Treatment of a Facial Nerve Neuroma with Fractionated Stereotactic Radiotherapy

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Key Words
Fractionated stereotactic radiotherapy · Facial nerve neuroma · Cerebellopontine angle · Tumor control

Abstract
Background: Facial nerve neuromas are extremely rare and are often mistaken for acoustic neuromas when located near the vestibular nerve. Usually presenting with facial weakness and hearing loss, facial nerve neuromas of the cerebellopontine angle have commonly been managed by surgery. We present the first reported case of a facial nerve neuroma treated with fractionated stereotactic radiotherapy (FSRT).

Methods: The patient was a 40-year-old woman who presented with tinnitus, dizziness and decreased hearing that was associated with a right intracanalicular mass on magnetic resonance imaging (MRI). She underwent a middle fossa craniotomy only to reveal a facial nerve tumor rather than an acoustic neuroma that was not resected due to the high risk of facial paralysis. Following surgery, her facial function worsened and was associated with tumor enlargement on MRI. She was referred for FSRT and received 54 Gy in daily 1.8-Gy fractions with a prescription isodose line of 90%.

Results: Three months after treatment she had no worsening of her pretreatment symptoms, and at the 1-year follow-up, she experienced facial weakness improvement accompanied by an absence of tumor growth on MRI. These clinical and imaging findings persisted at 48 months of follow-up.

Conclusion: In the first report of a facial nerve neuroma treated with FSRT, this treatment resulted in excellent long-term (4-year) tumor control with improvement of pretreatment symptomatology and absence of morbidity. This report demonstrates the potential for using FSRT to treat facial nerve neuromas of the cerebellopontine angle that could otherwise be associated with significant operative morbidity.

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instituted decreased risk of hearing loss if prolonged observation is instituted in order to provide the best chance of hearing preservation. After the imaging findings and the audiogram results, the presumptive diagnosis of a right acoustic neuroma was made. Given her young age and the size and location of the tumor, surgical resection of the lesion via a middle fossa approach was recommended due to the inevitability of a postoperative House-Brackman grade III facial palsy [10, 11]. However, there is an increased risk of hearing loss if prolonged observation is instituted [12, 13]. Recently, fractionated stereotactic radiotherapy (FSRT) has been demonstrated as an efficacious treatment modality for acoustic neuromas of the cerebellopontine angle or internal auditory canal with minimal morbidity [7–9]. Although the definitive treatment of facial nerve neuromas is surgical resection, the timing of surgery is controversial, due to the inevitability of a postoperative House-Brackman grade III facial palsy [10, 11]. However, there is an increased risk of hearing loss if prolonged observation is instituted [12, 13]. Recently, fractionated stereotactic radiotherapy (FSRT) has been demonstrated as an efficacious treatment modality for acoustic neuromas of the cerebellopontine angle or internal auditory canal with minimal morbidity [14–16]. We present the first report of a cerebellopontine angle facial nerve neuroma treated with FSRT.

**Clinical Materials and Methods**

**Patient History**

Our patient was a 40-year-old woman with no significant medical history who began to experience tinnitus, dizziness and decreased hearing in her right ear 3 years prior to presentation. The magnetic resonance imaging (MRI) scan revealed an enhancing right intracanalicular lesion located in the internal auditory canal, and an audiogram confirmed a 20- to 30-dB decrease in hearing. Due to the imaging findings and the audiogram results, the presumptive diagnosis of a right acoustic neuroma was made. Given her young age and the size and location of the tumor, surgical resection of the lesion via a middle fossa approach was recommended in order to provide the best chance of hearing preservation.

A middle fossa craniotomy was performed 1 month later. The temporal bone was drilled to expose the internal auditory canal, after which the dural sheath covering the facial nerve was opened. Upon opening the sheath, the complex of cranial nerves 7 and 8 were immediately visible, and following microsurgical dissection it became apparent that the facial nerve and not the acoustic nerve was enlarged and contained the neuroma. The superior and inferior vestibular nerves and the cochlear nerve were identified as normal. Due to the risk of causing a permanent facial paralysis with attempted tumor removal, the decision was made to abort the surgical procedure.

Following surgery, the patient did well until the 2nd postoperative day, when she developed a House-Brackmann grade V right facial nerve palsy, which improved to a grade II to III 1 week later. Subsequently, she was followed with annual MRI scans to monitor the size of her lesion. Her right-sided hearing remained stable for 16 months until it worsened and was associated with decreased right eye lacrimation, decreased right eye closure and the new onset of a right facial twitch. Four months later, she experienced paralysis of her right face, and a subsequent MRI revealed growth of the tumor. On examination, she was deaf in the right ear, and the right facial nerve palsy had become a House-Brackmann grade IV, manifesting as an asymmetric droop to the right mouth, inability to close the right eyelid and inability to puff out her cheeks due to loss of air from the right side of her mouth. There was no lack of sensation on either side of the face.

At this point, she was considered for microsurgery, single-dose stereotactic radiosurgery or FSRT. After an informed consent, the patient decided to proceed with FSRT with the understanding that it would be unlikely that she would regain her right-sided hearing after treatment but that treatment would likely arrest the progression of her facial palsy without causing further damage of the facial nerve.

