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BACKGROUND: Pseudoprogression (PSP) detection in glioblastoma has important clinical implications and remains a challenging task. With the significant advances provided by machine learning (ML) in health care, we investigated the potential of ML in improving the performance of PET using O-(2-[¹⁸F]-fluoroethyl)-L-tyrosine (FET) for differentiation of tumor progression from PSP in IDH-wildtype glioblastoma. **METHODS:** We retrospectively evaluated the PET data of patients with newly diagnosed IDH-wildtype glioblastoma following chemoradiation. All patients presented imaging findings suspected of PSP/TP on contrast-enhanced MRI. For further diagnostic evaluation, patients underwent subsequently an additional dynamic FET-PET scan. The modified Response Assessment in Neuro-Oncology (RANO) criteria served to diagnose PSP. To develop a robust ML model, we trained a Linear Discriminant Analysis (LDA)-based classifier using FET-PET derived features on a training cohort and validated the results on a separate test cohort. The results of the ML model were compared with a conventional FET-PET analysis using the receiver-operating-characteristic (ROC) curve. **RESULTS:** Of the 44 patients included in this study, 14 patients were diagnosed with PSP. The mean (TBR_{mean}) and maximum tumor-to-brain ratios (TBR_{max}) were significantly higher in the TP group as compared to the PSP group (p=0.010 and p=0.047, respectively). The area under the ROC curve (AUC) for TBR_{max} and TBR_{mean} was 0.68 and 0.74, respectively. Using the LDA-based algorithm, the AUC (0.93) was significantly higher than the AUC for TBR_{max}. **CONCLUSIONS:** This study shows that in IDH-wildtype glioblastoma, ML-based PSP detection leads to better diagnostic performance compared to conventional ROC analysis.

NIMG-15. EVALUATING FLUCTUATING ENHANCEMENT IN OLIGODENDROGLIOMAS ON MAGNETIC RESONANCE IMAGING
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OBJECTIVE: To identify and characterize patterns of fluctuating contrast enhancement on magnetic resonance imaging (MRI) in patients with oligodendrogliomas. **INTRODUCTION:** Gliomas, particularly oligodendrogliomas, can exhibit fluctuating enhancement (FE) on MRI that can make it difficult to differentiate between treatment effect and active tumor. **METHODS:** We are conducting a single-center retrospective review of clinical and radiographic data for patients with oligodendrogliomas treated at Weill Cornell Medicine (WCM) from 2/2000-5/2018. We have identified patients with FE on MRI and tracked lesions > 5mm in at least one dimension to the resolution of the lesion or last available MRI. We have recorded time from initial diagnosis to development of FE, time from radiation to development of FE, and time from development to resolution of FE as well as molecular characteristics of each tumor. **RESULTS:** A total of 122 patients with oligodendrogliomas were identified. Thus far, fluctuating enhancement has been identified in 11 patients (5 men, 6 women) with 38 total fluctuating lesions. Isocitrate dehydrogenase-1 (IDH-1) mutation was present in 5 tumors, and 1p/19q co-deletion was present in 6. Mean time from initial diagnosis to development of FE was 44.6 months. In patients who developed FE after radiation, mean time from radiation to development of FE was 35.0 months. Twenty-seven lesions resolved, and mean time from onset to resolution of FE was 5.6 months, while mean time from start of radiation to resolution of FE was 41.0 months. Additionally, we will perform perfusion analysis on lesions > 5mm and identify patients who underwent surgical biopsy of FE with pathologic diagnosis. **CONCLUSIONS:** FE has been identified in 11 patients thus far. We are expanding our analysis to identify a larger cohort of patients with FE. Characterizing patterns of FE may aid clinicians in differentiating FE due to treatment effect from active tumor.

