Tumor Bed Dynamics After Surgical Resection of Brain Metastases: Implications for Postoperative Radiosurgery.

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Abstract
PURPOSE: To analyze 2 factors that influence timing of radiosurgery after surgical resection of brain metastases: target volume dynamics and intracranial tumor progression in the interval between surgery and cavity stereotactic radiosurgery (SRS).

METHODS AND MATERIALS: Three diagnostic magnetic resonance imaging (MRI) scans were retrospectively analyzed for 41 patients with a total of 43 resected brain metastases: preoperative MRI scan (MRI-1), MRI scan within 24 hours after surgery (MRI-2), and MRI scan for radiosurgery planning, which is generally performed ≤1 week before SRS (MRI-3). Tumors were contoured on MRI-1 scans, and resection cavities were contoured on MRI-2 and MRI-3 scans.

RESULTS: The mean tumor volume before surgery was 14.23 cm$^3$, and the mean cavity volume was 8.53 cm$^3$ immediately after surgery and 8.77 cm$^3$ before SRS. In the interval between surgery and SRS, 20 cavities (46.5%) were stable in size, defined as a change of ≤2 cm$^3$; 10 cavities (23.3%) collapsed by >2 cm$^3$; and 13 cavities (30.2%) increased by >2 cm$^3$. The unexpected increase in cavity size was a result of local progression (2 cavities), accumulation of cyst-like fluid or blood (9 cavities), and nonspecific postsurgical changes (2 cavities). Finally, in the interval between surgery and SRS, 5 cavities showed definite local tumor progression, 4 patients had progression elsewhere in the brain, 1 patient had both local progression and progression elsewhere, and 33 patients had stable intracranial disease.

CONCLUSIONS: In the interval between surgical resection and delivery of SRS, surgical cavities are dynamic in size; however, most cavities do not collapse, and nearly one-third are larger at the time of SRS. These observations support obtaining imaging for radiosurgery planning as close to SRS delivery as possible and suggest that delaying SRS after surgery does not offer the benefit of cavity collapse in most patients. A prospective, multi-institutional trial will provide more guidance to the optimal timing of cavity SRS.

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