CASE REPORT

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Radiosurgery Treatment of Trigeminal Schwannoma

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ABSTRACT Trigeminal schwannoma is a neurogenic tumor of the fifth cranial nerve. Despite the advances in surgical practice, stereotactic radiosurgery is an alternative treatment in the management of these patients due to problems such as nerve injuries and tumor accessibility The patient was admitted to our hospital with complaints of headache and tingling in the left face for the last few months. The patient was discussed in the neurooncology council and surgical intervention was not considered, and radiotherapy was decided. Radiotherapy was planned in the Elekta Versa HD MONACO v.5.51 treatment planning system. 14 Gy/1 fr stereotactic radiosurgery was performed. The patient completed stereotactic radiosurgery treatment without complications. In the follow-up, 7 mm peripheral contrast-enhanced solid components with central necrosis was observed in the gadolinum MRI taken. Stereotactic radiosurgery is an effective and powerful method for trigeminal schwannomas.

Keywords: Radiosurgery; trigeminal nerves; trigeminal nerve diseases

Trigeminal schwannoma (TS) is a neurogenic tumor of the fifth cranial nerve. They are in benign pathology and slow down gradually. However, malignant types of trigeminal schwannomas have also been reported. It can occur in any part of the trigeminal nerve. It can develop from the trigeminal nerve root, Gasserian ganglion or 3 peripheral branches. The tumor may grow towards the posterior fossa, middle fossa, infratemporal fossa, and orbit. It constitutes 0.07-0.36% of all intracranial tumors and 0.8-10% of intracranial schwannomas.[1,2] The optimal treatment for trigeminal schwannomas is difficult to determine due to the rarity of these tumors. Although microsurgical resection may be preferred in these patients, considering the location of the tumor, it can be an important reason for morbidity.[3]

CASE REPORT

A 41-year-old female patient was admitted to our hospital with complaints of headache which has increased its frequency in the last two years, a tingling sensation which started in front of the left ear and spread to the face in the last few months, occasional double visions, inability to control left eyeball movements, and drooping of the left eyelid. Neurological examination revealed decreased left facial sensation (V), decreased corneal reflex (V), and impaired eye movements (III). A 3.5x1.5 cm wide TS starting from the lower neighborhood of the left cavernous sinus and extending inferiorly in parallel to the nasopharyngeal wall, exerting extrinsic compression on the left deep temporal cortex and ending in the vicinity of the petrous apex, with diffuse enhancement compatible lesion was observed on cranial magnetic resonance imaging (MRI) with gadolinium contrast (Figure 1). In the differential diagnosis; the lesion in which meningiomas and metastases are included, a decrease in signal intensity on T1-weighted MRI images and an increase in signal intensity on T2-weighted images were found. The morphological

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appearance of the bicompartmental lesion is typical trigeminal schwannoma.

Hearing and visual field examinations were performed before the treatment for the patient, whose radiotherapy (RT) decision was taken in consultation with the neuro-oncology council. No defections were detected. A patient-specific thermoplastic mask was created for RT. Gross tumor volume (GTV) and organs at risk were determined by the Radiation Oncologist with the fusion of the patient's simulation Computed Tomography (CT) and MRI (Figure 2). Radiosurgery was planned as 14 Gy/1 fr in the MONACO v.5.51 treatment planning system Electa Versa HD, Stockholm, Sweden taking into account the dose constraints of risky organs in single fraction treatment schemes (Table 1).

The patient completed stereotactic radiosurgery (SRS) treatment without complications. After the SRS, the complaints which were present before the treatment, regressed. In the post-treatment period, complaints of non-continuous numbness and burning sensation on the left face developed. At the last visit, it has been noted that the patient's complaints about inability to control eye movements, double visions and drooping of eyelid, which continued for 10 months after the treatment, completely regressed. A reduction in the size of the lesion was observed in the contrast-enhanced MRI taken at the 7th month of the follow-up (Figure 3).

Informed Consent: Written informed consent was obtained from the patient.

DISCUSSION

Trigeminal schwannomas are seen more commonly in women aged 40-60 years.[4] Facial numbness and hypoesthesia are the most common symptoms. Typical trigeminal neuralgia and trigeminal motor impairment may develop in some patients.[5] In the

