LONG-TERM FACIAL NERVE CLINICAL EVALUATION FOLLOWING VESTIBULAR SCHWANNOMA SURGERY

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Abstract – Background: Facial function is important in accompaniment of patients operated on vestibular schwannoma (VS). Objective: To evaluate long term facial nerve function in patients undergoing VS resection and to correlate tumor size and facial function in a long-term follow-up. Method: Transversal study of 20 patients with VS operated by the retrosigmoid approach. House-Brackmann Scale was used preoperatively, immediately after surgery and in a long-term follow-up. Student t test was applied for statistic analysis. Results: In the immediate postoperative evaluation, 65% of patients presented FP of different grades. Improvement of facial nerve function (at least of one grade) occurred in 53% in the long-term follow-up. There was statistically significant difference in facial nerve outcome in long-term follow-up when tumor size was considered (p<0.05). Conclusion: The majority of patients had improvement of FP in a long-term follow-up and tumor size was detected to be a factor associated with the postoperative prognostic.

KEY WORDS: vestibular schwannoma, facial nerve function, retrosigmoid approach.

Avaliação clínica tardia do nervo facial no pós-operatório de schwannoma vestibular

Resumo – Contexto: A função facial é importante para acompanhamento dos pacientes operados de schwannoma vestibular (SV). Objetivo: Avaliar o grau de paralisia facial (PF) em pacientes operados de SV, correlacionando tamanho do tumor com função facial na avaliação tardia. Método: Estudo transversal com análise seriada de 20 pacientes com SV operados pela via retrosigmoido-transmeatal. A Escala de House-Brackmann foi utilizada no pré-operatório, pós-operatório imediato e pós-operatório tardio. O teste t de Student foi aplicado para análise estatística. Resultados: No pós-operatório imediato, 65% dos pacientes apresentaram graus variados de PF, sendo que 53% destes obtiveram melhora de pelo menos um grau de House-Brackmann na avaliação tardia. Houve diferença significativa no resultado da função facial no pós-operatório tardio quando o tamanho do tumor foi considerado (p<0.05). Conclusão: A maioria dos pacientes da amostra apresentou melhora da PF no pós-operatório tardio, sendo o tamanho do tumor um fator associado ao prognóstico.

PALAVRAS-CHAVE: schwannoma vestibular, função facial, via retrosigmoido.

Vestibular schwannoma (VS) is a benign tumor that arises from the eighth cranial nerve. It represents 8% to 10% of all brain tumors and 80% of all cerebellopontine angle tumors. In 1894, Charles Balance performed the first successful VS excision, but the mortality rate at that time was devastatingly high. Harvey Cushing improved surgical techniques and brought the mortality rate down to approximately 20% performing sub-total removal of the tumors. Improvement in surgical techniques and development of new technological devices had brought the mortality rate to under 2%. The advances and improvements in microsurgical techniques have changed the actual goals of surgery, being facial nerve preservation an utmost concern. Paralysis of the facial expression muscles is a debilitating and psychologically devastating condition for the patient. Preservation of facial nerve function after VS surgery is one of the most important goals to be achieved.

There is no established method that allows precise prediction of the long-term prognosis of facial nerve palsy after VS surgery. It has been suggested that tumor size is an approximate guide to predicting ultimate functional outcome.

The objective of this study is to analyze the facial nerve function in patients submitted to VS surgery by the retrosigmoid transmeatal approach and correlate tumor size with the grade of postoperative facial palsy (FP).
METHOD

Subjects

Twenty patients were enclosed in this study. They underwent surgical resection of VS from January 1999 to October 2002 at the Hospital das Clínicas of the State University of Campinas (HC/UNICAMP), in Campinas, Brazil.

The Ethics Committee on Research, State University of Campinas (UNICAMP) - Brazil, approved the study and a free and informed consent was obtained from each participant.

Procedures

All patients were evaluated before surgery by computerized tomography (CT) and/or magnetic resonance (MR). Tumor size was considered as the largest extrameatal diameter. Tumors were categorized as small (≤ 2.0 cm), medium (2.1–4.0 cm) and large (>4.0 cm).

The surgical standard retrosigmoid transmeatal approach was used in all patients by the same surgical team. The main goals of treatment were total removal of the tumor without major morbidity and excellent preservation of facial nerve function. No patients were submitted to previous treatment of their tumors.

Facial function was assessed in three specified time intervals: preoperative, immediate postoperative (24 hours) and in a long-term follow-up (18 months or longer). It was reported using the House-Brackmann facial nerve function grading system. Patients were divided into three subgroups: good facial function (Grades I-II), regular facial function (Grades III-IV), and poor facial function (Grades V-VI).

Data analysis

A descriptive analysis was performed, as well as statistical analysis using the Student t test for independent data. Statistical significance was set at p<0.05 to determine the possible association of the tumor size on final facial function.

RESULTS

Fifteen patients were female (75%) and five were male (25%). Patients’ ages ranged from 17 to 77 years old (mean 51 years old). Most patients (n=14) were older than 40 years old; 40% of patients (n=8) were 40 to 60 years old and 30% (n=6) were older than 60 years old. There was no predominance regarding the side of the tumor. The mean tumor size was 3.38 cm with a range of 1.5 cm to 5.0 cm. The distribution of the tumor size is represented in Fig 1. The minimum follow-up was 19 months and the longest one was 5 years and 10 months (mean time of 3 years and 10 months).

