Development of Post-Treatment Facial Palsys in Patients with Vestibular Schwannoma: Retrospective Study 2003 to 2021, Puebla, Mexico

Roberto Genchi Gatica [a], Gabriel Alejandro Contreras Palafox [b], Angelica Osorio Espinoza [c]

a. Research and Laboratories Department of Center of Superior Studies of Tepeaca, Puebla, Mexico. ORCID: https://orcid.org/0000-0002-4620-264X

b) National Institute of Neurology and Neurosurgery, Ciudad de México, Mexico. ORCID: https://orcid.org/0000-0002-4428-9964

c) Research and Laboratories Department of Center of Superior Studies of Tepeaca, Puebla, Mexico. ORCID: https://orcid.org/0000-0001-8081-2321

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Abstract

Introduction: Vestibular schwannomas are the most common benign intracranial tumors of the cerebellopontine angle, it is a tumor that grows from schwann cells and affects the eighth and seventh cranial nerve. Radiotherapy is the direct application of high doses of radiation directed at the lesion, resulting in an alternative treatment to neurosurgery.

Objective: To determine the number of clinical files of patients with vestibular schwannoma who developed facial palsy after treatment with single-dose, hypofractionated radiosurgery and neurosurgery.

Material And Methods: The study was performed by analyzing the clinical records of the "Manuel Velasco Suárez" National Institute of Neurology and Neurosurgery, in which the results of post-treatment facial palsy were found.

Results: The sample is composed of 137 clinical records in total, of which 90 were women and 47 were men, the average age between each group was 44.12 ± 14 years for single dose, 53.73 ± 11.16 years for hypofractionation and 38.85 ± 14.36 years for neurosurgery. It was possible to determine that the patients who developed facial palsy post treatment with neurosurgery were 44.11% of the total, the patients treated with hypofractionated dose radiosurgery had 30.7% and of the patients treated with single dose radiosurgery only 23.37% developed facial paralysis.

Conclusion: Patients treated with neurosurgery have a high percentage with development of facial palsy, followed in incidence by patients with vestibular schwannoma with hypofractionated dose radiosurgery treatment and finally patients treated with single dose radiosurgery.

Keywords: Neurology, radiosurgery, facial palsy

Introduction

Facial palsy is a neuromuscular condition caused by injury to the facial nerve that affects the motor and sensory pathways. This leads to impaired movement in the facial muscles, which can cause issues such as difficulty smiling, raising eyebrows, gesturing and controlling the eyes. It can also affect the secretion of saliva and tears, leading to an inability to retain saliva in the oral cavity, and can cause a diminished sense of taste (1).

Patients with this pathology may experience symptoms characteristic of a neuromuscular lesion, such as low motility, headaches, hyperacusis, and difficulty swallowing food or liquids. Complications include corneal abrasion and corneal dryness, which can cause the patient to lose their sight [(2).]

Facial paralysis is most commonly caused by idiopathic factors, with a rate of 30 to 40 cases per 100,000 people. This type of paralysis usually resolves on its own, without any progressive worsening, and has an acute onset and complete remission. Other causes of facial paralysis include tumors, infections, trauma, and congenital factors (3).

Facial paralysis is classified into two types: peripheral and central. The former is also known as Bell's palsy, idiopathic, or lower motor neuron paralysis. It is the most common type and causes paralysis of all the muscles on the affected side. On the other hand, the central type occurs due to upper motor neuron involvement and often leads to hemiplegia on the same side as the lesion. This type affects the muscles in the lower region of the face but leaves emotional movements active.

Facial paralysis can be diagnosed by considering three essential aspects. Firstly, clinical diagnosis involves examining the normal functions of the facial nerve such as tone, eye mobility, eyebrow elevation, etc. Secondly, topographic diagnosis consists of studying the function of the structures innervated by the facial nerve, which can be done through specialized tests such as the lacrimation test, Schirmer test, sialometry, and gustometry. Finally, electrodiagnosis is the most accurate test to determine the diagnosis, project a prognosis, and plan treatment. The maximum excitability test, electromyography, and eyelid reflex are some of the most commonly used tests in electrodiagnosis (4).

