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Feasibility of frameless single-fraction stereotactic radiosurgery for spinal lesions.

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OBJECT: The role of stereotactic radiosurgery for the treatment of intracranial lesions is well established. Its use for the treatment of spinal lesions has been limited by the availability of effective target-immobilizing devices. In this study the authors evaluated the CyberKnife Real-Time Image-Guided Radiosurgery System for spinal lesion treatment involving a single-fraction radiosurgical technique.

METHODS: This frameless image-guided radiosurgery system uses the coupling of an orthogonal pair of x-ray cameras to a dynamically manipulated robot-mounted linear accelerator possessing six degrees of freedom, which guides the therapy beam to the target without the use of frame-based fixation. Cervical lesions were located and tracked relative to osseous skull landmarks; lower spinal lesions were tracked relative to percutaneously placed gold fiducial bone markers. Fifty-six spinal lesions in 46 consecutive patients were treated using single-fraction radiosurgery (26 cervical, 15 thoracic, and 11 lumbar, and four sacral). There were 11 benign and 45 metastatic lesions. Tumor volume ranged from 0.3 to 168 ml (mean 26.7 ml). Thirty-one lesions had previously received external-beam radiotherapy with maximum spinal cord doses. Dose plans were calculated based on computerized tomography scans acquired using 1.25-mm slices. Tumor dose was maintained at 12 to 18 Gy to the 80% isodose line; spinal cord lesions receiving greater than 8 Gy ranged from 0 to 1.3 ml (mean 0.3 ml). All patients tolerated the procedure in an outpatient setting. No acute radiation-induced toxicity or new neurological deficits occurred during the follow-up period. Axial and radicular pain improved in all patients who were symptomatic prior to treatment.

CONCLUSIONS: Spinal stereotactic radiosurgery involving a frameless image-guided system was found to be feasible and safe. The major potential benefits of radiosurgical ablation of spinal lesions are short treatment time in an outpatient setting with rapid recovery and symptomatic response. This procedure offers a successful alternative therapeutic modality for the treatment of a variety of spinal lesions not amenable to open surgical techniques; the intervention can be performed in medically untreatable patients, lesions located in previously irradiated sites, or as an adjunct to surgery.

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