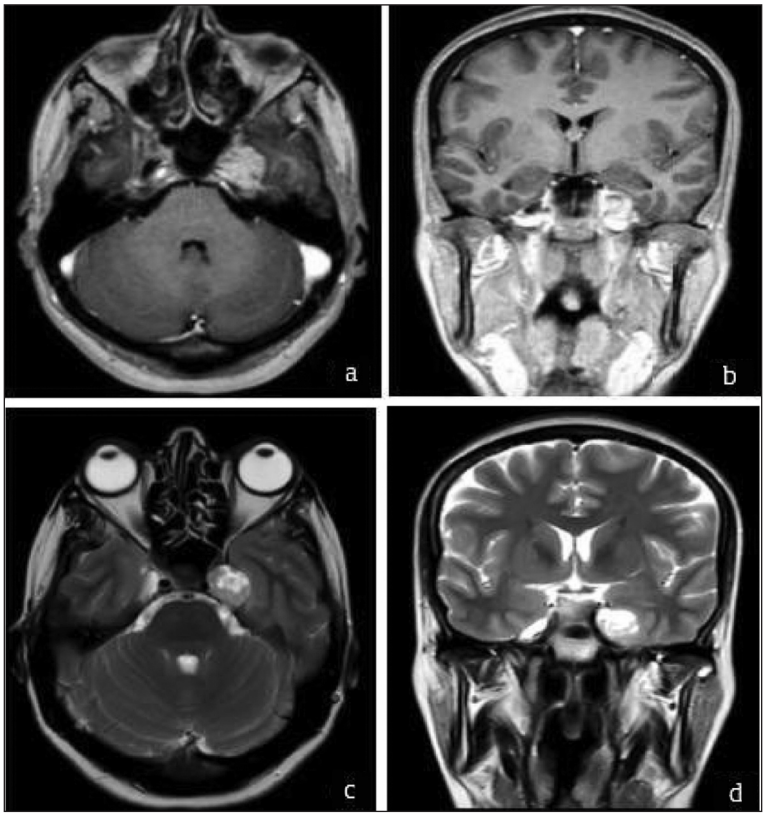

FIGURE 1: Contrast-enhanced T1 cranial magnetic resonance imaging axial **(a)** coronal **(b)**, T2 axial **(c)** and coronal **(d)** image sections show a trigeminal schwannoma adjacent to the cavernous sinus.

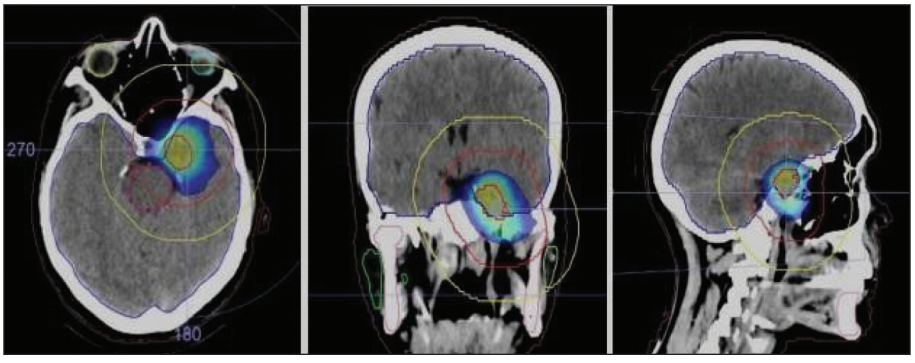

FIGURE 2: Coronal, transverse and sagittal images of the patient's plan created in the simulation computed tomography in the MONACO treatment planning system.

TABLE 1: Dose constraints of organ at risk in a single fraction and doses of our patient's organ at risk.

Structure	Constraint	Our case's dose
Brain parencyhma	Tissue V12 <5-10 mL	9.40 Gy
Brainstem	<10-12 Gy maximum	8.08 Gy
Optic nerve	<10-12 Gy maximum	7.82 Gy
Optic chiasm	<10-12 Gy maximum	11.5 Gy
Cochlea	<6 Gy maximum	9.37 Gy
Spinal cord	<8-10 Gy maximum	0.24 Gy

clinical evaluation of the disease, it should be remembered that it can be confused with odontogenic pain that cause trigeminal neuralgia, acute herpes zoster disease, trauma history, temporomandibular joint disorder.[6] Tumors involving Meckel's cave, such as meningioma, primary lymphoma, and metastasis should also be included in the differential diagnosis.[7]

The curative approach in the treatment of schwannomas is surgical total excision. They are RT-resistant and the effectiveness of chemotherapy is low. There are different surgicalanatomical classifications depending on the tumor's location.[1] Despite the latest advances, complete microsurgical resection is difficult because of the tumor location being closely related to the vascular structures in the skull base, the cavernous sinus, Meckel's cave, and the extension of the tumor into the posterior fossa. In the study of Neves et al. with 14 patients, gross total resection was achieved in 71% of the patients with microsurgery. There were no deaths and 57% morbidity was observed, often in the form of cranial nerve paralysis. In this study, open surgery has been recommended for large masses due to both the possibility of gross total resection and fast improvement in symptoms by eliminating the mass effect, and radiosurgery has been recommended for a long local control in case of subtotal resection.[4]

Adding SRS to subtotal resection offers a reduction in overall treatment morbidity and a better quality of life.[4] Raju et al., suggested radiosurgery for