The evolution of facial nerve function in the three specified time span is illustrated in Fig 2. Three patients (15%) had FP preoperatively. Two of them had House-Brackmann grade VI in this period and the other one had...
A hypoglossal-facial nerve anastomosis\textsuperscript{12} was carried out during the first year postoperative in 4 patients (20%) that presented no recovery of the facial function. A House-Brackmann grade IV was obtained in 1 case, and grade III in 2 cases. One patient (tumor size 5.0 cm and previous FP) showed no improvement of FP. For this patient plastic surgery procedures are recommended for facial function rehabilitation.

No impairment of facial nerve deficit was observed in the interval between hospital discharge and follow-up examination.

Facial function in long-term follow-up was also analysed with respect to tumor size (Table 1). Patients with regular (Grades III-IV) or poor (Grades V-VI) facial function had medium and large tumors, respectively.

There was a statistically significant difference (Table 2) in immediate and long-term facial nerve outcome when the tumor size was considered. Patients who presented improvement of FP had smaller tumors.

**DISCUSSION**

VS is considered by many surgeons to be one of the most difficult brain tumors to be removed without additional neurologic deficits. Since the first successful resection of a VS occurred in 1894\textsuperscript{2}, surgical techniques have been continuously refined to reduce patient morbidity and mortality rates\textsuperscript{3,4} over the last century, treatment of VS has undergone immense changes and the focus of surgery has improved from prolongation of patient’s life towards preservation of cranial nerve function\textsuperscript{5}, specially the seventh nerve.

Loss of facial nerve function is a debilitating and psychologically devastating condition\textsuperscript{13}. Patients with FP may experience several limitations as difficulty to speech and

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### Table 1. Final House-Brackmann Grades according to tumor size.

<table>
<thead>
<tr>
<th>House-Brackmann grade</th>
<th>Tumor size</th>
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<tbody>
<tr>
<td></td>
<td>≤ 2.0 cm n (%)</td>
<td>2.1 cm–4.0 cm n (%)</td>
<td>&gt;4.0 cm n (%)</td>
<td>Total (n=20) (%)</td>
</tr>
<tr>
<td>I-II</td>
<td>4 (20)</td>
<td>7 (35)</td>
<td>2 (10)</td>
<td>13 (65)</td>
</tr>
<tr>
<td>III-IV</td>
<td>0</td>
<td>4 (20)</td>
<td>0</td>
<td>4 (20)</td>
</tr>
<tr>
<td>V-VI</td>
<td>0</td>
<td>0</td>
<td>3 (15)</td>
<td>3 (15)</td>
</tr>
</tbody>
</table>

### Table 2. Mean and standard deviation of the tumor size classified for improvement/no-improvement in long-term follow-up related to immediate postoperative time.

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Tumor size (mean, cm)</th>
<th>Standard deviation</th>
<th>t*</th>
<th>p</th>
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<tbody>
<tr>
<td>Yes (n=11)</td>
<td>2.90</td>
<td>0.78</td>
<td>2.355</td>
<td>0.030</td>
</tr>
<tr>
<td>No (n=9)</td>
<td>3.97</td>
<td>1.23</td>
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*Student t test for independent data. Statistical significance was set at p<0.05.
eat and may experience drooling. Furthermore, these patients may have significant ophthalmic complications from loss of the blink reflex, upper and lower eyelid retraction, and lagophthalmos. The absence of orbicularis muscle tone also causes a loss of the corneal “squeegee” effect and predisposes the patient to dry eye symptoms and corneal exposure. Socially, facial paralysis presents a distorted continence that others find disquieting. Affected individuals are avoided and often feel socially isolated. The combination of physical and psychological disabilities often results in a lasting postoperative depression.

The mean age of the patients of this series (51 years old) and the predominance of individuals of the feminine sex (75%) were in agreement with studies that indicate greater frequency of the VS in females in the fifth and sixth decades of life.
In our series tumor size proved to be an important variable on outcome in the long-term follow-up. Statistical significance (p<0.05) was demonstrated in comparison to immediate postoperative results, showing that a large tumor is associated with poorer postoperative facial nerve function (Table 2).

Facial nerve can tolerate a large degree of stretching, compression or distortion, which is caused by the tumor, without apparent FP. However, as the tumor grows, the individual fibers of the facial nerve may become splayed over the tumor capsule. Not surprisingly, very large tumors place the nerve under greater tension, which increases the likelihood of stretch injury and may explain the high rate of FP seen in patients with large tumors. Alternatively, nerve dysfunction may result from poor vascularization of nerve segments that are effaced by large tumors.

It would appear that the bigger is the tumor the greater is the risk to the nerve. However, size cannot predict the relationship or invasiveness of the tumor with regard to the nerve, the degree of adhesiveness, or the difficulty of dissection. The facial nerve can traverse any part of the tumor capsule and even pass through the tumor itself, and this occurs equally in small and large tumors.

Patients with preoperative facial weakness had a poorer prognosis in terms of facial nerve function following VS surgery. This also could be observed in our series. It may be due to infiltration of the facial nerve by the VS, especially if the tumor is large.

In conclusion, in spite of the large developments in VS surgery in the last century, FP remains a frequent complication. The majority of the patients of this study presented improvement of the FP in an average time of 3 years and 10 months (65%). It was clear that it is possible to obtain normal to near-normal facial function in patients operated on by retrosigmoid transtemporal approach. Tumor size was a significant factor for postoperative facial nerve function in a long-term follow-up. This is consistent with other published series.

REFERENCES