radiosurgery (12–15 Gy) for tumors 2–6 cm in greatest diameter. In that study 15 Gy was found to be safe in the preop setting but further escalation was not attempted. An additional 30 patients received preop SRS off-study (median dose 15 Gy). The median postop dose was 16 Gy. LMD recurrence was defined as focal pachymeningeal or diffuse leptomeningeal enhancement of the brain, spinal cord, or cauda equina, dural enhancement beyond 5 mm from the index metastasis, subependymal enhancement, or enhancement of cranial nerves. This definition is not limited to carcinomatosis. All events were categorized and confirmed by at least two physicians. RESULTS: 40/140 (29%) patients developed new focal or diffuse LMD. Preop SRS was associated with a higher freedom from leptomeningeal recurrence (84% vs 60% at one year, p=0.021 Breslow, p=0.128 log-rank). Since later LMD may not be related to surgery, a second analysis censoring follow-up at one year was performed and confirmed this trend (p=0.008 Breslow, p=0.014 log-rank). CONCLUSIONS: Preoperative SRS is associated with a reduction in the risk of LMD compared to postop SRS. Focal pachymeningeal dissemination may not always be recognized as related to surgery. A randomized trial of preop vs postop SRS is warranted.

RADI-13. IMPACT OF CITV AND BRAF MUTATION ON MELANOMA METASTASIS RESPONSE TO STEREOTACTIC RADIOSURGERY

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INTRODUCTION: Survival prognostication is an important aspect of personalizing oncologic care for patients with melanoma brain metastasis (BM). We previous demonstrated the utility of a cumulative intracranial tumor volume modified diagnosis-specific graded prognostic assessment scale (CITV-dsGPA) for SRS-treated melanoma BM patients. Pertinent prognostic variables in this model included age, Karnofsky performance status (KPS), and CITV. Here we determined whether the incorporation of BRAF mutation status into this CITV-modified scale further enhanced its prognostic accuracy. METHODS: We collated the survival pattern of 331 melanoma BM patients with known BRAF mutation status treated with stereotactic radiosurgery (SRS) and validated our findings in an independent cohort of 174 patients. All patients with BRAF mutation were treated with BRAF inhibitors. The prognostic utility of the model with and without BRAF mutation information was compared using the net reclassification index (NRI > 0) and integrated discrimination improvement (IDI) metric. RESULTS: Presence of the BRAF mutation was associated with a reduced hazard of death in univariate Cox proportional hazards survival analysis (hazard ratio (HR) 0.74, p< 0.001). This effect persisted in a multivariate model that controlled for age, KPS, and CITV (HR 0.72, p< 0.001). Addition of BRAF mutation status to the CITV-ds-GPA model for melanoma significantly improved its prognostic value, with NRI >0 of 0.294 (p=0.01) and IDI of 0.017 (p=0.02). We validated these findings in an independent cohort of 174 melanoma patients. CONCLUSIONS: Optimal survival prognostication for SRS-treated patients with melanoma BM requires an integrated assessment of age, KPS, CITV, and BRAF mutation status.

RADI-14. FRAMELESS STEREOTACTIC RADIOSURGERY ON THE GAMMA KNIFE ICON: EARLY EXPERIENCE FROM 42 PATIENTS WITH BRAIN METASTASES

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BACKGROUND: The Gamma Knife (GK) Icon uses a Cone-Beam CT (CBCT) scanner and an infrared camera system to support the delivery of frameless radiosurgery. There are limited data on patients treated with frameless GK radiosurgery (GKRS) for brain metastases. OBJECTIVE: To describe the early experience, process, technical details, and short-term outcomes with frameless GKRS for brain metastases at our institution. METHODS: We describe our patient selection and workflow for frameless GKRS in detail. Because of the short interval of follow-up, we provide crude rates of local control. RESULTS: 42 patients had a total of 96 brain metastases. Median age was 69. 77 intact lesions were treated definitively, 18 cavities postoperatively, and 1 had GKRS for recurrence after resection. 11 patients underwent repeat GKRS to the same area. Median dose was 20Gy in 1 fraction (range: 14–21), 24Gy in 3 fractions (range: 19.5–27), and 25Gy in 5 fractions (Range: 25–30). Median treatment time was 23.7 minutes (Range: 7.3 – 85.5). 29 patients had a follow-up MRI in our records after completing GKRS. Median follow-up time was 105 days (Range: 16 – 314). 16 local recurrences (LR) were identified in 9 patients. An additional 6 patients had distant brain recurrence without LR. Crude mean time between GKRS and LR was 101 days (range 44–161 days). There were 6 patients with grade 1, 3 with grade 2, 2 with grade 3, and 1 with grade 4 toxicity. We found an improvement in workflow and a greater number of patients eligible for GKRS due to the ability to fractionate treatments. CONCLUSION: We report a large cohort of consecutive patients with brain metastases treated with frameless GKRS. We look forward to studies with longer follow-up to provide valuable data on clinical outcomes and to further our understanding of the radiobiology of hypofractionation in the brain.

