nosis primarily relied on interpretation of imaging with only a minority confirmed using the gold standard of pathological examination. Furthermore, the cohorts of these studies included a mix of primary histologies. PURPOSE: To identify the combination of clinical variables and radiomic features most predictive of RN in patients with melanoma brain metastasis (BM) with GK-SRS in order to train a machine learning classifier to distinguish RN from tumor progression. METHODS: We retrospectively studied 86 patients with a melanoma BM that received initial GK-SRS followed by resection, thereby pathologically confirming tumor or RN. Clinical variables including lesion volume, age at surgery, GK-SRS dose, lesion hemorrhage, lesion location, gender, BM velocity, and drug therapy type were obtained from chart review. We extracted radiomic features from contrast-enhanced T1-weighted MR images using PyRadiomics. A consensus clustering algorithm identified representative radiomic features. Non-parametric hypothesis testing was performed on the clinical variables and representative radiomic features. RESULTS: Of the 86 patients, 17 (19.8%) patients exhibited RN and 69 exhibited tumor progression. Lesion volume was associated with development of RN ($p = 0.038<0.05$) with a median volume of 1.5 cc (0.01-26.71 cc). Clustering analysis identified seven representative radiomic features; five were found to have statistically significant association with development of RN. CONCLUSION: In this dataset with pathologically confirmed diagnoses in a histologically homogeneous patient cohort, we reproduced previously reported findings that the clinical variable of lesion volume is associated with RN and we identified several radiomic features associated with RN in patients with melanoma BM. We are using these variables and features to train a machine learning classifier to distinguish RN from tumor.

NEIM-07

DIFFERENTIAL DIAGNOSIS OF TUMOR RECURRENCE AND RADIATION NECROSIS AFTER STEREOTACTIC RADIOTHERAPY FOR BRAIN METASTASES WITH 320-ROW ADCT PERFUSION IMAGE AND T1/T2 MATCH: RADIOLOGICAL AND PATHOLOGICAL ANALYSIS

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BACKGROUND AND PURPOSE: Radiation necrosis occurs from 6 months to several years following stereotactic irradiation (STI) for brain metastases when tumor recurrences are also most likely. Conventional MR imaging does not provide sufficient information to differentiate between radiation necrosis and tumor recurrence. Methionine-PET, FDG-PET and MR spectroscopy sometimes lead to false positive findings. We applied 320-row area detector CT perfusion imaging for the differentiation because it shows vascularity of lesions in the whole brain. MR T1/T2 match sign also evaluate because it is convenient diagnostic method. METHOD: Between October 2006 and September 2021, 48 lesions enlarged in 46 patients 3 to 122 months (median: 11 months) after STI. Differential diagnosis was performed with CT perfusion imaging and MR T1/T2 match sign. To calculate the regional cerebral blood volume (rCBV), the regions of interest (ROIs) were located in the enhanced areas. The lesions progressively increased in size or became symptomatic were resected and diagnosed by pathological examination. RESULTS: Mean age was 63 years, and 60% were male. Primary were lung 31, breast 9, kidney 3, colon 2, melanoma 2, and uterus 1. Mean time to progression from STI was 11 months (range; 3-122). Pathological diagnosis revealed 38 lesions (79%) had tumor recurrence, and 10 (21%) had radiation necrosis. A cut off value rCBV of greater than 3.0 analyzed by ROC curve provided the best sensitivity and specificity for identifying recurrent metastatic tumors, at 89% and 100%, respectively. T1/T2 match sign was provided sensitivity and specificity for identifying recurrent tumors, at 84% and 90%, respectively. To estimate intralesional pathological heterogeneity, contradistinction of CBV map and T1/T2 match sign is useful for the choice of intraoperative maneuver. CONCLUSION: Perfusion CT imaging and T1/T2 match sign demonstrated reliable methods for differentiating tumor recurrence from radiation necrosis after STI.

