RTHP-32. RECONSIDERING RADIORESISTANCE: LINAC-BASED STEREOTACTIC RADIOSURGERY FOR INTRACRANIAL METASTASES FROM MELANOMA AND RENAL CELL CARCINOMA
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PURPOSE: Melanoma and renal cell carcinoma (RCC) are traditionally classified as radioresistant histologies. Data using stereotactic radiotherapy (SRS) alone for radioresistant brain metastases demonstrate local control similar to non-radioresistant histologies. We report the University of Chicago experience treating melanoma and RCC with linear accelerator-based LINAC-based SRS. METHODS: Patients treated with SRS alone for brain metastases from melanoma or RCC between 2000-2015 were retrospectively analyzed. Metastases were followed using MRI. Freedom from local failure (FFLF), freedom from distant intracranial failure (FDFIF) and overall survival (OS) were assessed. Log-rank and Cox proportional hazard models were used for analysis. RESULTS: Eighty-one patients were included, with median age 60.9 years and median ECOG=1. Forty patients presented asymptptomatically and 31 had neurologic symptoms. Seventy-two patients had extracranial metastases, 32 had single brain metastases and 51 had primary tumor control. Cone-based SRS was used for 35 patients and micro-multileaf collimators for 46 patients. Median SRS dose was 18Gy (range 15-20Gy) prescribed to median isodose line of 80% (range 56-99%). One hundred seventeen lesions were treated, with median diameter 12.6mm (range 3.4-98.9mm) and median lesion volume 0.80cm3 (range 0.01-12.4cm3). Actuarial OS at 6 months and 1 year was 55.4% and 30.2%, respectively. Actuarial FFDFC at 1 year was 55.4% and 30.2%, respectively. Actuarial projection of 5-year FFLF of 51.5% for melanoma and 79.4% for RCC. On multivariable analysis, there was a trend toward improved FFLF for RCC patients (HR=0.63, p=0.06). Salvage therapy included WBRT (n=7), SRS (n=10), surgery (n=2), WBRT+SRS (n=1) and surgery+SRS (n=2). Four patients developed biopsy-proven radiomedicoradiosurgery. CONCLUSION: LINAC-based SRS for melanoma and RCC is safe and effective with long-term neurological toxicity. There is a trend toward improved FFLF for patients with RCC compared to those with melanoma. FFLF was lower than other histologies from historical reports, but consistent with published data for melanoma and RCC.

RTHP-33. OUTCOMES AFTER STEREOTACTIC RADIATION THERAPY FOR PRIMARY CNS LYMPHOMA
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INTRODUCTION: The standard of care for primary CNS lymphoma (PCNSL) typically includes high dose methotrexate systemic therapy (HD-MTX) followed by whole brain radiation therapy (WBRT). Many patients cannot tolerate this regimen, and there is increased risk of leukoencephalopathy in elderly patients receiving WBRT after HD-MTX. In our institution, we have offered stereotactic radiosurgery in 1-3 fractions for disease refractory to HD-MTX in a subset of patients who are felt to be high-risk for WBRT. METHODS: Medical records of five patients who received part-to-fill radiation for persistent or refractory CNS lymphoma were reviewed. Four patients received stereotactic radiosurgery (SRS) via single fraction or three-fraction regimen to doses of 21-24 Gy; one patient received salvage SRS three years after WBRT. Outcomes recorded were overall survival, and local control in RT field, and intracranial progression-free survival (outside of RT field). RESULTS: Five patients (eight lesions) were treated with stereotactic radiosurgery (SRS) or PCNSL. Median follow up was 8.5 months, with two patients free of disease recurrence at last follow up. Median overall survival was not reached as three patients remain alive. Two patients had distant intracranial failure (salvaged with WBRT and chemo, respectively), and a third patient developed a marginal recurrence (salvaged with repeat SRS). There was no Grade 2 or higher acute or late toxicity. CONCLUSION: Stereotactic radiation therapy may provide favorable local control in patients with refractory PCNSL at high risk with WBRT. Prospective trial is warranted to validate the efficacy of such an approach.

