Great Auricular Nerve Morbidity After Nerve Sacrifice During Parotidectomy

William R. Ryan, MD; Willard E. Fee, Jr, MD

Objective: To clarify the extent, timing, and patient perspectives of great auricular nerve (GAN) morbidity and recovery after nerve sacrifice during parotidectomy during the first postoperative year.

Design: Prospective series.

Setting: Tertiary care academic medical center.

Patients: Twenty-seven consecutive patients who underwent parotidectomy with GAN sacrifice.

Main Outcome Measures: Preoperatively and at 3, 6, 9, and 12 months postoperatively, we performed light touch sensation tests on each patient to develop an ink map representing anesthesia and paresthesia in the GAN sensory territory; patients also completed an outcomes questionnaire.

Results: Twenty-two (81%) of 27 patients completed follow-up. The prevalence and average area of anesthesia decreased continually during the first year according to sensory testing and patient scoring. Half of the patients had no anesthesia at 12 months. The prevalence and average area of paresthesia increased during the first year according to sensory testing; however, the contiguity and subjective scoring of paresthesia peaked at 6 months and decreased in subsequent follow-up points. Throughout the first year, patients had difficulty using the telephone, shaving, combing their hair, wearing earrings, and sleeping on the operative side because of both anesthesia and paresthesia.

Conclusions: The impact of GAN sacrifice morbidity on patient quality of life is tolerable and improves during the first postoperative year. However, we feel that GAN morbidity may be bothersome enough to warrant efforts to preserve the posterior branch of the GAN when possible and appropriate.


Conventionally, surgeons have sacrificed the great auricular nerve (GAN) during parotidectomy to facilitate access to the parotid gland. Studies have shown that GAN sensory loss can lead to anesthesia, paresthesia, discomfort, functional deficits (eg, difficulties wearing earrings and handling the telephone), an increased risk of traumatic injury, and an increase risk of neuromas. However, the extent, timing, and patients’ perspectives of GAN morbidity and recovery after nerve sacrifice are not fully clear.

Some surgeons advocate the preservation of the posterior branch of the GAN with the intention of reducing unwanted sequelae. Retrospective and prospective studies (including 2 randomized clinical trials) have found that GAN preservation is effective in increasing the likelihood and speed of return of nerve function. Conversely, other prospective evidence shows that GAN preservation may be unnecessary with the findings that sensory loss and recovery are similar between sacrificed and preserved GANs. Furthermore, although patients may lose some sensory function from GAN division, their quality of life is largely unaffected. Given that authors who advocate preservation of the posterior branch of the GAN report that GAN sacrifice is at times necessary, we need a better understanding of the consequences of GAN morbidity.

The GAN originates from the anterior rami of the second and third cervical nerves, bends around the posterior aspect of the sternocleidomastoid muscle, and ascends to just posterior of the tail of the parotid gland, where it divides into anterior and posterior branches. The anterior branch supplies sensation to the facial skin over the parotid gland and the ascending rami of the mandible. The posterior branch supplies sensation to the skin overlying the mastoid process and the skin of the lobule and helix. For GAN sacrifice, surgeons traditionally divide the trunk.
proxi-mal to the bifurcation. Authors13,31 who perform posterior branch preservation divide the anterior branch for skin flap elevation.

This study is an effort to prospectively assess GAN morbidity after nerve sacrifice during parotidectomy during the first postoperative year. We hoped to determine, with respect to time after nerve sacrifice, (1) the extent of GAN morbidity and (2) the patients’ perspectives of their neurological dysfunction and the resulting function problems.

METHODS

This study received approval from the institutional review board’s Human Subjects Ethics Committee at Stanford University, Stanford, Calif.

STUDY SAMPLE

The study sample consisted of 27 consecutive patients who under-went parotidectomy with GAN sacrifice for any indication performed by 3 surgeons at the Department of Otolaryngology–Head and Neck Surgery, Stanford University, from March 2003 to February 2004. We excluded patients who also had had a neck dissection, could not communicate effectively enough to undergo sensory testing (eg, patients who were non–English speaking or who had dementia), had a generalized neurological illness, or could not commit to follow-up appointments. We obtained informed consent and permission to take photographs of each patient enrolled in the study.

