Over the past 10-15 years, there has been a trend toward greater use of radiosurgery for the treatment of vestibular schwannomas.1,2 Much attention has been turned toward studying the morbidity associated with this treatment, particularly rates of hearing and facial nerve preservation. Hearing preservation rates have been correlated with the amount of radiation delivered to the cochlea.3,4 Likewise, facial nerve preservation rates have been linked to the marginal dose of radiation delivered.5

Little attention has been focused on studying the effects of Gamma Knife radiosurgery (GK) with respect to toxicity to the vestibular system, or the relationship between vestibulotoxicity and radiation dose. Patients treated with radiosurgery can have significant balance impairment after treatment. Treatment planning is carefully undertaken to minimize the dose delivered to the labyrinth (Figure 1). The goal of this study is to determine whether toxicity to the labyrinth can be minimized in a dose dependent fashion.

METHODS AND MATERIALS

This study is a retrospective case series of all patients who underwent treatment for vestibular schwannoma with GK radiosurgery between 1/2007 and 7/2013. Patients were excluded if they had previous surgery or carried a diagnosis of neurofibromatosis type 2.

Patients were treated to a median marginal dose of 12.5 Gy to the 50% isodose volume. The mean, maximum, and minimum doses to the labyrinth were recorded.

Results: There was no significant difference in the degree of pre-treatment caloric weakness in patients receiving <3 Gy compared to those receiving >3 Gy to the labyrinth (30.9% vs. 44.6%; p>0.05). Post-treatment, patients treated with >3 Gy to the labyrinth had a greater degree of caloric weakness than patients treated with <3 Gy at first post-treatment VNG (mean 65.9% vs. 32.1%; p<0.05). This difference persisted at final post-treatment VNG. Twenty-six patients received less than 3 Gy to the labyrinth, and 26 patients received more than 3 Gy. There was no significant difference in the degree of pre-treatment caloric weakness in patients receiving less than 3 Gy compared to those receiving greater than 3 Gy to the labyrinth (30.9% vs. 44.6%; p>0.05).

Overall, 27% of patients had improvement in baseline caloric weakness at the time of their initial post-treatment VNG. Twenty-five percent of patients had improvement in caloric function compared to their baseline at the time of final post-treatment VNG. For the cohort as a whole, there was an average decrease in caloric function by 11% at first post-treatment VNG. There was an 18% decrease in caloric function at final post-treatment VNG.

CONCLUSIONS

Patients treated with Gamma Knife radiosurgery for vestibular schwannomas who received a mean dose of greater than 3 Gy to the labyrinth exhibited a greater caloric weakness after treatment than patients who received a mean dose of less than 3 Gy. Efforts should be made to minimize the mean dose to the labyrinth in order to preserve vestibular function.

REFERENCES