RTHP-34. PLACEMENT OF SCALP ELECTRODES (NOVO TTF) DOES NOT SIGNIFICANTLY CHANGE RADIATION DOSIMETRY WHEN DELIVERING CRANIAL INTENSITY MODULATED RADIATION THERAPY (IMRT)
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INTRODUCTION: A recent phase III trial in patients with glioblastoma demonstrated survival benefit with tumor treating fields (NovoTTF) after completion of post-operative chemoradiation. There may be benefit to utilizing NovoTTF during radiation therapy. We investigate whether placement of the NovoTTF transducer arrays during radiation delivery impacts dosimetry. METHODS: We generated radiation plans using a cranial phantom with and without NovoTTF transducer arrays in place for five tumor locations based on real patient data. All plans were generated using VMAT (volume modulated arc therapy) with sparing techniques on NovoTTF arrays. The plans were then applied to phantoms with NovoTTF transducer arrays. Key dosimetric parameters, including planning target volume (PTV) coverage, dose to organs at risk, mean scalp dose, and scalp D10cc/D20cc, etc were collected and compared. Verification of dosimetric results was done through OSL and film measurement. RESULTS: Mean scalp dose was 13.1Gy +/- 3.5 Gy with scalp sparing VMAT technique. The placement of NovoTTF transducer arrays did not significantly affect the PTV coverage by the prescription dose, minimum PTV dose, or mean PTV dose. Doses to avoidance structures including the brainstem, optic chiasm, lens, and cochlear nerve were slightly lower with the placement of NovoTTF transducer arrays; however, these were non-significant. OSL and film measurement confirmed the findings from dosimetric comparison. CONCLUSION: In a cranial radiation phantom model, the presence of NovoTTF transducer arrays does not impact radiation dosimetry. The impact would be even less in actual patient treatment due to frequent change of arrays with slight shift in placement.

RTHP-35. IMPACT OF TUMOR TREATMENT FIELD ARRAY ON PROTON BEAM DOSE DISTRIBUTION AND IMAGE GUIDANCE IN THE TREATMENT OF CNS MALIGNANCIES
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INTRODUCTION: Use of tumor treatment fields (TTFs) after radiotherapy and temozolomide for glioblastoma multiforme (GBM) increases survival. Prescribing the TTF system concurrently with radiotherapy may yield the maximum disease control. We studied the impact of TTF on proton beam dosimetry and cone-beam CT (CBCT) image quality. METHODS: Two commercially available TTF arrays were positioned on a Zebra multi-layer ion chamber system and a PBU-50 head phantom. Each TTF array consists of nine ceramic discs encased in plastic with connecting metal wires. Single proton beams at various clinical energies (range: 135-225 MeV) were directed through the ceramic disc component of the TTF array. Depth dose measurements were then obtained for the proton beam to determine the degree of TTF array-associated beam backscatter. For IGRT assessment, CBCT images were obtained with the two arrays in place. Image quality and degree of scatter were qualitatively assessed using the contralateral side of the phantom without TTF arrays as an internal control. RESULTS: Measurement of the pristine Bragg peak of a single 145 MeV pencil beam generated by a spot scanning proton therapy system was 14.75 cm. After placement of the TTF array in line with this beam, depth of penetration decreased to 14.03 cm, yielding a pullback of 7.2 mm. Similar results were obtained (range: 7.2-7.5 mm) at other energies within our beam’s clinical range of 90-250 MeV. This change may be due to a high degree of scatter compromised visualization of the skull of the phantom. If all four arrays were present, CBCT-based image guidance likely would not be possible without modification of the array layout. CONCLUSIONS: Use of the TTF system in a proton beam therapy may be possible with alterations in treatment planning and array placement on radiotherapy treatment days. Further clinical study is warranted to determine feasibility and whether an additional clinical effect is possible.

RTHP-36. CONTRIBUTION OF DWI AND RADIATION THERAPY DOSE DISTRIBUTION TO RESPONSE ASSESSMENT IN PATIENTS WITH RECURRENT GLOMUS TREATED WITH HYPERRADIOSENSITIVITY PROTON THERAPY
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INTRODUCTION: A recent phase III trial in patients with glomus tumors demonstrated an objective response rate of 75% with a median time to local failure of 43 months. Prophylactic cranial irradiation (PCI) is frequently given to patients with recurrent or metastatic glomus tumors, resulting in cranial radiation therapy (RT) doses ranging from 30 to 40 Gy. The contribution of diffusion-weighted imaging (DWI) to radiation therapy (RT) dose distribution in recurrent glomus tumors treated with hyper-radiosensitizing proton therapy (HTP) was evaluated. METHODS: Patients with recurrent glomus tumors who underwent HTP were included. The DWI fractionation profile was extracted using an in-house MATLAB program. A three-dimensional dose distribution of proton pencil beam scans was measured using a Gafchamber. Results of the DWI fractionation profile were compared to the Gafchamber measurements to determine the relative response. RESULTS: Seven patients, including 6 recurrent glomus tumors and 1 metastatic glomus tumor, were included. The in-house MATLAB program successfully extracted the DWI fractionation profile from the proton pencil beam scans for all seven patients. The Gafchamber measurements showed a strong correlation between the DWI fractionation profile and the measured Gafchamber response. CONCLUSIONS: The contribution of DWI to radiation therapy dose distribution was successfully evaluated in patients with recurrent glomus tumors treated with proton therapy.