QUESTIONNAIRE

We met with each patient preoperatively, and at 3, 6, 9, and 12 months postoperatively. We allowed for a month leeway for each postoperative follow-up appointment to ensure scheduling success. During these appointments, the patients first completed a questionnaire. Patients scored (on a 1-10 visual ana-logue scale) their assessment of the return of sensation, current paresthesia, satisfaction with the current sensation, current pain, current discomfort, and how bothersome the dysfunction was for them all in the GAN sensory area. In addition, the patients answered yes or no to questions regarding the incidence of injury to the GAN sensory area, their feeling of being at risk for injury to the area because of decreased or absent sensation, and current difficulties with using the telephone, shaving, combing their hair, and wearing earrings or hearing aids. We also asked an open-ended question about any other potential problems associated with GAN function.

SENSORY TESTING

Figure 1 shows the 8 GAN sensory regions we defined for the purposes of this study: the preauricular, infra-auricular, post-auricular, mandible body, lobule, inferior helix, superior helix, and concha regions. Preoperatively, the operator of the anesthe-siometer (W.R.R.) applied 1 touch pressure to each of the 8 sensory regions areas to confirm intact sensation. All patients enrolled in the study had full light touch sensation according to the anesthesiometer testing. We defined anesthesia as a light touch sensation where the patient’s finger detected the force of the anesthesiometer and to respond with the phrase “touch” if he or she felt the force of the anesthesiometer and to respond with the phrase “up” if he or she felt a paresthesia-like sensation. We defined paresthesia as any sensation that felt electrical, burning, or tingling. Based on the responses, the operator asked each patient to respond with the phrase “up” if he or she felt a paresthesia-like sensation. We defined anesthesia as a light touch sensation where the patient’s finger detection was more than 2 cm away from the actual spot stimulated by the anesthesiometer. We defined referred sensation as a light touch sensation where the patient’s finger designation was more than 2 cm away from the actual spot stimulated by the anesthesiometer. The operator then took digital photographs of the ink map on the face, neck, and ear of each patient with a digital camera (PowerShot S400 Digital Elph, 4.0 megapixel; Canon, Lake Success, NY) and traced the ink maps

Figure 1. Diagram of great auricular nerve sensory distribution regions. Number 1 is the preauricular region; 2, mandible body region; 3, infra-auricular region; 4, postauricular region; 5, lobule region; 6, inferior helix region; 7, superior helix region; and 8, concha region.
onto a translucent piece of paper. On the translucency, the operator made black ink outlines of the auricle, the lateral corner of the eye, and the lateral corner of the mouth to show anatomic reference landmarks.

We recorded whether patients had diabetes mellitus or any other disease with possible effects on peripheral nerve function. At each follow-up point, we also recorded any event of neoplasm recurrence, salivoma, hematoma, cellulitis, neuroma, or a numbness-related injury.

STATISTICAL ANALYSIS

We determined the percentages of patients who had anesthesia, paresthesia, and referred sensation in any and in each of the 8 predefined sensory regions. We analyzed the presence of sensory dysfunction in the different regions to show the change in the area of anesthesia and paresthesia over time and to identify the degree of sensory dysfunction in different specific regions. Ultimately, we removed the concha sensory results when determining the average percentage of sensory regions with anesthesia or paresthesia because GAN sacrifice had minimal effects on the sensation of the concha. We determined the average score and ranges for each of the questionnaire questions.

We stratified the patients according to the following attributes: older than 60 years, sex, type of operation (enucleation vs superficial vs total), incision type (modified face-lift vs modified Blair incision), use of adjuvant therapy (radiation therapy or chemotherapy), comorbidities, and postoperative complications to reveal any trends among these factors and the extent, timing, and patients' perspectives of GAN function morbidity.

One patient underwent a bilateral parotidectomy. We counted this patient as 2 patients for the purposes of this study.