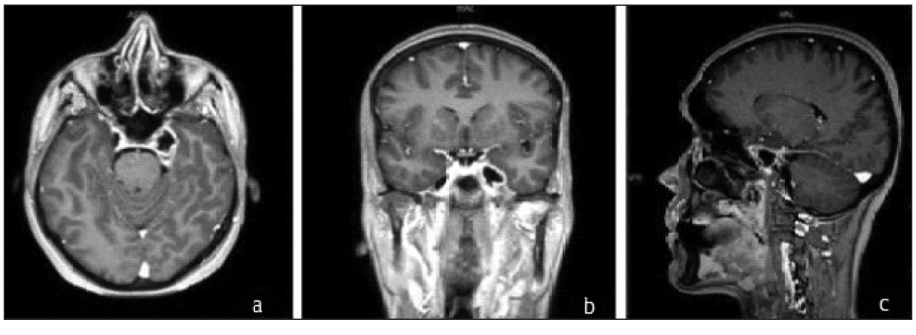

FIGURE 3: At the 7th month after the treatment, a regressed trigeminal schwannoma adjacent to the cavernous sinus is observed in the contrast-enhanced T1 cranial magnetic resonance imaging axial **(a)** and coronal **(b)** and sagittal **(c)** images.

small trigeminal schwannomas, residual tumor and tumors involving the cavernous sinus after microsurgery.[8] Xiao et al. recommended RT to control tumor growth in patients with inoperable, small tumor volume, residual tumor tissue or recurrent tumor in their study.[9] The progression rates after subtotal resection range from 12% to 35.7%. For this reason SRS, as adjuvant therapy in subtotal resections or as an alternative to surgery in inoperable patients is valuable.[2] In our case, the patient was discussed in the Neuro-oncology council and SRS was decided because of not considering surgery. The effect mechanism of SRS in trigeminal schwannomas has been accepted as a combination of direct tumoricidal and delayed intratumoral vascular obliteration.[10] Huang et al., achieved a 100% tumor control rate with 15 Gy (in the range of 12-20 Gy) applied to 16 patients with TS. After 44 months of radiological follow-up, regression was detected in 9 patients and stability in 7 patients. In 5 of those patients clinical symptoms improved and the symptoms of the remaining patients stood stable. New neurological deficits were observed in none of the patients.[11] Hasegawa et al. after a median follow-up of 54 months found 5 and 10-year local control rates in 37 patients with TS 84%. There was full regression in 20 patients and partial regression in 4 patients. The tumor remained stable in 8 patients. Progression, uncontrollable facial pain, and radiation-induced edema developed in 5 patients. One patient had new neurological symptoms despite local control.[12] PeciuFlorianu et al., published a meta-analysis. According to this study, after the SRS, it was analyzed as; local control 92.3%, tumor regression 62.7%, tumor progression 9.4%, general clinical improvement 43.2%, general clinical worsening 10.7%, facial hypoesthesia improvement 39.1%, diplopia improvement 48.2%, trigeminal nerve dysfunction 30%, cranial nerve dysfunction 8.7%.[2] In our case, no acute side effects were observed, the complaints of tingling in the left face and headache, which were present before the treatment, regressed. In the post-treatment period, complaints of non-continuous numbness and burning sensation on the left face developed. At the last visit, it has been noted that the patient's complaints about inability to control eye movements, double visions and drooping of eyelid, which continued for 10 months after the treatment, completely regressed. Control visual field and hearing tests performed were resulted similar to those before SRS.

Trigeminal Schwannomas are rare tumors. The primary treatment of trigeminal schwannomas is surgery, and the main goal should be total resection of the mass. Because of the anatomical localization of trigeminal schwannomas being surgically arduous places, the treatment is also difficult. Local recurrence rates are high after subtotal resection. Especially for small tumors, tumors whose endoscopic microsurgery is not suitable, patients at risk of anesthesia, patients with postoperative residual tumor or recurrence can be recommended SRS due to similar local control rates.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

***Idea/Concept:** İlknur Harmankaya, Didem Karaçetin; **Design:** İlknur Harmankaya; **Control/Supervision:** Didem Karaçetin, İlknur Harmankaya, **Data Collection and/or Processing:** İlknur Harmankaya, **Analysis and/or Interpretaion:** İlknur Harmankaya, Didem Karaçetin; **Literature Review:** İlknur Harmankaya; **Writing the Article:** İlknur Harmankaya, Tuğçe Hilal Uçgun; **Critical Review:** Evrim Duman, Didem Karaçetin, Tuğçe Hilal Uçgun; **References and Fundings:** İlknur Harmankaya; **Materials:** İlknur Harmankaya; **Olgu Sunumu Çevirisi:** Tuğçe Hilal Uçgun.*

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