RADI-17. TUMOR CONTROL AND SURVIVAL IN PATIENTS WITH TEN OR MORE BRAIN METASTASES TREATED WITH STEREOTACTIC RADIOSURGERY: A RETROSPECTIVE ANALYSIS

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INTRODUCTION: To assess tumor control and survival in patients treated with stereotactic radiosurgery (SRS) for 10 or more metastatic brain tumors. METHODS: Patients were retrospectively identified. Clinical records were reviewed for follow-up data, and post-treatment MRI studies were used to assess tumor control. For tumor control studies, patients were separated based on synchronous or metachronous treatment, and control was assessed at three-month intervals. The Kaplan-Meier method was employed to create survival curves, and regression analyses were employed to study the effects of several variables. RESULTS: Fifty-five patients were treated for an average of 17 total metastases. Forty patients received synchronous treatment, while 15 received metachronous treatment. Univariate analysis revealed an association between larger brain volumes irradiated with 12 Gy and decreased overall survival (p=0.0406); however, significance was lost on multivariate analysis. Among patients who received synchronous treatment, the median percentage of tumors controlled was 100%, 91%, and 82% at 3, 6, and 9 months, respectively. Among patients who received metachronous treatment, the median percentage of tumors controlled after each SRS encounter was 100% at all three time points. CONCLUSIONS: SRS can be used to treat patients with 10 or more total brain metastases with an expectation of tumor control and overall survival that is equivalent to that reported for patients with four or fewer tumors. Development of new metastases leading to repeat SRS is not associated with worsened tumor control or survival. Survival may be adversely affected in patients having a higher volume of normal brain irradiated.

RADI-18. STEREOTACTIC RADIOSURGERY OR FRACTIONATED STEREOTACTIC RADIOSURGERY FOR BRAIN METASTASES FROM SMALL CELL LUNG CANCER

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BACKGROUND: Current standard of care (SOC) management of the brain differs between non-small cell lung cancer (NSCLC) & small cell lung cancer (SCLC). For SCLC, WBRT is considered SOC, even for solitary metastasis. In the setting of no-known metastases, prophylactic cranial irradiation (PCI) is considered SOC. SRS is occasionally utilized in SCLC, e.g. in setting of limited metastasis after WBRT/PCI, or limited metastasis after excellent systemic response to extracranial therapy, or if patient declines WBRT. In this study, we sought to understand more about the nature and outcomes of patients with SCLC who received intracranial SRS at our institution. METHODS: We reviewed radiosurgery treatments from 2005 thru 2019 for patients with SCLC who received SRS. Variables included were: time interval between diagnosis/SRS and death, prior WBRT/ PCI, number of targets, performance status, modality (GK or linac), prior surgery, and available follow-up. RESULTS: We identified 92 SRS treatments among 74 patients. 30 received upfront SRS, the remainder as post-WBRT/PCI salvage. Median survival after initial diagnosis was 22.0 months (min = 6.6, max 55.4). Median survival after first SRS was 6.1 months (min = 0.5, max = 40.4). Median recorded KPS was 75.6. Mean number of mets treated was 3.4 (min = 1, max = 12). Prescription dose range was 12 to 20Gy in single fraction, and 25 to 30Gy in five fraction treatment. 53 treatments were performed on Gamma Knife, 37 with linear accelerator. Four patients were treated post-operatively, one patient was treated pre-operatively. CONCLUSIONS: Survival in our cohort of SCLC patients receiving intracranial SRS compared favorably with historical SCLC controls (8-13mo after dx). Future work will seek to clarify whether there is a difference in brain metastasis velocity between patients treated with upfront PCI/WBRT or SRS, and also seek to address the minimum necessary dose to control SCLC metastases.