RADI-15. CLUSTERING AND GROUPING OF BRAIN METS IN RADIOSURGERY TREATMENTS

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INTRODUCTION: Radiosurgical treatment of numerous lesions in the brain with 'single-isocenter' radiosurgery on a linac often requires using multiple isocenters. With our TPS (Elements, Brainlab) multiple plans need to be generated for each set of lesions, and a sum plan calculated. We investigated how to distribute multiple lesions into two groups for two isocenters to achieve a good summed dose distribution. METHODS: The DICOM RS file is exported and the PTV data is extracted by a MATLAB program that calculates the convex hulls, estimated radii, and the centers of mass for each PTV. Two approaches were tried: (1) Lesions close to each other (closer than a certain limit) are put in different groups and (2) Create clusters by *kMeans* clustering, which allows close lesions but the groups are distant from each other. MATLAB programs were written for all approaches. Treatment plans were generated for three patients (20, 13, 15 lesions) using each method and compared with the actual treatment plan used to treat the patient based on the intuitive grouping of lesions by the planners. Dose maximums outside the lesions, and volumes in the normal tissue exceeding 75, 50 and 25% of the prescription dose were evaluated. RESULTS AND DISCUSSION: The coverage of all lesions for all plans were 95% of the prescription dose. The first approach allowed lowering the maximum dose between lesions, but with summing dose distributions this advantage disappeared. The maximum dose and the 75, 50 and 25% dose volumes were also all worse than in plans generated by experienced planners and higher normal brain doses are delivered if closely spaced lesions are separated into different isocenters for treatment. However, the clustering approach resulted in the same or better values of these same parameters, i.e. improved dose distributions over the dosimetrist's intuitively chosen separation.

RADI-16. ECONOMIC IMPLICATIONS OF PREOPERATIVE VERSUS POSTOPERATIVE STEREOTACTIC RADIOSURGERY FOR BRAIN METASTASES

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OBJECTIVE: Retrospective data suggests preoperative stereotactic radiosurgery (preSRS) reduces radiation necrosis (RN) and leptomeningeal disease (LMD) failure after resection of brain metastases (BM) as compared to postoperative SRS (postSRS). We evaluated the potential financial impact of a reduction in symptomatic RN (SRN) and LMD, should preSRS become a national standard. METHODS: A decision tree was designed to evaluate the two strategies: preSRS vs. postSRS. We assumed no difference in survival and that a reduction in SRN and LMD exists on par with retrospective data. Effectiveness was not considered given unclear health utilities. Treatments for SRN considered were dexamethasone, bevacizumab, surgical resection, or hyperbaric oxygen (HBO). Treatments for LMD considered included conventional radiation, SRS, systemic therapy (lapatinib/capecitabine), or no therapy. Probabilities were extracted from the 2-year LMD/SRN rates and subsequent treatment patterns observed in retrospective data. Treatment costs were based on the 2019 Medicare physician fee schedule and published data in 2019 US dollars without discounting. National costs to the healthcare system were estimated by assuming 200,000 BM cases per year with a surgical utilization rate of 16%. Deterministic and probabilistic sensitivity analyses (PSA) were performed. RESULTS: The incorporated rate of LMD and SRN for postSRS was 22.4% and 16.4% and 4.3% and 4.9% for preSRS, respectively. The expected mean costs were $3,129 for postSRS and $810 for preSRS. Deterministic sensitivity analysis demonstrated that the model was sensitive to only LMD/SRN rates. PSA demonstrated that in 95% of simulations, the expected savings ranged from $770-$6,429/patient. Therefore, the national healthcare system stands to save approximately $74 million per year if preSRS was a national standard (range $25–206 million). CONCLUSIONS: A prospective randomized trial demonstrating the effectiveness of preSRS in the reduction of LMD and/or SRN would carry a significant return on investment through the reduction of subsequent treatment costs.