Surgery for large vestibular schwannomas: how patients and surgeons perceive quality of life

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Object. The aim of this study was to assess the consequences of total removal of a large vestibular schwannoma on the patient’s symptoms and quality of life (QOL).

Methods. A questionnaire regarding preoperative and postoperative symptoms with measures of both daily and global QOL and a modified 36-Item Short Form Health Survey (SF-36) QOL instrument were sent to 103 patients who had undergone surgery via a retrosigmoid approach for total removal of a Grade III or IV vestibular schwannoma. In addition, 48 patients underwent follow-up clinical examinations to assess their conditions.

Seventy-two of the 103 patients completed and returned the questionnaire. Forty-six (64%) of the schwannomas were Grade IV and 26 (36%) were Grade III. The patients’ pre- and postoperative symptoms were similar to those reported in other studies. The patients’ perceptions of facial movement were likely to be worse than the clinicians’ estimation based on the House–Brackmann classification. All scores in the QOL categories were significantly reduced when compared with normative data. Patients with large vestibular schwannomas had lower scores in all SF-36 categories except pain compared with data from other studies. Psychological problems were the preponderant symptoms, and their presence was the most powerful predictive variable for global and daily QOL.

Conclusions: Surgery for a large vestibular schwannoma has a significant impact on the patient’s QOL. To improve QOL postoperatively, the patient should be prepared and well informed of the consequences of such a surgery on QOL. Clinicians must be aware that early involvement of a clinical psychologist may be very helpful.

KEY WORDS • vestibular schwannoma • acoustic neuroma • quality of life • 36-Item Short Form Health Survey

Although vestibular schwannomas are benign tumors characterized by slow growth, they may be locally destructive because they erode the internal auditory canal and compress the lower cranial nerves. Large tumors may be associated with compression of the brainstem or obstruction of cerebrospinal fluid pathways, with resultant symptomatic hydrocephalus. Estimation of outcome following vestibular schwannoma surgery tends to be based primarily on the surgeon’s perspective, concentrating on surgical approach, complications, facial nerve preservation, and mortality rate. Since the 1990s, more attention has been paid to patients’ assessments of QOL after surgery, which are sometimes obtained using generic QOL questionnaires that allow comparisons with population norms and results of other studies. As pointed out in an editorial by Farace and Marshall, most studies have focused on rates of specific symptoms to evaluate QOL rather than including open-ended questions to evaluate global and daily QOL. The aim of the present study was to assess the consequences of excision of a large vestibular schwannoma on patients’ symptoms, employment status, and facial function. Quality of life was evaluated using the SF-36 QOL questionnaire, and global and daily QOLs were measured by using open-ended questions. The results were analyzed to determine interrelationships among factors and are discussed to develop strategies for patients harboring large vestibular schwannomas.

Clinical Material and Methods

Patient Population

Our series was composed of 103 consecutive patients who underwent surgery for Grade III or IV tumors. Cases treated between 1982 and 2001 were selected. The study was approved by the Lausanne Health Ethics Committee. Classification by tumor size was based on the Koos grading system. A retrosigmoid transmeatal approach was performed in each patient by the same surgeon (N.d.T.) to treat...
a unilateral vestibular schwannoma. This approach is the one most frequently used in neurosurgery; it allows good control and exposure of the brainstem, cranial nerves, and vascular structures, and provides good anatomical and functional preservation of the seventh and eighth cranial nerves.

A questionnaire booklet consisting of an inventory of pre- and postoperative symptoms and postoperative outcomes derived from the Wiegand and Fickel questionnaire, together with a modified SF-36 QOL instrument and additional open-ended questions derived from the Barham and Stephens questionnaire, was sent to each patient (Table 1). Responses to the open-ended questionnaire were classified for global and daily QOL into three categories: unchanged, better, and worse. Daily activities were classified into seven categories: cooking, driving, eating, socializing, sleeping, walking, and working. The SF-36 is a self-rating patient questionnaire composed of eight multiple-item function scales used to measure physical ability, social functioning, health, pain, emotional status, and vitality. All measurements have been linearly transformed such that all the scales range from 0 to 100, with higher scale scores representing a higher level of functioning for the function multi-items. The item related to physical ability was not analyzed because of the patients' inadequate responses to this item.

