



Predictors of Hearing Loss after Gamma Knife Radiosurgery for Vestibular Schwannoma

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Introduction

Modern software and high resolution imaging modalities have improved radiosurgical treatment for vestibular schwannoma (VS). Predictors of hearing loss following treatment are imperative for patient counseling and disease management.

Methods

A prospectively maintained database of patients with serviceable hearing [American Academy of Otolaryngology-Head and Neck Surgery (AAOHNS) class A or B] who underwent gamma knife radiosurgery (GKS) for VS between 2007 and 2011 was reviewed. The study was limited to subjects treated using the Perfexion Gamma Plan system who underwent high-resolution computed tomography (CT) for treatment planning. Clinical features including patient and tumor characteristics, pre- and post-operative audiometric data, and radiosurgical planning parameters including mean and max doses to 3D volumes of the cochlea were analyzed. Univariate and multivariate associations were evaluated using logistic regression

Results

Fifty-nine patients met study criteria and were included. Mean and median post-operative audiometric follow-up was 20 and 14 months respectively. Sixty-four percent of all subjects and 77% of AAOHNS class A patients maintained serviceable hearing during the follow-up period. Tumor control was achieved in 97% of patients. Patients with a pre-operative speech discrimination score (SDS) <70% were 11.1 times more likely to develop non-serviceable hearing (AAOHNS class C or D)(OR 0.09; p=0.031) and 12.5 times more likely to have >10% drop in SDS (OR 0.08; p=0.037) following GKS. Radiosurgical dose analysis revealed that patients with a tumor margin dose >12Gy were 7.0 times more likely to develop non-serviceable hearing (OR 6.95; p=0.005); each 1Gy increase in cochlear max was associated with a 32% increased odds of developing non-serviceable hearing (OR 1.32; p=0.008).

Conclusions

Excellent pretreatment hearing and tumor margin dose were jointly associated with hearing preservation following GKS. While cochlear dose may play a role in hearing preservation, hearing loss following GKS is likely multifactorial and complete tumor treatment is recommended for optimal tumor control.

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Understand the use of 3-dimensional cochlear volumes using high resolution CT to obtain mean and max cochlear doses and how this relates to traditional MRI-based point-dose calculations.
- 2) Understand how cochlear dose relates to loss of serviceable hearing following GKS for VS.
- 3) Understand how various clinical and radiosurgical parameters play a role in hearing loss following GKS for improved patient counseling.

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