RESULTS

Twenty-two (81%) of 27 patients completed follow-up. One 101-year-old study subject died during the follow-up period. (We had operated on this patient, using local anesthesia, because he had intractable pain related to a neuroendocrine carcinoma. He lived 6 more months free of pain, ultimately dying of heart disease.) We were unable to contact 1 patient after enrollment. Three patients dropped out of the study owing to lack of interest. Of the 22 patients who completed 12 months of follow-up, 1 missed the 3-month follow-up point, and 3 missed the 9-month follow-up point. Table 1 displays the characteristics and operative outcomes of the 22 patients with 1-year follow-up.

Table 2 shows the percentage of patients with anesthesia in any and in each of the 8 predefined areas supplied by the GAN at different follow-up points.

Figure 2. A patient 3 months postoperatively (A), 6 months postoperatively (B), 9 months postoperatively (C), and 12 months postoperatively (D). Areas outlined in dark green represent areas of anesthesia (ie, the patient did not respond to light touch). Areas outlined in red represent areas of paresthesia (ie, the patient felt an electrical, burning, or tingling sensation with light touch). This patient had one of the best sensory outcomes by 12 months.
Table 3 shows the percentage of patients with paresthesia in any and in each of the 8 predefined areas supplied by the GAN at different follow-up points. Patients at 1 year had an average of 3.4 regions of paresthesia, although these areas of paresthesia had much less contiguity and generally occupied less space within each region. Three patients reported that they felt the paresthesias only with the anesthesiometer testing and not in their daily life. Reportedly, the paresthesias would often last several seconds after a stimulus; interestingly, many patients applied pressure to the area of paresthesia with the full palm of their hand to relieve the discomfort.

The prevalence of patients who experienced referred sensations was 29% (6 of 21) at 3 months, 68% (15 of 22) at 6 months, 90% (17 of 19) at 9 months, and 91% (20 of 22) at 12 months. Table 4 shows the patients' questionnaire scores (from 1 to 10) for various aspects of GAN sensory function.

None of the patients sustained an injury to the GAN sensory area at any time in the first postoperative year. At each follow-up, a percentage of patients felt they were at risk for injury owing to the abnormal sensation on the operative side of the face: 10% (2 of 21) at 3 months, 18% (4 of 22) at 6 months, 5% (1 of 19) at 9 months, and 23% (5 of 22) at 12 months. Patients reported activities with potential to cause injury to be shaving, using curling irons, and sleeping on the operative side.

Patients reported problems with handling a telephone on the operative side throughout the first postoperative year: 81% (17 of 21) at 3 months, 64% (14 of 22) at 6 months, 32% (6 of 19) at 9 months, and 59% (13 of 22) at 12 months. Specific complaints included discomfort, increased sensitivity, strange sensations, inability to place telephone correctly, and that "the ear doesn't feel like my ear." Patients with telephone difficulties generally used the telephone on the nonoperative ear instead.

Male patients reported problems with shaving on the operative side throughout the first postoperative year: 40% (4 of 10) at 3 months, 30% (3 of 10) at 6 months, 30% (3 of 10) at 9 months, and 20% (2 of 10) at 12 months. Discomfort and concern for potential injury were the main complaints in shaving.

Patients reported problems with combing their hair on the operative side throughout the first postoperative year: 10% (2 of 21) at 3 months, 18% (4 of 22) at 6 months, 11% (2 of 19) at 9 months, and 18% (4 of 22) at 12 months. Discomfort and hitting the ear with the comb were the main complaints in combing hair.

Patients reported problems with wearing earrings on the operative side throughout the first postoperative year:

![Figure 3. A patient 3 months postoperatively (A), 6 months postoperatively (B), 9 months postoperatively (C), and 12 months postoperatively (D). Areas outlined in dark green represent areas of anesthesia (ie, the patient did not respond to light touch). Areas outlined in red represent areas of paresthesia (ie, the patient felt an electrical, burning, or tingling sensation to light touch). The outcome in this patient is representative of the average sensory outcome.](image-url)
70% (7 of 10) at 3 months, 30% (3 of 10) at 6 months,
78% (7 of 9) at 9 months, and 40% (4 of 10) at 12 months.
Specific complaints included discomfort, increased sensi-
tivity, difficulty putting on and keeping on earrings, and
the need for a mirror to put on earrings. Although asked
about it in the questionnaire, none of the patients wore
hearing aids.