Patients were also asked to assess their own facial functions by using a self-evaluate scale in which they assessed the percentage of movement derived from the Brackmann and Barrs questionnaire. Raw data were converted to House–Brackmann grades. All patients were invited to undergo a clinical examination to assess their complaints. During this examination, facial nerve function was evaluated by an independent otolaryngologist (K.N.). If it was not possible to examine the patient, results of the 1-year postoperative clinical evaluation were derived from the medical record. These methods allow a comparison between the patient's self-estimation and the clinician's determination of facial nerve function at the time the questionnaire was completed.

All data were analyzed using SPSS software for Windows (SPSS, Inc., Chicago, IL). Nonparametric methods were used. A stepwise regression analysis was applied to variables determined to be significant by the univariate analysis. A logistic regression analysis was performed to determine the OR with 95% CIs. A probability value less than 0.05 was considered significant.

**Results**

Seventy-two questionnaires were returned, yielding a 70% response rate. Thirty-one patients did not respond. The mean age of the nonrespondents was 50.7 years; 64.5% were men and 35.5% women. The ratios of men to women were equally represented in patients with Grade III and Grade IV schwannomas.

In the respondent subgroup, the mean age of the patients was 50.8 years; 57% were women, and 43% were men. Twenty-six (36%) patients had Grade III tumors, and 46 (64%) patients had Grade IV tumors. The mean time elapsed since surgery at questionnaire completion was 91 months (7.6 years) with a range of 6 to 228 months (19 years). The frequencies of pre- and postoperative symptoms are summarized in Tables 2 and 3.

**Working Capacity**

Seventy-six percent of the patients were employed before surgery. After surgery, 15% of the respondents reported a change of employment. Sixty-two percent of the respondents returned to work at 100% capacity, 5% at 75% capacity, 7% at 50% capacity, and 4% at 25% capacity. Twenty-two percent of the respondents never returned to work and most (54%) of the patients who did return to work did so within 6 months postoperatively.

**Facial Nerve Function**

Seventy-eight percent of the respondents noted a deficit in facial movement postoperatively. Three patients (4%) reported absence or little movement of the face, a capacity corresponding to House–Brackmann Grades V and VI. According to the clinician's estimation of facial nerve function, most patients displayed good facial movements, and no patient had complete facial nerve paralysis. Seven patients underwent plastic surgery to recover facial motion corresponding to House–Brackmann Grades III and IV. All results concerning postoperative facial nerve function are summarized in Table 4. In four patients, when the facial nerve had to be sacrificed at the time of tumor resection, an end-to-end facial nerve anastomosis was performed. Two years after surgery, a clinical examination showed partial recovery of facial movement in 50% of these patients.

**Quality of Life**

**Comparison With Norms.** The patients' mean scores on the SF-36 QOL questionnaire together with the standard deviation and range for the seven categories that were compared with norms are given in Table 5. Compared with population norms the patients had very low mean scores for emotional status, physical ability, and social functioning.

The mean scores in the present study were compared with those of surgically treated patients in other studies. The results of this comparison are given in Table 6. The scores were lower in all categories except physical pain in patients undergoing surgery for a large vestibular schwannoma.

**Sex of Patient.** Thirty-three men and 29 women completed the questionnaire. In all seven categories, women scored lower than men. When an analysis was performed using the Mann–Whitney U-test, a trend among women was shown for less vitality (p = 0.055), and statistically significant lower scores for women were demonstrated for physical ability
Quality of life after surgery for large vestibular schwannoma

TABLE 2
Preoperative symptoms in patients with vestibular schwannomas in the present series compared with those in other studies*

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>tumor size</td>
<td>all</td>
<td>large</td>
<td>all</td>
<td>large</td>
</tr>
<tr>
<td>mean age (yrs)</td>
<td>52.3</td>
<td>46.1</td>
<td>52</td>
<td>50.7</td>
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<tr>
<td>men (%)</td>
<td>37.7</td>
<td>46.8</td>
<td>53</td>
<td>43</td>
</tr>
<tr>
<td>hearing loss (%)</td>
<td>85</td>
<td>93.7</td>
<td>83</td>
<td>90</td>
</tr>
<tr>
<td>tinnitus (%)</td>
<td>54</td>
<td>73.7</td>
<td>68</td>
<td>54</td>
</tr>
<tr>
<td>balance problems (%)</td>
<td>61</td>
<td>57.4</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>facial numbness (%)</td>
<td>34</td>
<td>31.6</td>
<td>23</td>
<td>37</td>
</tr>
<tr>
<td>headache (%)</td>
<td>NR</td>
<td>44.7</td>
<td>NR</td>
<td>42</td>
</tr>
<tr>
<td>facial nerve weakness (%)</td>
<td>13</td>
<td>4.7</td>
<td>NR</td>
<td>11</td>
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</tbody>
</table>

* NR = not reported.