NIMG-16. EXPLORATORY EVALUATION OF Q-SPACE TRAJECTORY IMAGING PARAMETERS AS NOVEL IMAGING BIOMARKERS FOR GLIOMAS
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Neuroimaging offers a non-invasive means to probe tumor tissue in order to inform decision making at all phases of brain tumor treatment. Diffusion MRI is particularly sensitive to tumor tissue microstructure, with greater heterogeneity being reflected as a larger diffusional kurtosis. Q-Space Trajectory Imaging (QTI) uses tensor-valued diffusion encoding (encoding along multiple directions per shot) to disentangle Isotropic Mean Kurtosis (MK_i)

from Anisotropic Mean Kurtosis (MK_a), which are otherwise conflated in the Total Mean Kurtosis (MK_t). To test whether disentangling MK_i and MK_a facilitates a more specific probe of tumor tissue heterogeneity and malignancy, we investigated if QTI parameters could distinguish low- from high-grade gliomas and enhancing from non-enhancing regions using pre-operative QTI imaging of 13 WHO grade I-II and 18 grade III-IV glioma patients. We also analyzed these features separately for *de novo* and recurrent tumors. Regions of Interest (ROIs) were drawn on QTI maps, with support from T1 and T2-weighted images, for enhancing region, non-enhancing region, necrotic cavity, cyst, edema and resection cavity. ROC was used to gauge QTI parameter performance in classifying tumor characteristics. MK_i was found to be the strongest predictor of tumor grade (AUC = 0.74, p = 0.019). MK_i and MK_a separated *de novo* from recurrent tumors (AUC = 0.80 and 0.76, p < 0.05). MK_i separated enhancing regions from non-enhancing regions with an AUC of 0.88 in all tumors and 0.97 in *de novo* tumors. Our preliminary results highlight that tensor-valued diffusion MRI and QTI analysis have the potential to non-invasively characterize tumor grade. Further, MK_i accurately differentiated enhancing from non-enhancing tumors and could potentially substitute for gadolinium injection in some situations thereby decreasing risk, time, and cost. Our ongoing studies in larger groups aim to further correlate molecular tumor markers (eg. IDH1 status) with these diffusion parameters.

NIMG-17. VALIDATION OF DIFFUSION MRI AS AN IMAGING BIOMARKER FOR BEVACIZUMAB THERAPY IN RECURRENT GLIOBLASTOMA IN A RANDOMIZED PHASE III TRIAL OF BEVACIZUMAB WITH OR WITHOUT VB-111 (GLOBE)
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BACKGROUND: Evidence from independent single center as well as multicenter phase II trials have suggested diffusion MRI is a strong predictive imaging biomarker for survival benefit in recurrent glioblastoma (rGBM) treated with anti-VEGF monotherapy, but not systemic chemotherapies or combination therapies with anti-VEGF agents. The current study builds on this body of evidence by evaluating these diffusion MR phenotypes in a large randomized phase III clinical trial. **METHODS:** Patients with rGBM were enrolled in a phase III randomized (1:1), controlled trial (NCT02511405) to compare the efficacy and safety of bevacizumab (BV) versus bevacizumab in combination with ofranergene obadenovec (BV+VB-111), an anti-cancer viral therapy. In 170 patients with diffusion MRI available, pre-treatment enhancing tumor volume and ADC histogram analysis were used to phenotype patients as having high (>1.24 um²/ms) or low (< 1.24 um²/ms) ADC_L, the mean value of the lower peak in a double Gaussian model of the ADC histogram within the contrast enhancing tumor. **RESULTS:** Baseline tumor volume (P=0.3460) and ADC_L (P=0.2143) did not differ between treatment arms. Univariate analysis showed that patients with high ADC_L had a significant survival advantage when pooling all patients (P=0.0006), as well as when examining the BV (P=0.0159) and BV+VB-111 individually (P=0.0262). Multivariable Cox regression accounting for treatment arm, age, baseline tumor volume and ADC_L identified continuous measures of tumor volume (P< 0.0001; HR=1.0212) and ADC_L phenotypes (P=0.0012; HR=0.5574) as independent predictors of OS. **CONCLUSION:** Baseline diffusion MRI and tumor volume are independent imaging biomarkers of OS in rGBM treated with BV or BV+VB-111. Since ADC_L was predictive of OS in combination BV+VB-111, results support the working hypothesis that co-administration of VB-111 with BV may block any VB-111 anti-tumor effect, whereas VB-111 monotherapy or priming may result in higher efficacy of VB-111.

NIMG-18. THE CLINICAL SIGNIFICANCE OF ¹³N-NH₃, ¹⁸F-DOPA, AND ¹⁸F-FDG PET/CT IN THE DIFFERENTIAL DIAGNOSIS BETWEEN GLIOMA RECURRENCE AND TREATMENT EFFECTS
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BACKGROUND: Glioma often recurs and the imaging evaluation whether the tumor has returned after glioma treatment is still challenging. PET/CT is one of the most important techniques to assess the post-treatment of glioma.