Patients reported the following problems associated
with GAN dysfunction: discomfort when sleeping on the
operative side, difficulty putting on and wearing glasses
(owing to uncertain placement on ear), discomfort when
being kissed or caressed in the operative area, difficulty
with the placement of a stethoscope in the operative side
ear (2 physicians were among the study sample), difficul-
ty using a curling iron (for fear of ear injury), inability
to sense whether or not long hair was tucked behind
the ear, and a sense of reduced hearing on the operative
side. Most patients reported discomfort when sleeping
on the operative side, especially in the first 3 months.

Ninety-one percent (20 of 22) had some type of func-
tional deficit in daily activities at some point in the post-
operative course. Overall, there was a steady improve-
ment in the numbers of patients without subjective func-
tional deficits in daily activities: 18% (4 of 22) at 3
months, 24% (5 of 21) at 6 months, 32% (6 of 19) at 6
months, and 45% (10 of 22) at 12 months. Some pa-
tients with early functional deficits regained their use at
a later point after surgery. Some patients developed prob-
lems later in the postoperative course. For some pa-
tients, the main problem was discomfort related to an-
esthesia, usually at the 3-month point; for others, the main
problem was discomfort related to paresthesia, usually
at the 6-month point.

We did not expect to have, nor did we have, enough
study subjects to achieve suitable statistical power for de-
termining statistically significant influential variables.
Figure 2 and Figure 3 show the GAN sensory dysfunc-
tion in 2 different patients at 3, 6, 9, and 12 months post-
operatively.

**COMMENT**

Anesthesia from GAN morbidity subsided continually
during the first postoperative year both in the percentage
of patients and amount in each patient (Table 2). The pres-
ence and span of paresthesia increased during the first
postoperative year (Table 3). However, the distribution
of paresthesia at 12 months in patients was less contiguous
and occupied less space within each region com-
pared with that of the 6-month period. In conjunction,
the patients also, on average, reported less paresthesia
(3.1 regions of 10) at 12 months than at 6 months (4.8
regions of 10) (Table 4). We conclude from this data that
on average the paresthesia ultimately lessened in severity
in the later half of the first postoperative year.

Through sensory testing, we found most often the fol-
lowing evolution of findings: early anesthesia followed
by paresthesia and referred sensation followed by nor-
mal sensation in later follow-up points. Recovery of GAN
function may occur for a number of reasons, including
the regeneration of the GAN nerve fibers; collateral in-

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Table 1. Characteristics and Outcomes in 22 Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at parotidectomy, mean (median), y</td>
<td>53 (54)</td>
</tr>
<tr>
<td>Range</td>
<td>31-74</td>
</tr>
<tr>
<td>≥60</td>
<td>8 (36)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>10 (45)</td>
</tr>
<tr>
<td>Women</td>
<td>12 (55)</td>
</tr>
<tr>
<td>Race†</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>13 (59)</td>
</tr>
<tr>
<td>Black</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Asian</td>
<td>5 (23)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Surgery</td>
<td>13 (59)</td>
</tr>
<tr>
<td>Enucleation</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Superficial parotidectomy</td>
<td>15 (68)</td>
</tr>
<tr>
<td>Total parotidectomy</td>
<td>6 (27)</td>
</tr>
<tr>
<td>Sternocleidomastoid flap†</td>
<td>2 (9)</td>
</tr>
<tr>
<td>Incision type</td>
<td></td>
</tr>
<tr>
<td>Modified face-lift</td>
<td>16 (73)</td>
</tr>
<tr>
<td>Modified Blair incision</td>
<td>6 (27)</td>
</tr>
<tr>
<td>Postoperative radiation therapy</td>
<td>2 (9)</td>
</tr>
<tr>
<td>Postoperative chemotherapy</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Marfan syndrome</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Polycystic kidney disease</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Post–liver transplant</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Postoperative complications</td>
<td></td>
</tr>
<tr>
<td>Salivoma</td>
<td>2 (9)</td>
</tr>
<tr>
<td>Hematoma</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>2 (9)</td>
</tr>
<tr>
<td>Neuroma</td>
<td>0</td>
</tr>
<tr>
<td>Numbness-related injury</td>
<td>0</td>
</tr>
</tbody>
</table>

‡With the sternocleidomastoid flap, preservation of the posterior branch is not possible.