(p = 0.027). Women reported more psychological (p = 0.043, Fisher exact test) and balance (p = 0.003, Fisher exact test) problems than men.

Age of Patient. The mean age of the respondents was 50.8 years (range 18–78 years). Age was dichotomized into two categories: 55 years of age or younger, and older than 55 years of age. Although age was not statistically significant in any category, all categories of the SF-36 showed a trend for patients 55 years of age or younger to have lower SF-36 scores than older patients.

Facial Function. Twenty-one patients reported a postoperative House–Brackmann Grade I or II outcome. Forty-eight patients reported a Grade III or IV, and three patients a Grade V or VI outcome. When the clinician’s estimation of facial nerve function was taken into account, no patient was considered to have complete facial nerve paralysis. Facial function was divided into two categories: patients with House–Brackmann Grades I to III, and those with Grades IV to VI. When an analysis was performed using the Mann–Whitney U-test, there was a statistically significant probability that the mental health (p = 0.014), emotional status (p = 0.006), and general health (p = 0.004) of patients with Grades IV to VI would be affected. In all seven SF-36 categories, patients with facial function between Grades IV and VI scored lower than those with a Grade between I and III. Postoperative facial disorders was correlated with the presence of psychological disorders (Spearman r = 0.279, p = 0.017) and tumor size (r = 0.289, p = 0.014).

Presence of Balance Problems. Postoperative balance problems were reported by 52 patients (72.2%). Patients with balance problems scored lower in all seven categories of the SF-36 QOL questionnaire, with statistically significant values for vitality (p = 0.02) and social functioning (p = 0.009). Physical functioning was not scored. As mentioned before, there was a correlation between sex and balance problems. A significant negative correlation was found between the time since surgery and the presence of balance problems (r = −0.269, p = 0.022). Patients with balance problems also reported tinnitus (p = 0.001, Fisher exact test).

Presence of Headache. Thirty-seven patients (51.4%) experienced persistent postoperative headaches. Patients with headaches scored lower in six of the seven categories (mental health was not affected), but only scores for the categories of physical ability (p = 0.035) and physical pain (p = 0.009) had statistically significant lower values. There was a significant correlation between headache and tinnitus (p = 0.001, Fisher exact test).

Presence of Psychological Problems. Anxiety, nervousness, and depression were reported by 22 patients (30.6%). In these patients, statistically significant lower scores were found in six of the seven categories: physical pain (p = 0.02), emotional status (p = 0.011), general health (p = 0.007), vitality (p = 0.005), physical ability (p = 0.003), and mental health (p = 0.003). Scores for social functioning were also lower among these patients than among those without psychological problems, but the mean value was not statistically significant. A stepwise regression analysis showed no significant independent factor among nine variables determined as significant by univariate analysis: sex, age, time since surgery, presence of hearing loss, tinnitus, balance problems, headache, facial function, and tumor size.

Time Since Surgery. The mean time elapsed since surgery at questionnaire completion was 91 months (7.6 years). The time since surgery was divided into three categories: 6 months to 5 years, longer than 5 years to 10 years, and longer than 10 years. The numbers of patients in these groups were equally distributed. Patients who had undergone surgery between 6 months and 5 years before they filled out the questionnaire had better SF-36 scores in all categories than those in other groups (except for social functioning when compared with patients who had undergone surgery longer than 10 years before completing the questionnaire), but no statistically significant difference was found. As mentioned earlier, a significant negative correlation was found between

TABLE 3
Symptoms in patients after surgery for vestibular schwannomas in the present series compared with those in other studies (%)*