NEIM-08

A PHASE II STUDY OF MULTIPARAMETRIC MR-GUIDED HIGH DOSE ADAPTIVE RADIOTHERAPY WITH CONCURRENT TEMOZOLOMIDE IN PATIENTS WITH NEWLY DIAGNOSED GLIOBLASTOMA

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BACKGROUND: Biologically-informed radiotherapy (RT) targeting an adversely prognostic hypercellular/hyperperfused imaging phenotype in patients with newly diagnosed glioblastoma (GBM) may improve outcomes by identifying emerging regions of treatment resistance associated with survival (OS), and is under investigation as a target for individualized, adaptive RT in an ongoing Phase II trial (NCT04574856). METHODS: In this single-arm study, patients with newly diagnosed GBM following resection undergo dose-intensified chemoRT targeting the residual hypercellular (TV_{HCV}, mean contralateral normal brain+2SD) and hyperperfused tumor volume (TV_{CBV}, contralateral normal frontal grey matter+1SD) identified using high b-value diffusion-weighted and dynamic contrast-enhanced perfusion MRI. TV_{HCV}/TV_{CBV} is treated to 50 Gy in 20 fractions (2.5 Gy/fraction), and following mid-RT reassessment, the persistent and developing TV_{HCV}/TV_{CBV} is treated to 30 Gy in 10 fractions (3 Gy/fraction). The primary endpoint is improvement in OS, with planned interim safety analysis. RESULTS: Since October 2020, 16 of 30 patients have been enrolled. Median age was 58 years (range, 29-75) and 69% were male. No patient underwent biopsy, and 50% had gross total resection; 23% had MGMT methylated tumors, and all except 2 were IDHwt. Median TV_{HCV}/TV_{CBV} was 6.9 cc (range, 1.9-42.8) pre-RT and 30% (range, 1-72%) was nonenhancing. By mid-RT, TV_{HCV}/TV_{CBV} was reduced to 4.2 cc (range, 0.8-34.3) and 47% (range, 3-74%) was nonenhancing. The TV_{HCV}/TV_{CBV} persisting from pre- to mid-RT was 2.3 cc (range, 0-24.2), with an additional 1.8 cc (range, 0.3-20.6) newly developing outside of the initial region. All patients underwent adaptive replanning for boost without interruption. Planned interim analysis determined an acceptable rate of neurologic toxicity and safety to continue enrollment. CONCLUSION: Individualized, adaptive radiotherapy using an advanced imaging biomarker to assess emerging and especially nonenhancing regions of treatment resistance in patients with GBM is feasible, with short term safety in an early cohort and longer-term efficacy outcomes anticipated with ongoing accrual.

FINAL CATEGORY: SUPPORTIVE CARE

SPCR-01

RAPIDPLAN HIPPOCAMPAL SPARING WHOLE BRAIN MODEL VERSION 2 - HOW FAR CAN WE REDUCE THE DOSE?

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BACKGROUND: Whole-brain radiotherapy (WBRT) has been the standard palliative treatment for patients with brain metastases due to its effectiveness, availability, and ease of administration. Recent clinical trials have shown that limiting radiation dose to the hippocampus is associated with decreased cognitive toxicity. In this study, we updated an existing Knowledge Based Planning (KBP) model to further reduce dose to the hippocampus and improve other dosimetric plan quality characteristics. METHODS: 42 clinical cases were contoured according to NRG-CC001 guidelines. A new dosimetric scorecard was created as an objective measure for plan quality. The new Hippocampal Sparing Whole Brain Version 2 (HSWBv2) model adopted a complex recursive training process and was validated with five additional cases. HSWBv2 treatment plans were generated on the Varian Halcyon™ and TrueBeam™ systems and compared against plans generated from the existing (HSWBv1) model released in 2016. RESULTS: On the Halcyon™ platform, 42 cases were re-planned. Hippocampal $D_{100\%}$ from HSWBv2 and HSWBv1 models had an average dose of 5.75 Gy and 6.46 Gy, respectively ($p<0.001$). HSWBv2 model also achieved a hippocampal D_{mean} of 7.49 Gy, versus 8.10 Gy in HSWBv1 model ($p<0.001$). Hippocampal $D_{0.03CC}$ from HSWBv2 model was 9.86 Gy, in contrast to 10.57 Gy in HSWBv1 ($p<0.001$). For PTV_3000, $D_{98\%}$ and $D_{2\%}$ from HSWBv2 model were 28.27 Gy and 31.81 Gy, respectively, compared to 28.08 Gy ($p=0.020$) and 32.66 Gy from HSWBv1 ($p<0.001$). Among several other dosimetric quality improvements, there was a significant reduction in PTV_3000 $V_{105\%}$ from 35.35% (HSWBv1) to 6.44% (HSWBv2) ($p<0.001$). On five additional validation cases, dosimetric improvements were also observed on TrueBeam™. CONCLUSION: In comparison to published data in addition to the HSWBv1 model, the HSWBv2 model achieved higher quality HA-WBRT treatment plans through further reductions in hippocampal dose while improving target coverage and dose conformity/homogeneity. HSWBv2 model is shared publicly.