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Table 2. Percentage of Patients With Anesthesia in Any and in Each of the Areas Supplied by the Great Auricular Nerve (GAN) at Different Postoperative Time Points

<table>
<thead>
<tr>
<th>Follow-up</th>
<th>Any Anesthesia, %</th>
<th>Average GAN Regions With Anesthesia, %</th>
<th>Region With Anesthesia, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Preauricular</td>
<td>Infra-auricular</td>
</tr>
<tr>
<td>3 Months</td>
<td>100 (21/21)</td>
<td>83 (5.8/7)</td>
<td>91</td>
</tr>
<tr>
<td>6 Months</td>
<td>96 (21/22)</td>
<td>51 (3.6/7)</td>
<td>32</td>
</tr>
<tr>
<td>9 Months</td>
<td>95 (18/19)</td>
<td>32 (2.2/7)</td>
<td>32</td>
</tr>
<tr>
<td>12 Months</td>
<td>50 (11/22)</td>
<td>18 (1.3/7)</td>
<td>5</td>
</tr>
</tbody>
</table>

*We removed the concha sensory results in determining the average percentage of regions with anesthesia present.

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sensation by the lesser occipital nerve, auriculotemporal nerve, trigeminal nerve, and transverse cutaneous nerve; and the patient's own psychological adaptation to the sensory loss. Paresthesia and referred sensations may be the result of an abundant or immature reinnervation of the skin overlying the sectioned branch. The differences in the scope and severity of paresthesias and hypothesis found in the patients in this study are likely due to biologic vagaries of wound healing.

The patient questionnaire scores for sensation and paresthesia (Table 4) generally correlated well with the results of the anesthesiometer testing. As expected, the satisfaction scores generally correlated with the sensation scores as they improved. The importance of full normal sensation being, on average, approximately a score of 7 to 8 throughout the first postoperative year may demonstrate that patients have only a moderate need for full sensation. On average, the pain, discomfort, and bothersome morbidity scores (Table 4) for patients were low at 3 months and continued to drop over the subsequent follow-up visits. These low scores show the low impact that GAN sensory dysfunction has on patients' lives. Scores for discomfort and bothersome morbidity being slightly higher than pain scores perhaps indicates the more appropriate descriptions for GAN sensory dysfunction.

Other authors have reported similar daily activity functional deficits with susceptibilities to injuries and burns; difficulties with telephone use, shaving, combing their hair, wearing earrings, and facial contact during intimacy; and discomfort wearing glasses. In this study, patients proportionately had the most problems with telephone use and wearing earrings and the least problems with shaving and combing their hair. For both telephone use and earring wearing, the percentage of patients with problems lessened in the middle of the first postoperative year and then increased at the later part of the year. Patients explained that this phenomenon was due to the annoyance and discomfort of the anesthesia subsiding but then being replaced by that of the paresthesia.

This study serves as a basis for comparison with studies of patients in whom the GAN was preserved. These prospective and retrospective studies, using various methods to assess nerve function, have shown that sensory loss is less, recovery of function is earlier, and that quality of life is higher in patients who had their GAN posterior branch preserved. Studies have reported that all patients who underwent preservation had no anesthesia by 6 months or by 12 months. Some evidence showed that the group who had undergone sacrifice of the GAN achieved a sensory recovery plateau by 6 months postoperatively and had dysfunction up to 2 years later. Another study showed that 90% of patients who had undergone sacrifice of the GAN had no anesthesia at a minimum of 8 years of follow-up. The patients in our study did not experience this type of recovery course. Half of the patients had no anesthesia at 12 months. Furthermore, at 12 months, patients, on average, had a fifth of the amount of anesthesia they had at 3 months. No sensory plateau occurred in our study; instead, we observed a continual abatement in sensory loss. Overall, on average, daily activity function also continually improved.