Treatment for facial palsy, depends on its classification, origin, affected area, magnitude, intensity, and time since onset. Corticosteroids are administrated within 72 hours to increase chances of remission and reduce involuntary movements. Prednisone initial dose is 60-80mg orally for 5 days, decreasing gradually. Deflezacort, an alternative steroid, is administered at 30mg orally for 15 days. Antivirals are recommended in combination with other medications. Most commonly used are Valacyclovir 1000mg TID for 1 week and Aciclovir 400mg 5 times a day for 10 days, although controversial. Lubricating eye drops and protective glasses are recommended to preserve ocular function and vision. A nonmedical treatment option is physiotherapy, which includes electrotherapy, thermal therapy, massages, and facial exercises, all of which help improve circulation, thereby improving facial function. Surgical decompression of the nerve is an alternative treatment that involves an open craniectomy of the middle cranial fossa. However, this treatment is only recommended for patients who have lost more than 90% of their facial nerve function and is not suitable for all cases (4).

Vestibular schwannomas are the most common benign intracranial tumors of the cerebellopontine angle, also known as acoustic nerve neurinoma, it is a tumor that grows from schwann cells and affects the eighth and seventh cranial nerves (5, 6).

They are the most frequent neoplasms of the posterior cranial fossae, being more common in the external auditory canal. They represent 80 to 90% of cerebellopontine angle tumors and approximately 7-8% of intracranial tumors (7).

It has an incidence of 1-2 per 100,000 inhabitants per year (8), affecting both sexes equally, although there is a slight predominance in women. Its first manifestations appear between the fourth and sixth decade of life, characterized by tinnitus, hearing loss, instability or balance disturbances (9). The Koos classification for vestibular schwannomas is designed to stratify tumors according to the extension and extent that the tumor causes in the brainstem (10).

The diagnosis of these tumors will mainly be based on imaging studies (magnetic resonance), audiometry, and the symptoms that patients present, which manifest with various signs and symptoms such as: tinnitus, hearing loss, facial paralysis, and vertigo (11-13).

The treatment covers various scenarios ranging from observation, microsurgery, surgery, radiosurgery and will focus on reducing the symptoms caused by the mass effect produced by the size of the tumor (14, 15).

Although there are various ways to assess facial functionality, the House-Brackmann scale is currently the most widely used (16, 17). This tool to analyze the degree of facial paralysis was proposed by American physicians John W. House and Derald E. Brackmann between 1983-1984. The study includes 6 evaluations ranging from facial nerve functionality considered normal (grade I) to total facial paralysis (grade VI) (18, 19). Although facial functionality entails the exploration of various muscles of the face, the most important determining factors lie in the ability to raise the eyebrow and return it to its normal position and the mobility of the labial commissures (20).

In the end, it has become the most used scale since 1984 due to its high effectiveness. (20).

The treatment of vestibular schwannomas that cause compression and mass effect and other symptoms includes observation and follow-up through imaging studies such as magnetic resonance imaging, radiation treatment, either single or hypofractionated doses, or open surgery (21).

Radiosurgery and microsurgery are the gold standard for the treatment of vestibular schwannomas that cause compression of intracranial structures (22) . Radiotherapy is defined as the direct application of high doses of radiation directed at the lesion, thus reducing its growth and the effect of compression on adjacent structures, resulting in an alternative treatment to surgery (23, 24).

For small and medium-sized tumors, radiation treatment represents a safe and effective option for disease control with various side effects. The choice of the type of radiation to be used will depend on the Koos classification, on the existing tools in the institution. to which the patient is registered (whether or not he has the necessary equipment) as well as the experience and decision of the treating physician (25).

Surgical therapy has always represented the treatment of choice for total resection of vestibular schwannomas; however, with the advent of radiation, it has been reserved for larger tumors and for young patients. The main objective of this treatment is to avoid tumor progression and preservation of neurological functions. Like all surgery, this treatment can produce unwanted side effects in patients, including damage to adjacent structures such as the facial nerve, so this modality will only be chosen if the mass effect produced is relevant and affects the patient's neurological capacities, always seeking to preserve the facial nerve and choosing this option in most

cases only if the tumor has a classification on the Koos scale greater than or equal to III (26-30).

The National Institute of Neurology and Neurosurgery "Manuel Velasco Suárez" in Mexico City is the reference place for most neurological disorders detected in third and second level hospitals throughout Mexico, therefore, it annually receives a significant amount of patients diagnosed with vestibular schwannoma who come for treatment among the options offered, the most relevant currently is undoubtedly radiosurgery in its two modalities.

It is considered that the information reported is insufficient, this research focuses on which treatment modality presents fewer side effects with respect to facial paralysis. The situation that affects these patients as a result of the treatment used for their disease is worrying, therefore, the present investigation will address the study of vestibular schwannomas and their relationship with facial paralysis as a side effect of having received the chosen therapy.

