Neurosurgery. 2010 Mar;66(3):486-91; discussion 491-2.

T1/T2 matching to differentiate tumor growth from radiation effects after stereotactic radiosurgery.

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OBJECTIVE: We define magnetic resonance imaging (MRI) and clinical criteria that differentiate radiation effect (RE) from tumor progression after stereotactic radiosurgery (SRS). METHODS: We correlated postoperative imaging and histopathological data in 68 patients who underwent delayed resection of a brain metastasis after SRS. Surgical resection was required in these patients because of clinical and imaging evidence of lesion progression 0.3 to 27.7 months after SRS. At the time of SRS, the median target volume was 7.1 mL (range, 0.5-26 mL), which increased to 14 mL (range, 1.3-81 mL) at the time of surgery. After initial SRS, routine contrast-enhanced MRI was used to assess tumor response and to detect potential adverse radiation effects. We retrospectively correlated these serial MRIs with the postoperative histopathology to determine if any routine MRI features might differentiate tumor progression from RE. RESULTS: The median time from SRS to surgical resection was 6.9 months (range, 0.3-27.7 months). A shorter interval from SRS to resection was associated with a higher rate of tumor recurrence (P = .014). A correspondence between the contrast-enhanced volume on T1-weighted images and the low signal-defined lesion margin on T2-weighted images ("T1/T2 match") was associated with tumor progression at histopathology (P < .0001). Lack of a clear and defined lesion margin on T2-weighted images compared to the margin of contrast uptake on T1-weighted images ("T1/T2 mismatch") was significantly associated with a higher rate of RE in pathological specimens (P < .0001). The sensitivity of the T1/T2 mismatch in identifying RE was 83.3%, and the specificity was 91.1%. CONCLUSIONS: We found that time to progression and T1/T2 mismatch were able to differentiate tumor progression from RE in most patients. When REs are suspected, surgery may not be necessary if patients respond to conservative measures. When tumor progression is suspected, resection or repeat radiosurgery can be effective, depending on the degree of mass effect.

PMID: 20173543 [PubMed - in process]