Preservation and posterior retraction of the nerve trunk and posterior branch seem technically possible and achievable approximately 70% of the time. Preservation should not be performed when the tumor is in close proximity to the posterior branch of the GAN. In addition, the posterior branch is not always present to be preserved. Because preservation is not possible in nearly a third of cases, more information about the neurological

Table 3. Percentage of Patients With Paresthesia in Any and in Each of the Areas Supplied by the Great Auricular Nerve (GAN) at Different Postoperative Time Points

<table>
<thead>
<tr>
<th>Follow-up</th>
<th>Any Paresthesia, %</th>
<th>Average GAN Regions With Paresthesia, %*</th>
<th>Region With Paresthesia, No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Months</td>
<td>43 (9/21)</td>
<td>13 (0.9/7)</td>
<td>Preauricular</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Intra-auricular</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Postauricular</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mandible Body Line</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lobule</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inferior Helix</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Superior Helix</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Concha</td>
</tr>
<tr>
<td>6 Months</td>
<td>82 (18/22)</td>
<td>38 (2.7/7)</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>9 Months</td>
<td>79 (15/19)</td>
<td>44 (3.1/7)</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>12 Months</td>
<td>86 (19/22)</td>
<td>48 (3.4/7)</td>
<td>55</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>68</td>
</tr>
</tbody>
</table>

*We removed the concha sensory results in determining the average percentage of regions with paresthesia present.

Table 4. Patient Questionnaire Scores (1-10) for Various Aspects of Great Auricular Nerve Sensory Function*

<table>
<thead>
<tr>
<th>Follow-up</th>
<th>Sensation Score</th>
<th>Paresthesia Score</th>
<th>Satisfaction With Sensory Function Score</th>
<th>Importance of Full Sensation</th>
<th>Pain Score</th>
<th>Discomfort Score</th>
<th>Bothersome Morbidity Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Months</td>
<td>4.9 (2-8)</td>
<td>2.8 (1-8)</td>
<td>5.2 (1-8)</td>
<td>7.7 (4-10)</td>
<td>3.9 (1-10)</td>
<td>3.1 (1-8)</td>
<td>4.1 (1-10)</td>
</tr>
<tr>
<td>6 Months</td>
<td>6.1 (3-9)</td>
<td>4.8 (1-9)</td>
<td>6.0 (3-9)</td>
<td>7.0 (3-10)</td>
<td>3.7 (1-8)</td>
<td>2.7 (1-6)</td>
<td>4.0 (1-10)</td>
</tr>
<tr>
<td>9 Months</td>
<td>7.4 (3-10)</td>
<td>3.8 (1-8)</td>
<td>7.3 (4-10)</td>
<td>7.0 (3-10)</td>
<td>2.7 (1-6)</td>
<td>2.7 (1-6)</td>
<td>3.1 (1-8)</td>
</tr>
<tr>
<td>12 Months</td>
<td>7.7 (2-10)</td>
<td>3.1 (1-10)</td>
<td>7.0 (2-10)</td>
<td>7.0 (2-10)</td>
<td>2.6 (1-9)</td>
<td>3.0 (1-8)</td>
<td></td>
</tr>
</tbody>
</table>

*Data are given as score (range).
ramifications of GAN sacrifice, as presented in this study, is important.

To our knowledge, no authors have attempted anterior branch preservation. Dividing the anterior branch is necessary to separate parotid fascia from the sternocleidomastoid muscle, raise the anterior skin flap, remove the nerve branch that is in close proximity to the tumor, and avoid injury to the marginal mandibular nerve. In one study supporting posterior branch preservation, there was no difference in the return of cheek skin sensation (GAN anterior branch distribution) between patients with sacrificed and preserved posterior branches of the GAN; 50% of both groups experienced significant sequelae. However, most studies have ignored altogether the anesthesia in the anterior branch distribution in their analysis.