Aim

The objective is to determine the number of patients with vestibular schwannoma who developed facial paralysis after treatment with single-dose, hypofractionated radiosurgery and surgery.

Materials And Methods

A retrospective, cross-sectional, heterodemic, and single-center study of the patient clinical records was performed.

Through the review of clinical records, the number of patients who developed facial paralysis was determined, the data was emptied into a sheet that allowed filtering those records of patients with different degrees of facial paralysis, type of treatment, id, age, gender and year in which treatment was received.

The degree of facial paralysis was determined in the patients during their consultation, recorded in the file by the specialist, according to the 6 degrees of progression previously described.

Inclusion and Non-Inclusion Criteria

Complete clinical records of adult male and female patients diagnosed with vestibular schwannoma with diseases that do not influence the progress of facial paralysis were included. and those treated with hypofractionated dose radiosurgery, single dose and those who received treatment with surgery, whose facial paralysis has been assessed using the House Brackman scale before and after surgery and who have been followed up for more than 6 months at the Institute.

Incomplete clinical records of patients diagnosed with vestibular schwannoma with facial paralysis secondary to another aetiology, those who received surgery with more brain tumors or histology other than vestibular schwannoma and treated with hypofractionated dose radiosurgery, single dose, and those who received surgical treatment,

Clinical records of patients with a diagnosis of vestibular schwannoma and treated with hypofractionated dose radiosurgery, a single dose without a minimum medical follow-up of 6 months, those who received treatment with surgery who have not used the House Brackman scale to assess facial paralysis, were eliminated. who have not completed their complete treatment and those who received treatment with surgery who have received 2 or more concomitant treatments.

Statistic Analysis

The statistical analysis of the data was carried out through measures of central tendency and percentage analysis, using the Excel® program. The age of the patients at the time of treatment was determined and the (mean ± SD) was established, it was determined through a percentage analysis in which of the treatments there was a lower frequency of facial paralysis.

Ethical Considerations

The present study adheres to the ethical, institutional norms, to the principles established in the Declaration of Helsinki and Tokyo, to the Regulation of the General Health Law in Research for Health, as well as to what is established in the Bioethics Committee and the Research Committee of the Tepeaca Center for Higher Studies. No sensitive information was obtained from the records of these patients.

Results

The analysis of clinical records of patients diagnosed with vestibular schwannoma treated with any of the modalities chosen through the inclusion, exclusion and elimination criteria was carried out from January 2003 to January 2021 of the National Institute of Neurology and Neurosurgery "Manuel Velasco Suárez" in Mexico City.

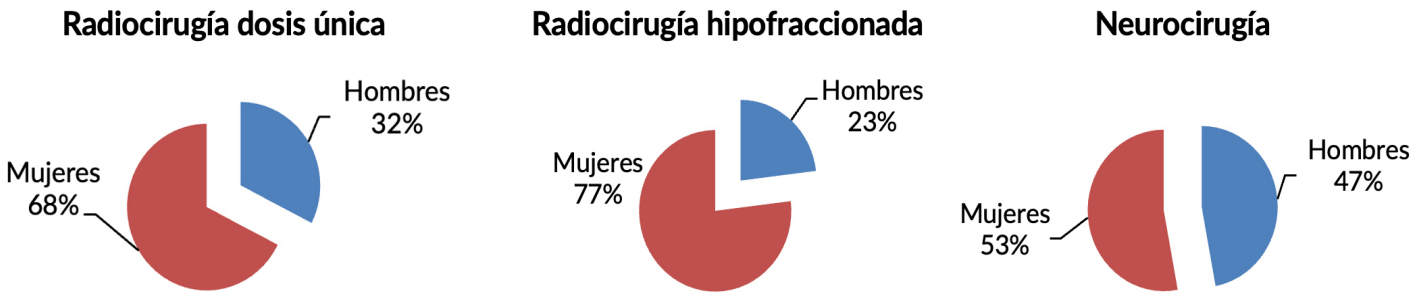
Facial paralysis was assessed using the House-Brackmann scale, which was evaluated by the attending physician or consultant and is recorded in the clinical record of each patient.

The sample consisted of a total of 137 clinical records of people distributed in 3 groups depending on the treatment they obtained (group A: single dose radiosurgery, group B: hypofractionated radiosurgery or group C: neurosurgery).

