Neoadjuvant Stereotactic Radiosurgery for Cerebral Metastatic Disease is Associated with Decreased Radiation Dosages due to Improved Target Delineation and Reduced Tumor Volume

Alejandro Bugarini, MD¹; Evan Meekins, MS²; Anand Mahadevan, MD²; Michel Lacroix, MD¹; Andrew R. Conger, MD, MS¹

¹Neurosurgery Department, Geisinger Medical Center, Danville PA 17821
²Radiation Oncology Department, Geisinger Medical Center, Danville PA 17821

Poster ID: 2584
Disclosures: None
Introduction:

Stereotactic radiosurgery (SRS) after maximal safe resection of cerebral metastasis has become the standard of care due to excellent local control\textsuperscript{1} and improved overall survival rate.\textsuperscript{2-5} This approach, however, can be associated with significant side effects secondary to radiation necrosis which in turn is directly proportional to the prescribed radiation dose.\textsuperscript{2,6}

Limited studies have compared post to pre-operative SRS in terms of local recurrence leptomeningeal disease and overall survival.\textsuperscript{7,8} To our knowledge, our study is the first one to explore the association between tumor volume and radiation dosage. We hypothesize that, preoperatively, tumor volume is reduced, enhancing target delineation during SRS and thereby decreasing radiation dosages.
Methods:

A single cohort of 143 tumors from 61 patients was identified and retrospectively analyzed. After a diagnosis of brain metastatic disease was given, this group received subsequent treatment at two academic institutions (Geisinger Medical Center and Geisinger Wyoming Valley Hospital) between February 2016 to March 2019. Subjects included in the final analysis were those who underwent surgical resection and adjuvant SRS to surgical bed at a single institution; 30 patients with a total of 33 brain metastases were ultimately studied. Postoperative tumor volume (TVol) and prescribed radiation dosages (DRx) were obtained at the planning stage prior to SRS. Preoperative volumetric data was obtained from MRI studies employing surgical planning software. Theoretical DRx was calculated based on same post surgical planning models.
Figure 1: Analysis of volumetric data revealed a trend towards larger presurgical TVol (mean preoperative TVol 11.56cc, SD=11.25 vs. 10.38cc postoperatively, SD=10.71; t[32]=0.43, p=0.33).
Figure 2: There was a significant increase in DRx postoperatively (mean=22.01Gy, SD=3.71) compared to theoretical preoperative treatment (mean=17.15Gy, SD=2.0), t(32)=-6.61, p<0.00001.
Discussion:

In our analysis, we found that preoperative DRx is significantly decreased compared to postoperative values. Contrary to our hypothesis, presurgical TVol was found to be increased, presumably due to associated cystic or hemorrhagic components. Neoadjuvant SRS is thus associated with decreased DRx and could have a more benign side-effect profile. Lesions with associated cyst or hematoma might not be optimal candidates for neoadjuvant SRS. These findings could support the use of neoadjuvant SRS for the treatment of brain metastatic disease.
Summary Points:

(1) Neoadjuvant SRS is associated with decreased radiation dosages due to lower targeted tumor volume.
(2) Presurgical tumor volume was found to be increased, presumably due to associated cystic or hemorrhagic components.
(3) Neoadjuvant SRS is thus associated with decreased radiation dosages and could have a more benign side-effect profile.
(4) Lesions with associated cyst or hematoma might not be optimal candidates for neoadjuvant SRS.
References