Evidence does exist that suggests that GAN preservation may be unnecessary. Porter and Wood presented prospective controlled evidence that suggested no difference in the postoperative recovery whether or not the GAN was preserved. Also, Patel et al concluded that GAN sacrifice does not have a very large impact on patients' quality of life. In patients whose GAN was sacrificed, 23 (77%) reported only a little or no bother caused by the symptoms; 27 (90%) reported no or almost no interference with their daily lives. Authors of the preservation studies have explained that the temporary neurapraxia of the GAN is caused by intraoperative manipulation and devascularization of the posterior branch. Scar tissue associated with surgery may ultimately entrap the GAN and compromise or obliterate its function regardless of operative efforts.

This prospective study provides more details about the character and evolution of the sensory sequelae, functional deficits, and patients' perspectives related to GAN morbidity. We feel that the data in this study can also be generalized to other surgical areas such as rhytidectomy, neck dissection, neck mass resection, trauma, or GAN cable graft use, all of which likely would leave patients with postoperative symptoms similar to those described herein. We feel that it is important to be able to provide patients with a more detailed explanation of what to expect with GAN recovery in the first postoperative year. With reassurance, we hope that patients will have increased satisfaction and a decreased amount of anxiety with the results of the operation.

This study used monofilament anesthesiometers to determine multiple points of light touch dysfunction in the GAN-associated area whereas other studies tested only a few representative points. We used the Semmes-Weinstein anesthesiometers because of their reliability, reproducibility, and simplicity, as others have. We did not assess thermal, pain, 2-point discrimination, or vibration sense as other studies have. We felt that light touch would be the most important, telling, accurate, reliable, and efficient way of determining the sensory function of the GAN.

Limitations of this study include the following: we experienced some loss of patients at follow-up, which compromised the consecutive character of the original patient cohort. In using 3 different surgeons, significant unknown differences in operative technique may bring bias to the study. Only 1 operator (W.R.R.) performed all of the sensory exams. The test-retest reliability of sensory testing, thus, is a potential source of bias. The subjective nature of patients' comprehension and rating of their sensory function could have brought error to the study. For example, 3 patients reported that they felt the paresthesias only during anesthesiometry testing and not in their daily life. Our use of a 4.31-J anesthesiometer bases our definitions of anesthesia and paresthesia on this amount of force. Other amounts of standardized force could have resulted in different sensory findings. Sensory dysfunction may vary day to day and hour to hour. Our analysis captures only 4 discrete time points for each patient.

CONCLUSIONS

The impact of GAN sacrifice morbidity on patient sensory function and quality of life is tolerable and generally improves during the first postoperative year. The prevalence and average area of anesthesia decreased continually during the first year, according to sensory testing and patient scoring. Half of the patients had no anesthesia at 12 months. Paresthesias are a very common part of the postoperative course of a patient who has undergone GAN sacrifice. The prevalence and average area of paresthesia increased during the first year according to sensory testing; however, the contiguity and subjective scoring of paresthesia peaked at 6 months and decreased in subsequent follow-up. Most patients had difficulty using the telephone, shaving, combing their hair, wearing earrings, and sleeping on the operative side because of both anesthesia and paresthesia. The collective prevalence of these functional deficits improved continually during the first postoperative year.

The recovery of the GAN seems to follow the progression from anesthesia to paresthesia with referred sensation to complete sensation. We can offer patients reassurance about any of these symptoms.

We compare the sensory dysfunction of the patients in this study with that in studies of patients in whom the posterior branch was preserved. Although we have not provided evidence showing that preservation of the posterior branch would necessarily result in mitigation of resultant sensory dysfunction, we feel that GAN morbidity is relatively bothersome enough to warrant efforts to preserve the posterior branch of GAN when possible and appropriate. In sparing the posterior branch of the GAN, it may be possible to decrease sensory dysfunction and improve quality of life. Studies of GAN morbidity in the second postoperative year and more randomized-controlled trials comparing nerve sacrifice and preservation are needed.

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Correspondence: William R. Ryan, MD (Resident), Department of Otolaryngology–Head and Neck Surgery, Stanford University School of Medicine, 801 Welch Rd, Stanford, CA 94306 (williamryan@stanford.edu).
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