The characteristics of the population studied were the following, for each of the groups: gender, age, treatment used and percentage of patient records who presented facial paralysis after treatment, determining the following:

Identification of the gender of the clinical records of patients with vestibular schwannoma and treated with single dose radiosurgery, hypofractionated and surgery. It was observed that of a total of 77 patients who were treated with neurosurgery, 25 are men and 52 are women. It was observed that of a total of 26 patients who were treated with neurosurgery, 6 are men and 20 are women. It was observed that of a total of 34 patients who were treated with neurosurgery, 18 are men and 16 are women (see figure 1)

Figure 1. Identification of the gender of patients with vestibular schwannoma and treated with single-dose, hypofractionated radiosurgery and neurosurgery.



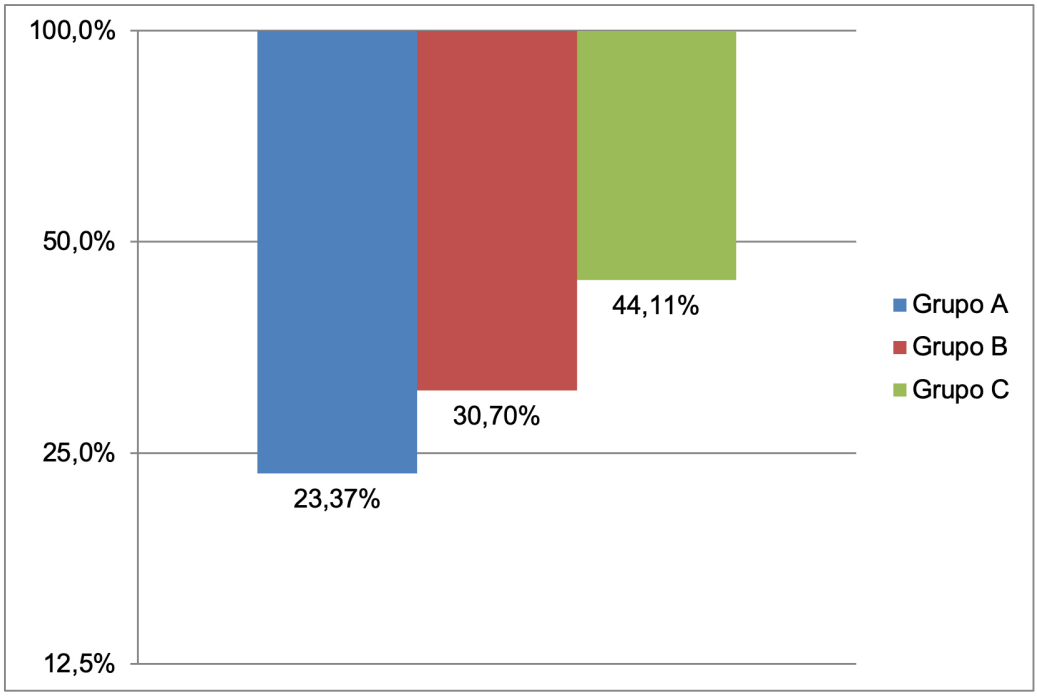
Source: Patient clinical records

Identification of the mean age of clinical records of patients with vestibular schwannoma and treated with single dose, hypofractionated radiosurgery and surgery. The mean age in the clinical records of patients diagnosed with vestibular schwannoma and treated with single dose, hypofractionated dose and neurosurgery radiosurgery was 50.71 ±14.0 years, 45.61 ± 11.16 years and 38.94 ± 14.36 years respectively.

Determination of the number in percentages of patients who developed facial paralysis after treatment with single dose radiosurgery, hypofractionated dose and neurosurgery. It was observed that the number of patient records who received treatment for vestibular schwannoma with single dose radiosurgery, hypofractionated dose and neurosurgery was 77, 26 and 34 respectively. It was determined that of group A (patients treated with single dose radiosurgery) 23.37% of all patients treated with this modality developed facial paralysis after receiving treatment. From group B: It was

determined that the number of records of patients diagnosed with vestibular schwannoma and treated with hypofractionated dose radiosurgery who developed facial paralysis was 30.70% in total. It was observed that the number of records of patients diagnosed with vestibular schwannoma and treated with neurosurgery who presented facial paralysis is 44.11%, as you can see in figure 2.

