The spine cases included a fifth lumbar spine (case 1), fifth thoracic spine (case 2), and 10th thoracic spine metastases (case 3). Targets and organs at risk (OAR) were contoured by one experienced radiation oncologist according to International Spine Radiosurgery Consortium Guidelines and a 2 mm planning target volume (PTV) applied. The DICOM files were sent to each institute for planning. The treatment planning guidelines in the previous study included, prescribed dose of 24 Gy in two fractions with more than 70% prescribed dose to encompass D95, D0.035 <140% of the prescribed dose, and a maximum dose to the spinal cord planning organ at risk volume (PRV) or thecal sac <17 Gy. New guidelines added (D95 should be as high as possible (AHAP), D50 should be between 110% and 115% of prescribed dose and AHAP and D0.035 should be between 125% and 135% of the prescribed dose). The dose volume histograms (DVHs) were centrally reviewed.

Results: In our previous study the PTV D95 ranged from 70.0% to 99.6% in case 1 (mean ± SD: 21.21 ± 2.43 Gy), 70.4% to 98.8% in case 2 (20.32 ± 2.22 Gy), and 70.0% to 94.2% in case 3 (19.78 ± 1.97 Gy), respectively, and DS0 for PTV ranged from 99.2% to 116.3% in case 1 (25.62 ± 1.34 Gy), 91.7% to 119.6% in case 2 (25.97 ± 2.18 Gy) and 84.2% to 114.2% in case 3 (25.57 ± 2.14 Gy), respectively. In this study PTV D95 ranged from 80.4% to 100.0% in case 1 (21.96 ± 1.67 Gy), 76.3% to 95.8% in case 2 (20.91 ± 1.67 Gy), and 70.4% to 94.2% in case 3 (20.3 ± 1.86 Gy), respectively and D50 for PTV ranged from 109.6% to 115.4% in case 1 (27.02 ± 0.53 Gy), 110.0% to 117.5% in case 2 (27.06 ± 0.63 Gy) and 107.5% to 115.0% in case 3 (26.89 ± 0.67 Gy), respectively.

Conclusion: We succeeded to minimize the inter-institutional variations.


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The Role of Stereotactic Radiosurgery in the Reirradiation of Metastatic Spinal Tumors
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Purpose/Objective(s): Spinal metastases are common in cancer patients and are often managed with palliative radiation therapy. With improved survival, local recurrence within a previously irradiated spinal field presents a therapeutic challenge. We sought to evaluate the outcomes of patients treated with stereotactic radiosurgery (SRS) in the setting of recurrent spinal metastases after previous irradiation.

Materials/Methods: This is an IRB-approved retrospective review of patients with recurrent spinal metastases in a previously irradiated field that were subsequently treated with SRS between 2002 and 2013 at a single institution. Local control (LC) was defined as no progression on magnetic resonance imaging at the treated site, and overall survival (OS) of the treated population was evaluated with the Kaplan-Meier method. CTCAE 4.0 was used to assess toxicity.

Results: SRS was delivered to 97 metastatic spinal lesions in 73 patients that were previously irradiated at that spinal level. The median age was 61 years old (range 17-87) and the Karnofsky performance status was 80 (range 50-90). The most common histology was metastatic non-small cell lung cancer (16%) followed by breast cancer (15%). The median follow-up was 10.9 months. Seventy-eight (80.4%) spinal segments were initially treated with external beam radiation therapy and the remainder (19.6%) with radiosurgery. Time from initial irradiation has a median of 14.2 months (range 0.03-1187). Median OS was 14.8 months and 1-year OS was 59.7% (95% CI 52.8-72.5). While majority of spinal recurrence were treated with SRS for a total of 24 Gy in 3 fractions, the median salvage SRS was 22 Gy in 2 fractions (range 10-35 Gy in 1-5 fractions). Furthermore, only 6 patients (6.2%) developed radiographic evidence of local progression after salvage SRS. In those who failed locally, the median time to progression was 7.3 months (range 2.8-16.4). One patient developed grade 3 gastrointestinal toxicity and another developed grade 4 neurotoxicity.

Conclusion: These results suggest that salvage SRS for spinal metastases recurring in previously irradiated fields, most often with 24 Gy in 3 fractions, is a safe and efficacious treatment option.


