Purpose/Objective: Stereotactic radiosurgery (SRS) for the treatment of benign intracranial lesions has become widely accepted. However, the data for SRS for benign extra-cranial tumors is currently limited. The purpose of this study was to evaluate the feasibility, toxicity, and local control of patients with benign lesions treated with the CyberKnife Frameless Radiosurgery System (Accuray, Sunnyvale, CA).

Materials/Methods: From September 2001 thru January 2004, 50 benign tumors in 35 patients were treated using the CyberKnife. This frameless image-guided radiosurgery system utilizes the coupling of an orthogonal pair of x-ray cameras to a dynamically manipulated robot-mounted 6-MV linear accelerator capable of six degrees of freedom that guides the therapy beam to the intended target without the use of frame-based fixation. Real-time image tracking allows for the tracking of patient movement with a 1-mm spatial accuracy. Of these fifty tumors, there were 19 neurofibromas, 11 meningiomas, 7 hemangioblastomas, 5 schwannomas, 4 paragangliomas, 2 hemangiopericytomas, 1 pseudotumor, and 1 ependymoma. The anatomic location of these tumors was spinal (16 cervical, 4 thoracic, 14 lumbar, and 2 sacral), neck (6), intracranial (3), orbital (3), and brainstem (2). The median number of fractions was 1 with all but 3 lesions treated with 1 to 5 fractions. The median treatment delivery time per fraction was 59 minutes (range 11-194 minutes). Twenty-one lesions were initially surgically resected. Ten lesions received prior external beam radiation with a median dose 48 Gy (range 40-54 Gy), and one lesion received two prior CyberKnife treatments for a total dose of 32 Gy to the 80% isodose line. The median follow-up was 8 months (range 1-25 months). Acute and late toxicity was graded using the National Cancer Institute Common Toxicity Criteria (CTC) scale. Symptomatic response was documented as improved, stable, or progression. Follow-up imaging was used to assess local control.

Results: The median tumor dose delivered was 16.0 Gy to the 80% isodose line (range 9-31 Gy). The median tumor volume was 4.5 cc (range 0.2-98.6 cc). The median spinal cord volume receiving more than 8 Gy was 0.025 cc (range 0.2-5 cc), and the median maximum spinal cord dose was 11.2 Gy (range 0-19.8 Gy). There were no patients that suffered a significant (Grade 3,4, or 5) acute toxicity. There was no observed late toxicity. Seventy-eight percent of patients experienced an improvement of their pre-treatment symptoms while only 1 patient experienced symptom progression. Of the 26 patients who underwent follow-up imaging, the local control rate was 96%.

Conclusions: This study suggests that CyberKnife Radiosurgery is a safe and efficacious treatment modality for benign tumors, including those patients with recurrent previously irradiated lesions. There is significant symptom relief with minimal acute toxicity from CyberKnife. Local control rate thus far is encouraging, but further follow-up is needed to assess long-term control rates as well as late effects. The major potential benefits of radiosurgical ablation of benign lesions are short treatment time in an outpatient setting with rapid recovery and symptomatic response. This technique offers a successful alternative therapeutic modality for the treatment of a variety of benign lesions not amenable to open surgical techniques, in medically inoperable patients, lesions located in previously irradiated sites, or as an adjunct to surgery.