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Abstract

Stereotactic Radiosurgery for Refractory Trigeminal Neuralgia: A Single Institution Experience Using an Image-Guided Linear Accelerator-Based Treatment System

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Abstract

Objectives: Trigeminal neuralgia (TN) is a debilitating craniofacial pain syndrome associated with paroxysmal episodes of excruciating pain along the distribution of cranial nerve V. Stereotactic radiosurgery (SRS) is often a treatment of last resort for patients whose symptoms are refractory to medical or surgical intervention. We report the feasibility, accuracy, and efficacy of SRS for refractory TN using an image-guided linear accelerator-based treatment system.

Methods: Nine patients with refractory TN were treated at our institution. Patient immobilization was achieved with a stereotactic head frame secured in place by a neurosurgeon. Computed tomography (CT) simulation was performed and the CT image set was coregistered with high-resolution magnetic resonance (MR) images. The radiosurgical target was defined and contoured by the treating radiation oncologist. A dedicated treatment planning system was used. Patients were positioned on a 6 degree of freedom couch for the procedure. Multiple cone beam computed tomography (CBCT) images were obtained for positional verification. Radiosurgery was performed on a linear accelerator-based treatment system. Clinical response was determined using the Barrow Neurological Institute (BNI) pain intensity score.

Results: All 9 patients successfully underwent SRS without complications. CBCT image-guidance allowed for positional corrections to be made for deviations greater than 0.5 mm or 0.5 degrees at the time of initial localization and midway through treatment. Median number of CBCT images obtained for positional verification was 4 (range, 3-7). SRS was delivered using 14 partial arcs with a 4 mm conical cone and 6 MV flattening-filter-free photon energy. All patients were treated with a single fraction. Median radiosurgical target volume was less than 0.004 cc (range, < 0.004-0.200 cc). Median isocenter dose was 85 Gy (range, 80-90 Gy). Median brainstem dose to 0.035 cc and to 0.5 cc was 10.94 Gy (range, 5.41-14.19 Gy) and 3.15 Gy (range, 2.13-3.70 Gy), respectively. Median monitor units (MUs) delivered was 20,060 (range, 19,266-21,909 MUs). Median treatment delivery time (including image-guided positional corrections and beam on time) was 56 minutes (range, 50-82 minutes). Median follow-up time was 2 months (range, 2-15 months). Median BNI pain intensity score was III (range, I-V). Four patients (44.4%) achieved complete pain response, another 4 patients (44.4%) achieved partial pain response, and 1 patient (11.1%) achieved no pain response. Follow-up MR images were

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available for 4 patients: Stable to improved radiographic findings were demonstrated in all 4 patients. The patient with improved radiographic findings had a BNI pain intensity score of IV after a follow-up time of 12 months.

Conclusions: SRS for medically or surgically refractory TN using an image-guided linear accelerator-based treatment system is safe and efficacious. The treatment is well-tolerated with almost half of patients achieving complete pain response and the majority of patients achieving at least partial pain response. Post-treatment radiographic findings may not correlate with clinical outcomes. Long-term clinical data in a larger cohort of patients is needed to assess the validity of these findings.