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>type of surgery</td>
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<td>RS</td>
<td>TL</td>
<td>TL</td>
<td>RS</td>
</tr>
<tr>
<td>tumor size</td>
<td>all</td>
<td>all</td>
<td>large</td>
<td>large</td>
<td>all</td>
</tr>
<tr>
<td>hearing loss</td>
<td>94.3</td>
<td>65.0</td>
<td>100</td>
<td>96</td>
<td>90</td>
</tr>
<tr>
<td>tinnitus</td>
<td>59</td>
<td>35</td>
<td>—</td>
<td>57</td>
<td>50</td>
</tr>
<tr>
<td>balance problems</td>
<td>67</td>
<td>56</td>
<td>—</td>
<td>78</td>
<td>74</td>
</tr>
<tr>
<td>facial nerve dysfunction</td>
<td>63</td>
<td>45</td>
<td>47.3</td>
<td>63</td>
<td>78</td>
</tr>
<tr>
<td>headache</td>
<td>66</td>
<td>9</td>
<td>uncommon</td>
<td>47</td>
<td>51</td>
</tr>
<tr>
<td>psychological problems</td>
<td>69</td>
<td>NR</td>
<td>NR</td>
<td>24–37</td>
<td>31</td>
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</tbody>
</table>

* MF = middle fossa; RS = retrosigmoid; TL = translabyrinthine; — = not applicable.
the time since surgery and the presence of balance problems ($r = -0.269$, $p = 0.022$). A significant negative correlation was also found between the time since surgery and the presence of tinnitus ($r = -0.356$, $p = 0.002$).

**Presence of Hearing Loss and Tinnitus.** Postoperative hearing loss was reported by 65 patients (90%) and tinnitus by 36 patients (50%). The SF-36 scores were lower in patients affected by hearing loss and tinnitus than in those not affected; however, no statistically significant difference could be demonstrated. The presence of hearing loss was not correlated with any other QOL parameter.

**Overall Presence of Symptoms.** Women reported more postoperative symptoms than men ($p = 0.01$, Mann–Whitney U-test). The number of postoperative symptoms was divided into two categories: patients with one to three postoperative symptoms and patients with three or more postoperative symptoms. Using the Mann–Whitney U-test, there were statistically significant lower scores in physical pain ($p = 0.041$), physical ability ($p = 0.036$), vitality ($p = 0.01$), and social functioning ($p = 0.01$) in patients with three or more symptoms.

Tumor size did not influence the SF-36 scores but affected the outcome of facial function ($p = 0.015$). Patients unable to work for longer than 6 months postoperatively showed lower scores in all seven SF-36 categories, but no statistically significant differences were found between patients being unable to work for longer than 6 months and those who returned to work within 6 months. No differences in SF-36 scores were detected between patients who underwent clinical examination and those who did not.

**Global QOL.** Thirty-four patients considered their global QOL unchanged; 27 patients, worse; and 11 patients, much better. To perform a stepwise regression analysis, we considered the 11 patients with a much better global QOL to have an unchanged QOL. The stepwise regression analysis showed two significant independent factors (facial nerve dysfunction and the presence of psychological problems) among 10 variables determined significant by the univariate analysis (Table 7). A logistic regression analysis of these two independent variables showed an OR of 2.8 (95% CI 1.5–5.2) for facial nerve dysfunction and an OR of 27.7 (95% CI 4–191.5) for psychological problems.

**Daily QOL.** Forty-nine patients reported an unchanged daily QOL, 23 considered their daily QOL to be worse, and none reported a better daily QOL following surgery. The stepwise regression analysis showed one significant independent factor (presence of psychological problems) among 10 variables determined to be significant by the univariate analysis (Table 7). A logistic regression analysis of the one independent variable showed an OR of 4.8 (95% CI 1.3–18.1) for psychological problems. Patients with facial nerve dysfunction mentioned at least four daily activities that were affected (in order of importance): socializing, eating, cooking, and sleeping. For those with hearing loss, three daily activities were affected: socializing, working, and driving. Psychological problems affected three daily activities: working, socializing, and sleeping. Headache affected working and sleeping, and balance problems affected walking and driving.

**Discussion**

In the last decade, vestibular schwannoma surgery has led to a substantial improvement in the mortality rate as well as in facial nerve function and hearing preservation.2,9,26–27 This has reportedly led to an improvement in patients’ QOLs and surgeons’ satisfaction.21,23 The use of radiosurgery has achieved good tumor control, especially for small- and medium-sized vestibular schwannomas.11,22,24,32 In elderly patients, treatment should be reserved for tumors that have been shown to have clear progression on neuroimaging.22 A challenge remains regarding large tumors, be-

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**TABLE 4**

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<tbody>
<tr>
<td>type of surgery</td>
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<td></td>
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<tr>
<td>tumor size</td>
<td>TL &amp; MF</td>
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<td>TL</td>
<td>RS</td>
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<tr>
<td>facial nerve function*</td>
<td>patient’s self-estimation (%)</td>
<td>Grades I–II</td>
<td>Grades III–IV</td>
<td>Grades V &amp; VI</td>
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<tr>
<td></td>
<td>Grades I–II</td>
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<td></td>
<td>Grades III–IV</td>
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<td>—</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Grades V &amp; VI</td>
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<td>—</td>
<td>7</td>
</tr>
<tr>
<td>clinician’s determination (%)</td>
<td>Grades I–II</td>
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<td>68</td>
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<td></td>
<td>Grades III–IV</td>
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<tr>
<td></td>
<td>Grades V &amp; VI</td>
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</table>

* Based on the House–Brackmann classification.

