56-77), 5/11 (45%) patients underwent subtotal resection, 2/11 (18%) biopsy alone, and 3/10 (30%) patients were MGMT methylated. Mean TVMET was 9.8 cc (0-25.9 cc), and mean TVHCV was 7.6 cc (1.7-20.4 cc), with the union on average 2.5x smaller than TVGd and 8.5x smaller than TVFLAIR. The mean volume of overlap between TVMET and TVHCV was only 1.6 cc (0-8 cc) and percentage overlap was 12% (0-34%), with no spatial overlap in 3 patients. No cases of TVMET and TVHCV extended beyond TVFLAIR, whereas 4 cc (1.1-12.5 cc) of combined TVMET and TVHCV extended beyond TVGd. **CONCLUSIONS:** TVMET and TVHCV subregions identified with known prognostic advanced imaging modalities demonstrate minimal spatial overlap and significant extension beyond the standardly boosted volume. Analyses correlating these subregions with recurrence and their relationship with other advanced imaging parameters before and during treatment are ongoing. Int J Radiat Oncol Biol Phys. 92(4):811-819, 2015. Int J Radiat Oncol Biol Phys. 73(2):479-85, 2009.

NIMG-64. THE POTENTIAL OF 7T ANATOMICAL IMAGING FOR CLINICAL ASSESSMENT OF CONTRAST-ENHANCING AND T2-HYPERINTENSE LESIONS IN PATIENTS WITH GLIOMA

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PURPOSE: 7 Tesla (7T) MRI scanners can provide novel information to improve the characterization of gliomas. However, patients who receive 7T scans must undergo separate clinical evaluations at lower field strengths due to a lack of clinical validation of 7T anatomical imaging. The purpose of this study was to develop a robust volumetric anatomical imaging protocol for the clinical evaluation of patients with glioma at 7T and compare lesion definition to standard 3T imaging. **METHODS:** 3D T2-weighted, T2 FLAIR, and T1-weighted sequences at 7T were optimized to match the contrast, resolution, and scan time of corresponding clinical sequences at 3T. Ten patients with contrast-enhancing glioma (grades II-IV) were scanned with a protocol consisting of pre-contrast anatomical imaging and post-contrast T1-weighted imaging at both field strengths, with the 7T scan occurring in between the pre- and post-contrast 3T imaging. A half-dose of contrast was used at 7T, with an additional half-dose given immediately afterwards at 3T to provide similar lesion contrast given the 2.3-fold difference in field strength. Metrics for comparison between field strengths included volumes of T2 and contrast-enhancing lesions, and Likert-scale ratings (1-5) of lesion definition by a neuro-radiologist. **RESULTS:** T2 and contrast-enhancing lesion volumes were not significantly different between field strengths, despite the trend in larger enhancing lesion volumes at 3T, which was expected given the protocol design. 7T T2-weighted and post-contrast T1-weighted images received on average half-point higher Likert-scale ratings than corresponding 3T images, whereas the opposite trend was observed with the T2 FLAIR and pre-contrast T1-weighted images. **CONCLUSION:** Our pilot study suggests that clinical assessment of contrast-enhancing and T2-hyperintense lesions in glioma is feasible at 7T, which would obviate the need for two scans, allowing patients to take advantage of the increased sensitivity in metabolic and physiologic imaging available at 7T and ultimately improve patient care.