2320

A Phase I/II Trial of 5 Fraction Stereotactic Radiosurgery With 5-mm Margins With Concurrent and Adjuvant Temozolomide in Newly Diagnosed Supratentorial Glioblastoma Multiforme
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Purpose/Objective(s): We sought to determine the maximum tolerated dose (MTD) of 5 fraction stereotactic radiosurgery (SRS) delivered with concurrent and adjuvant temozolomide (TMZ) in newly diagnosed glioblastoma multiforme (GBM).

Materials/Methods: Adult patients with newly diagnosed supratentorial GBM were enrolled on an IRB approved protocol of 5 consecutive days of SRS in escalating doses in a 3 + 3 design on 4 dose levels: 25 Gy, 30 Gy, 35 Gy, and 40 Gy targeting the GTV of the resection cavity/residual tumor with a 5mm CTV margin and 0mm PTV margin. There were 2 arms per PTV size: < 60 cm3 (Arm 1) and 60-150 cm3 (Arm 2). A dose limiting toxicity (DLT) was a CTCAE Grade 3-5 CNS toxicity within 30 days of SRS, with life-long assessment for late SRS-related adverse radiation effect (ARE). The maximum tolerated dose (MTD) was the highest dose where 0-1 out of 6 had an acute or late CNS Grade 3-5 toxicity. Secondary endpoints included progression free survival (PFS), overall survival (OS), and quality of life (QOL). Given the difficulty in interpreting post-SRS imaging, any new enhancement was scored as: 1. Progressive Disease (PD), if ultimately determined to be recurrent tumor; 2. Transient ARE if occurred within 5 months and resolved (i.e., pseudoprogression, PP); 3. Persistent ARE (i.e., radionecrosis, RN). All AREs were scored per CTCAE.

Results: From 2010 to 2015, 30 total patients were enrolled. The median age was 66 years (range 51-86 years) with median KPS of 80 (range 50-100). The median GTV was 26.8 cc (range 3.8-2320 cc). 5-mm Margins With Concurrent and Adjuvant Temozolomide in Newly Diagnosed Supratentorial Glioblastoma Multiforme

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Presence of RN was associated with improved median OS (33.2 vs 11.3 months; \( P = 0.024 \)).

**Conclusion:** The per-protocol MTD is 40 Gy in 5 fractions. However, a final dose recommendation is pending NTCP analysis. Limited margin, 5 fraction SRS with concurrent TMZ appears to be safe, with OS comparable to conventional fractionation.


### 2321

**Initial Report on Safety and Lesion Response of Melanoma Brain Metastases After Stereotactic Radiosurgery or Hypofractionated Radiation Therapy in Patients Receiving Concurrent Pembrolizumab**

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**Purpose/Objective(s):** Systematic treatment of metastatic melanoma (MM) increasingly involves pembrolizumab (pembro), a monoclonal antibody against the programmed death 1 (PD-1) receptor. MM patients with brain metastases often receive radiation treatment (RT) as stereotactic radiosurgery (SRS), but the efficacy and safety of concurrent pembro with SRS or other brain RT is unknown. We examined a single institution experience of SRS and hypofractionated RT with concurrent pembro in patients with melanoma brain metastases.

**Materials/Methods:** From October 2007 to December 2015, 131 patients with MM underwent either SRS or hypofractionated RT for brain metastases. Systemic treatments at the time of brain RT were examined and follow-up MRIs analyzed for treatment response. Concurrent treatment was defined as RT occurring during pembro administration period or up to 4 months after most recent pembro treatment. Individual lesion response was categorized by change in maximum diameter of the lesion: complete response defined here as disappearance of lesion, partial response as >20% decrease, and all other lesions defined as stable. Significant acute toxicities including hemorrhage were recorded.

**Results:** One hundred thirty-one patients with MM underwent either SRS or hypofractionated RT for brain metastases. Systemic treatments at the time of brain RT were examined and follow-up MRIs analyzed for treatment response. Concurrent treatment was defined as RT occurring during pembro administration period or up to 4 months after most recent pembro treatment. Individual lesion response was categorized by change in maximum diameter of the lesion: complete response defined here as disappearance of lesion, partial response as >20% decrease, and all other lesions defined as stable. Significant acute toxicities including hemorrhage were recorded.

**Conclusion:** Concurrent pembro with SRS appears to be safe and effective in rapidly reducing the size of melanoma brain metastases. We present here an initial report of these findings, as pembro becomes increasingly incorporated into treatment strategies for metastatic melanoma. Prospective data examining the effects of concurrent pembro with respect to longer term in-field and out-of-field recurrence free survival are required to evaluate these retrospective observations and further analyze the potentially synergistic effect of pembro with SRS.

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