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Tolerance of the spinal cord to stereotactic radiosurgery: insights from hemangioblastomas.

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Abstract

PURPOSE: To evaluate spinal cord dose-volume effects, we present a retrospective review of stereotactic radiosurgery (SRS) treatments for spinal cord hemangioblastomas.

METHODS AND MATERIALS: From November 2001 to July 2008, 27 spinal hemangioblastomas were treated in 19 patients with SRS. Seventeen tumors received a single fraction with a median dose of 20 Gy (range, 18-30 Gy). Ten lesions were treated using 18-25 Gy in two to three sessions. Cord volumes receiving 8, 10, 12, 14, 16, 18, 20, 22, and 24 Gy and dose to 10, 100, 250, 500, 1000, and 2000 mm³ of cord were determined. Multisession treatments were converted to single-fraction biologically effective dose (SFBED).

RESULTS: Single-fraction median cord D(max) was 22.7 Gy (range, 17.8-30.9 Gy). Median V10 was 454 mm³ (range, 226-3543 mm³). Median dose to 500 mm³ cord was 9.5 Gy (range, 5.3-22.5 Gy). Fractionated median SFBED(3) cord D(max) was 14.1 Gy(3) (range, 12.3-19.4 Gy(3)). Potential toxicities included a Grade 2 unilateral foot drop 5 months after SRS and 2 cases of Grade 1 sensory deficits. The actuarial 3-year local tumor control estimate was 86%.

CONCLUSIONS: Despite exceeding commonly cited spinal cord dose constraints, SRS for spinal hemangioblastomas is safe and effective. Consistent with animal experiments, these data support a partial-volume tolerance model for the human spinal cord. Because irradiated cord volumes were generally small, application of these data to other clinical scenarios should be made cautiously. Further prospective studies of spinal radiosurgery are needed.

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