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CyberKnife frameless single-fraction stereotactic radiosurgery for benign tumors of the spine.

Gerszten PC, Ozhasoglu C, Burton SA, Vogel WJ, Atkins BA, Kalnicki S, Welch WC.

Department of Neurological Surgery, University of Pittsburgh School of Medicine, UPMC Health System, Pittsburgh, Pennsylvania, USA. gerszten@neuronet.pitt.edu

OBJECT: The role of stereotactic radiosurgery in the treatment of benign intracranial lesions is well established. Its role in the treatment of benign spinal lesions is more limited. Benign spinal lesions should be amenable to radiosurgical treatment similar to their intracranial counterparts. In this study the authors evaluated the effectiveness of the CyberKnife for benign spinal lesions involving a single-fraction radiosurgical technique.

METHODS: The CyberKnife is a frameless radiosurgery system in which an orthogonal pair of x-ray cameras is coupled to a dynamically manipulated robot-mounted linear accelerator possessing six degrees of freedom, whereby the therapy beam is guided to the intended target without the use of frame-based fixation. Cervical spine lesions were located and tracked relative to skull osseous landmarks; lower spinal lesions were tracked relative to percutaneously placed fiducial bone markers. Fifteen patients underwent single-fraction radiosurgery (12 cervical, one thoracic, and two lumbar). Histological types included neurofibroma (five cases), paraganglioma (three cases), schwannoma (two cases), meningioma (two cases), spinal chordoma (two cases), and hemangioma (one case). Radiation dose plans were calculated based on computerized tomography scans acquired using 1.25-mm slices. Planning treatment volume was defined as the radiographic tumor volume with no margin. The tumor dose was maintained at 12 to 20 Gy to the 80% isodose line (mean 16 Gy). Tumor volume ranged from 0.3 to 29.3 ml (mean 6.4 ml). Spinal canal volume receiving more than 8 Gy ranged from 0.0 to 0.9 ml (mean 0.2 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. Pain improved in all patients who were symptomatic prior to treatment. No tumor progression has been documented on follow-up imaging (mean 12 months).

CONCLUSIONS: Spinal stereotactic radiosurgery was found to be feasible, safe, and effective for the treatment of benign spinal lesions. Its major potential benefits are the relatively short treatment time in an outpatient setting and the minimal risk of side effects. This new technique offers an alternative therapeutic modality for the treatment of a variety of benign spinal neoplasms in cases in which surgery cannot be performed, in cases with previously irradiated sites, and in cases involving lesions not amenable to open surgical techniques or as an adjunct to surgery.

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