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Dosimetric Stereotactic Radiosurgery Predictors of Long Term Trigeminal Neuralgia Freedom from Treatment Failure

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Introduction

Stereotactic radiosurgery (SRS) is a treatment modality for classical trigeminal neuralgia (cTN). Success of SRS in facilitating long term pain control is dependent on maximizing prescribed dose (PD) to the trigeminal nerve. We analyzed several internationally standardized SRS treatment parameters and assessed as a primary endpoint whether either of them would predict freedom from treatment failure (TF).

Methods

Between 2007-2015, 178 cTN patients underwent Gamma Knife SRS, with a 4 millimeter collimator. Pain before and after SRS was scored as level I-V per the Barrow Neurological Institute (BNI) pain intensity scoring criteria. Pain relief was graded as an improvement to BNI levels I, II, or III from pre-SRS BNI levels IV or V. TF was graded as a return to BNI levels IV or V or need for additional SRS or operative intervention. Time to TF (TTF) was measured. The energy index, conformity index, homogeneity index (HI) [(D2% minus D98%)/D50%], and gradient index were calculated. A statistical model using Cox regression evaluating our primary endpoint was designed comparing a) TF and non-TF patients to determine TF risk.

Results

Median PD was 80 Gy [range (r): 70-80]. The median follow-up was 15 months (r: 1.5-82). The median time to initial response was 1 month (r: 0.05-5) and the median TTF was 20 months (r: 0-82). Ninety percent reported initial pain relief, and actuarial rates of freedom from TF at 12, 24, 36 and 48 months were 55, 40, 33, and 28%, respectively. Statistical modeling showed that HI was the only treatment parameter that independently predicted time to TF (p=0.0273). Each unit increase in HI had a 88.3% decrease in TF risk (HR: 0.117 95% CI: 0.017-0.788).

Conclusions

This is the first cTN series showing that optimization of the HI enhances freedom from TF. Incorporation of the HI may be used to guide dosimetric treatment planning in SRS for cTN.

Learning Objectives

Learn about the importance of the homogeneity index in enhancing freedom from treatment failure in patients treated with SRS for cTN.

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