**FSRT Treatment**

All treatments were overseen by the neurosurgeon, radiation oncologist and medical physicist. Following a standardized testing simulation, the patient had FSRT treatment planning for her right facial nerve neuroma. After placement of a Gill-Thomas-Cosman relocatable headframe for immobilization (Integra Radionics, Burlington, Mass., USA), a CT scan with contrast was obtained (fig. 1) and planning was performed using the Radionics X-Knife 4.0 three-dimensional planning system (Integra Radionics). The size of the tumor was 1.0 × 1.0 × 0.6 cm, which was easily encompassed with a single 1.4-cm collimator. The patient received daily fractions of 1.8 Gy until a total target dose of 54 Gy was administered. The radiation was prescribed to the 90% isodose line using 5 rotational arcs with 300° of rotation, and an average dose of 0.016 Gy was delivered to the brainstem per daily fraction. Thirty treatments were stereotactically delivered over 6 weeks using a dedicated Varian 6/100 linear accelerator (Varian Medical Systems, Inc., Palo Alto, Calif., USA). The patient tolerated the procedure well, with no immediate or delayed posttreatment complications.

**Posttreatment Course**

Three months after treatment, the patient returned for serial follow-up with neurosurgery and radiation oncology, where she was noted to have no worsening of her pretreatment symptoms. MRI 6 months after treatment revealed the tumor to be stable in
size, with an area of central necrosis within the tumor. At the 1-
year follow-up, the patient began noticing a small amount of im-
provement in her right-sided facial droop and improved control
of her right eyelid. MRI scans 2 and 3 years after treatment re-
vealed continued stability in tumor size, which was associated
with gradually improving right-sided facial weakness. One year
later, the patient reported that she was doing ‘exceptionally well’,
with continuing improvement of her facial weakness and no clin-
ic evidence of disease progression. At 48 months after treat-
ment, the patient continues to demonstrate improvement of her
facial weakness (House-Brackmann grade II to III) and stable tu-
mor size on MRI.

Discussion

Most commonly presenting with facial weakness and
hearing loss, facial nerve neuromas can occur at any age
and have no particular gender predilection [4, 7, 17].
When occurring in the cerebellopontine angle or internal
auditory canal, facial nerve neuromas can clinically
mimic acoustic neuromas and are often not distinguished
until operative intervention, occasionally distinguishable
noninvasively by subtle findings on gadolinium-en-
hanced MRI [8, 18, 19]. Although the definitive surgical
approach for these tumors involves a middle cranial fos-
sa or retrosigmoid approach, the morbidity involved in
removing the tumor from the involved nerve remains sig-
ificant, even following facial nerve reconstruction using
the sural or greater auricular nerve as a graft [10, 17, 20–
22].

Over the past 2 decades, the predominant treatment
modality for small (maximum diameter <3 cm) acoustic
neuromas has shifted away from microsurgery to stereo-
tactic radiosurgery, with FSRT recently emerging as a
promising treatment modality for this disease [15, 16, 23–
25]. Given the similarity in location between small acous-
tic neuromas and cerebellopontine angle facial nerve
neuromas of similar size, it would be logical to surmise
that there should be a role for stereotactic radiosurgery or
FSRT for facial nerve neuromas of the cerebellopontine
angle. This concept has already been applied with regard
to stereotactic radiosurgery, whereby 2 recent reports
demonstrated tumor control of facial nerve neuromas af-
ter they had been treated with focused radiation follow-
ning subtotal resection [26, 27].

The present report details the use of FSRT for a cere-
bellopontine angle facial nerve neuroma. The choice of
FSRT over stereotactic radiosurgery for this patient was
derived primarily from the existing literature of both
modalities with regard to treatment of acoustic neu-
romas, which demonstrated FSRT to have less permanent
trigeminal nerve morbidity than stereotactic radiosur-
gery with comparable efficacy [14–16, 25, 28–31]. The re-
results in our patient demonstrated excellent 4-year long-
term tumor control associated with improvement in fa-
cial nerve function and no treatment-related morbidity.
FSRT should be seriously considered in appropriately se-
lected facial nerve neuroma patients as an alternative to
microsurgery, due to its efficacy and reduced risk of cra-
nial nerve morbidity compared to microsurgery of the
skull base [25, 28, 29].

Conclusion

In the first report of facial nerve neuroma treated with
stereotactic radiotherapy, FSRT resulted in excellent long-
term tumor control (4 years) with improvement in pre-
treatment symptoms and no morbidity. This report dem-
strates the potential for stereotactic radiotherapy in
treating facial nerve neuromas of the cerebellopontine
angle that could otherwise be associated with significant
operative morbidity. The low risk of cranial nerve mor-
bidity generally associated with FSRT of the skull base in
comparison with microsurgery should make FSRT a seri-
ous consideration for situations where facial nerve neu-
romas can be managed either partially or completely in a
noninvasive manner.

Acknowledgments

We would like to thank Drs. Bruce Gerbi, Samuel Levine and
Eric Nussbaum for invaluable assistance.

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