Figure 2. Percentage of patient records that did present post-treatment facial paralysis in each group



Source: Patient clinical records

Discussion and Conclusion

The follow-up of approximately 291 patients treated between the years 1995 and 2017 at the University Clinical Hospital of Salamanca, Spain in the otorhinolaryngology and cervicofacial surgery department who received surgical treatment. 140 patients completed the treatment and 6-month follow-up: 48.8% obtained function. facial grade II, 70.4% grade I-III, according to the results obtained from this study it can be concluded that surgical treatment is an important and determining factor in the worsening of facial paralysis given that, before the intervention, only the 6.2% of the patients had facial paralysis (31). Leoncio Arribas et al., 2014 reported that, of a total of 194 patients who were treated with radiation between 1997 and 2012, the most appropriate treatment for vestibular schwannomas is radio-

surgery, since they preserved the functions of the trigeminal nerve, hearing and therefore quality of life, thus concluding that the best treatment for vestibular schwannomas is radiation (32). On the other hand, Isaac B. Ng et al. in 2020 reported that 23 patients at the Tufts Medical Center in Boston, Massachusetts, United States between 1997 and 2017 who received treatment with radiosurgery, none presented impairment of facial grade functionality, concluding that treatment with radiosurgery represents an option safer for the treatment of vestibular schwannomas in terms of preservation of the facial nerve (33).

Among the main side effects that are considered really important in the treatment of vestibular schwannomas is undoubtedly facial paralysis, as mentioned above, this is a very limiting clinical entity in the lives of patients, which can affect profoundly their quality of life.

Carrying out the analysis of the data obtained and the graphs made, as well as guiding us with the objectives embodied in our work, it was possible to observe that the predominant gender in the records of patients diagnosed with vestibular schwannoma who were treated at the National Institute of Neurology and Neurosurgery "Manuel Velasco Suárez" is the female one, accounting for a total of 90 files, which represents more than half of the total clinical files that entered the study, in contrast to 47 files of male patients. It is of great relevance to mention that, as in the study, it coincides that the gender most affected by vestibular schwannomas is the female, as mentioned in the study carried out by Diéguez Guach in 2019, which mentions a 3:2 ratio of between female and male patients, is shown below (6).

It was possible to analyze and determine that the youngest age of the patient records that were treated was 18 years while the oldest was over 70 years. Regarding the average age of the treated patients, the following was determined: the average age of the patients who were treated with single-dose radiosurgery was 50.71 ± 14 years, in those treated with hypofractionated dose it was 45.61 ± 11.16 years and those treated with neurosurgery it was 38.94 ± 14.36 years, determining a mean age of 45 years among the 3 groups, something different from that reported by Leoncio Arribas et al. 2014 determined a mean age of 58.4 years, while Marcos Alonso et al., 2019 reported a mean age of 55 years. (31)(32) It can be determined that the age of the studied groups is fairly homogeneous, a fact that is confirmed by their degree of dispersion. It can also be observed that the average age of the 3 studies is between 38 and 55 years of age, Massons García and

Díaz de la Fuente in 2019, report that vestibular schwannomas are generally diagnosed at an average age of 50 years (8). Our study confirms previously reported data.

It was observed that a total of 137 records of patients who were treated, 77 records were of patients treated with single dose radiosurgery, 26 of patients treated with hypofractionated dose radiosurgery and the rest (34) were those treated with neurosurgery.

From this, the following could be determined: a total of 77 patient records that were treated with single-dose radiosurgery did not present facial paralysis before treatment in contrast to the amount of analysis performed after treatment, it was determined that a total of 18 people developed facial paralysis after treatment with single dose radiosurgery equivalent to 23.37% of the total records.

In the case of the files of the patients treated with hypofractionated dose radiosurgery, the total was 26 files that entered the study, from this group it was determined that a total of 8 people developed paralysis after treatment with hypofractionated radiosurgery equivalent to 30.7% of the total. of the files.

With these results, it can be concluded that of 100% of the patients of the National Institute of Neurology and Neurosurgery "Manuel Velasco Suárez" treated with single-dose radiosurgery, 23.7% developed facial paralysis and those treated with hypofractionated doses, 30.7% developed post-treatment facial paralysis. with radiosurgery, contrasting what was mentioned by Isaac B Ng et al. 2020, concludes that none of his patients had changes in the functionality of the facial nerve. We can associate this with the fact that the number of patients in his study (n) is only 23 patients, in contrast to the large number of our study of 103 patients in total. (33).

Finally, the records of group C (treated with neurosurgery) with a total of 34 records of patients who were treated with neurosurgery, determining that 15 people developed facial paralysis after treatment with neurosurgery, which is equivalent to 44.11% of the total records. The latter being the most affected group. Something similar was found in the article by Marcos Alonso et al., 2020 in which 48.1% of post-operative patients developed facial nerve paralysis. This can be associated with the route in which the tumor resection was performed, since it is known that the greater the manipulation of the parenchyma and the encephalic structures, the greater the post-treatment facial paralysis, since complete resection of vestibular schwannoma is associated mostly to its development (31).

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