Nervus Intermedius Outcomes after Vestibular Schwannoma Surgery and Radiosurgery: A Single Institution Experience

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Introduction

Nervus intermedius (NI) dysfunction in vestibular schwannoma (VS) is significant and present in up to 75% of patients following treatment. The NI comprises afferent sensory fibers from the nasopharynx, nose, external auditory meatus, and taste from the anterior two-thirds of the tongue. Additionally, it is responsible for parasympathetic innervation of the nasal mucosa, lacrimal gland, and the submandibular and sublingual salivary glands. There are sparse reports of NI outcomes following either radiation and/or surgical resection. Moreover, it is unclear how specific tumor characteristics and treatment modalities affect the NI. Herein, we present NI outcomes from our series of patients undergoing all treatment modalities for vestibular schwannoma and perform a review of the existing literature in order to determine which treatments and patient factors predispose to NI dysfunction following VS treatment.

Methods

We obtained institutional review board (IRB) approval for the study. A retrospective review was performed of all patients who underwent either gamma knife radiosurgery and/or open surgery for treatment of VS between January 1, 2008 and December 31, 2018. Inclusion criteria included a diagnosis of a vestibular schwannoma and post-treatment follow-up for at least 1 month. A total of 222 patients were identified and classified as having undergone open microsurgery, gamma knife or both microsurgery and gamma knife. Patients’ charts and pre- and post-treatment T1 contrast MRI studies were then reviewed for assessment of tumor volume, radiation treatment dose, surgical approach and Koos grade. Post-treatment clinical notes were used to define post-operative facial weakness and classified according to the House-Brackmann grades. Extent of resection was described in operative reports and confirmed with radiological data by comparing pre-operative MR images to immediate post-operative MR images. Reevaluation was classified as either gross total or partial tumor removal. Patients were stratified into three groups: Group 1 included 54 patients who underwent microsurgery, Group 2 with 27 patients who underwent combined microsurgery and radiosurgery treatment, and Group 3 with 17 patients who underwent both radiation and surgery. Twenty-eight percent of patients presented with pre-operative NI dysfunction; most commonly dry eye followed by taste dysfunction and lacrimation dysfunction (corticoid tears). Following treatment, 79% of patients experienced NI dysfunction most commonly dry eye. Statistical differences in dry eye and taste were observed when comparing the treatment groups and is more prevalent in the surgical group as compared to radiosurgery. In our series, only 20% of patients demonstrated recovery of NI function in our patient cohort. Of the 14 patients who experienced dysfunction in lacrimation, 4 patients (28%) demonstrated resolution of their symptoms. Rates of recovering from dry eye were much less and only 7/41 patients (17%) had resolution of their dry eye at two years. In comparison to dry eye and lacrimation dysfunction, gustatory dysfunction had higher rates of improvement and 50% of patients had improvement of their taste at 2 years (11/22 patients).

Results

98 patients responded to the questionnaire and were included within this study (44.1% response rate). Patients were stratified into three groups: Group 1 included 54 patients who underwent surgery, Group 2 with 27 patients who underwent combined microsurgery and radiosurgery treatment, and Group 3 with 17 patients who underwent both radiation and surgery. Groups were classified as having undergone open microsurgery, gamma knife or both microsurgery and radiosurgery treatment. Table 1: Patient Demographics

Table 1. Patient Demographics

<table>
<thead>
<tr>
<th>Patient Demographics</th>
<th>N</th>
<th>Total Number of Patients</th>
<th>Total Number of Radiation Patients</th>
<th>Total Number of Surgical Patients</th>
<th>Total Number of Patients with Rad and Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Patients [Total]</td>
<td>55</td>
<td>98</td>
<td>54</td>
<td>27</td>
<td>17</td>
</tr>
<tr>
<td>Female Patients [Total]</td>
<td>43</td>
<td>124</td>
<td>124</td>
<td>124</td>
<td>124</td>
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<tr>
<td>Overall Tumor Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Size (mm³)</td>
<td>6320.61</td>
<td>&lt;0.00001</td>
<td>5254.33</td>
<td>11018.9074</td>
<td>13664.84</td>
</tr>
</tbody>
</table>

Statistical Analysis: After compilation of the data, descriptive statistics were used to characterize the NI dysfunction in patients and statistical analysis was performed using GraphPad Prism 8. Statistical significance was accepted at a probability of 0.05. For subgroup analysis, statistical significance was determined by Fisher’s exact test, student t-test or ANOVA.