RADI-19. EVALUATION OF BRAIN METASTASIS LOCAL CONTROL POST RADIOSURGERY VIA MACHINE LEARNING AND RADIOMICS

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Stereotactic radiosurgery can be used to treat multiple, surgically inaccessible, metastatic brain lesions in a single, minimally invasive outpatient procedure. For brain metastasis, stereotactic radiosurgery can provide excellent local control depending on the robustness of the treatment plan. Previous studies have been performed correlating key radiation planning factors to higher local control probability such as tumor size and maximum dose. However, a separate non-inferiority study demonstrated that higher prescription isodose lines (in excess of 70% or higher) did not correlate to local failure. The previous works were limited to shallow feature levels regarding only the dicom plan information and lacked a predictive model. In order to address these conflicting conclusions and to support clinical decision making, we propose a radiosurgery informatics pipeline to support testing these hypotheses with observational data. First, a multidisciplinary team generated a mind-map of relevant information to inform database design. Portions of this mind-map were implemented in a relational database system (PorstgreSQL), and populated with information from 1024 patients treated for brain metastasis via stereotactic radiosurgery. Clinical information were derived from curated databases and the array of intervention variables were mined from the DICOM RT plans, structure sets, images and dose via MATLAB scripts. These factors include, but are not limited to, radiation dosimetry, prior whole brain radiation, radiomic imaging features, prior radiosurgery status, and physician determined local control status. From this pipeline, we plan to use a multi-level feature-based supervised machine learning approach that will be created via boosting to predict local control in patients using local failure timing, or lack thereof, provided by physician. To control for local failure observer bias, an unsupervised machine learning model via random trees will be created to predict clusters of patient parameters with similar local control rates.

RADI-20. RETROSPECTIVE OUTCOME ANALYSIS OF INTRAOPERATIVE RADIOTHERAPY (IORT) FOR SURGICALLY RESECTED BRAIN METASTASES: AN INTERNATIONAL COOPERATIVE STUDY.

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BACKGROUND & OBJECTIVE: The ideal delivery of adjuvant radiation to the surgical cavity of brain metastases (BMs) remains the subject of debate. Risks of leptomeningeal dissemination (LMD), local failure (LF) and radiation necrosis (RN) have prompted a reappraisal of the timing and/or modality of this critical component of BM management. IORT delivered at the time of resection for BMs requiring surgery offers the potential for improved LC and decreased LMD afforded by the elimination of delay in time to initiation of radiation following surgery and the possibility of dose escalation beyond that seen in stereotactic radiosurgery (SRS). This study provides a retrospective analysis with identification of potential predictors of outcomes. METHODS: Retrospective data was collected on patients treated with IORT immediately following surgical resection of BMs at three institutions according to the approval of individual IRBs. All patients were treated with the Zeiss Intrabeam device (Carl Zeiss Meditech, Germany) using spherical applicators ranging from 1.5 to 4.0cm with 50kV output. Statistical analyses were performed using SPSS (IBM) with endpoints of LF, DBF, incidence of RN, and overall survival (OS) and $p < 0.05$ considered significant. RESULTS: 54 patients were treated with IORT with a median age of 64 years. The most common primary diagnosis was non-small cell lung cancer (40%) with the most common location in the frontal lobe (38%). Median follow-up was 7.2 months and 1-year LC, DBF, and OS were 88%, 58%, and 73%, respectively. LMD was identified in 2 patients (3%) and RN present in 4 patients (7%). The only predictor of LC was extent of resection with 1-yr LC of 94% for GTR vs 62% for STR (p=0.049). CONCLUSIONS: IORT is a safe and effective means of delivering adjuvant radiation to the BM resection cavities with high rates of LC and low incidence of RN.

RADI-21. STEREOTACTIC RADIOSURGERY FOR 10 OR MORE BRAIN METASTASES PROVIDES EXCELLENT RATES OF INTRACRANIAL DISEASE CONTROL WITH SUPERIOR HIPPOCAMPAL SPARING

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BACKGROUND: Recent evidence supports hippocampal sparing during whole brain radiotherapy (HS-WBRT) to improve neurocognitive outcomes in patients with brain metastases (BM). This study sought to quantify the hippocampal dosimetry and treatment efficacy of stereotactic radiosurgery (SRS) to 10 or greater BM to clarify the roles of SRS and WBRT. METHODS: Patients at a single institution treated with SRS to 10 or more BM without WBRT from 1999 to 2016 were retrospectively reviewed. Treatment-related outcomes including overall survival (OS), freedom from progression (FFP), freedom from new metastases (FFNM), and adverse radiation effect (ARE)