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Treatment of Acoustic Neuromas with Spot Scanning Proton Stereotactic Radiotherapy: Dosimetric Comparison to LINAC-Based SRT

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Abstract

Objectives:

Linac-based stereotactic radiotherapy (SRT) is used to treat intracranial lesions, being particularly valuable for targets close to organs at risk (OAR). Our institution implemented proton SRT recently and is investigating conditions that may benefit from known dosimetric advantages of protons. Large acoustic neuromas respond to radiation and can impinge on the brainstem and cochlea. We performed a treatment planning comparison of proton and linac SRT for treatment of large acoustic neuromas.

Methods:

8 patients with acoustic neuromas (0.8-12cc) treated with 5-fraction linac SRT were retrospectively identified and replanned for proton SRT. Clinical plans were created using volumetric modulated arc therapy, while proton plans used pencil-beam scanning with patient specific brass apertures. Both were optimized to meet institutional plan goals. Proton SRT plans were normalized to match achieved linac SRT target coverage and evaluated for ipsilateral cochlea, brainstem, and healthy brain sparing.

Results:

Dose metrics were compared via two-tailed, paired t-tests. Relative to linac SRT, proton SRT significantly reduce mean and maximum doses to the ipsilateral cochlea (mean: 1718 vs 889 cGy, max: 2417 vs 2056, $P< 0.01$) with average percent differences of 50% and 19%, respectively. Healthy brain doses were also significantly reduced in terms of mean and V12cc dose ($P< 0.01$). However, brainstem max dose and V23Gy were not significantly different between linac and proton SRT ($P=0.18$, $P=0.44$).

Conclusion(s):

Spot scanning proton SRT showed potential to reduce radiation dose to OARs compared to linac-based SRT with equivalent target coverage. Specifically, cochlear and healthy brain doses were significantly reduced, but brainstem dose was not significantly affected. Since our institutional cochlear dose constraint matches the typical prescription of these cases (25 Gy), the reduced cochlear dose may have a meaningful impact on patient's post-treatment hearing.