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**TABLE 5**

<table>
<thead>
<tr>
<th></th>
<th>Jenkinson, et al., 1993</th>
<th>Ware, 1993</th>
<th>Leplege, et al., 1998</th>
<th>Present Study</th>
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<tr>
<td>physical pain</td>
<td>81.5*</td>
<td>75.2</td>
<td>74.3</td>
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<td>general health</td>
<td>72.7</td>
<td>72</td>
<td>69</td>
<td>68.2</td>
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<tr>
<td>mental health</td>
<td>74*</td>
<td>74.7*</td>
<td>67.8</td>
<td>66.8</td>
</tr>
<tr>
<td>vitality</td>
<td>61.4*</td>
<td>60.9*</td>
<td>61.4*</td>
<td>55.1</td>
</tr>
<tr>
<td>emotional status</td>
<td>83.1*</td>
<td>81.3*</td>
<td>80.9*</td>
<td>67.1</td>
</tr>
<tr>
<td>physical ability</td>
<td>85.8*</td>
<td>80.6*</td>
<td>80.7*</td>
<td>56.6</td>
</tr>
<tr>
<td>social functioning</td>
<td>88.1*</td>
<td>83.3*</td>
<td>80.7*</td>
<td>65.8</td>
</tr>
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</table>

* Statistically significantly different from the present study ($p < 0.05$).
The aim of this study, therefore, was to assess the consequences of the excision of a large vestibular schwannoma from the patient’s perspective, by using a combination of a structured QOL questionnaire and open-ended questions.

Preoperative Symptoms

In our cohort of patients, most patients with large vestibular schwannomas presented with symptoms lasting longer than 1 year before the diagnosis was made, and sometimes longer than 5 years beforehand. Hearing loss was a concern in 90% of our patients, a rate 5 to 7% higher than those reported for other series of patients with various tumor sizes, which confirms that hearing loss is an early-stage symptom. The surprising finding that balance problems concerned only 50% of our patients is confirmed by the results of a study conducted by Lanman and colleagues, in which 57.4% of patients had balance problems. Headache seemed to be an even more prevalent symptom, but the lack of information from other studies does not allow us to confirm this finding.

Postoperative Symptoms

The rates of postoperative symptoms in this study were similar to those in other series in which other operative approaches were used. The incidence of postoperative symptoms depends more on the surgeon’s experience and ability than on the surgical approach. Chronic headaches are a real problem after schwannoma surgery, especially when the retrosigmoid approach has been used. The bone flap was replaced in all of our patients, and only focal pain was experienced. Some patients continued to have headaches years after the operation. The origin of the headaches is probably multifactorial. They may be related to compression or section of the greater occipital nerve, but the persistence and chronicity of the pain may be related to the presence of psychological disturbances. In the present series, the retrosigmoid approach caused approximately the same rates of headache and balance problems as those reported following the use of other surgical approaches.

TABLE 6
Comparison of mean SF-36 scores in the present study with other studies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Kelleher, et al., 2002</th>
<th>Betchen, et al., 2003</th>
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<tr>
<td>physical pain</td>
<td>77.2</td>
<td>60.5*</td>
<td>72.5</td>
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<tr>
<td>general health</td>
<td>68.6</td>
<td>71.3</td>
<td>68.2</td>
</tr>
<tr>
<td>mental health</td>
<td>67.2</td>
<td>71.5*</td>
<td>66.8</td>
</tr>
<tr>
<td>vitality</td>
<td>60.3*</td>
<td>63.8*</td>
<td>55.1</td>
</tr>
<tr>
<td>emotional status</td>
<td>75.4</td>
<td>73.9</td>
<td>67.1</td>
</tr>
<tr>
<td>physical ability</td>
<td>57.9</td>
<td>71.7*</td>
<td>56.6</td>
</tr>
<tr>
<td>social functioning</td>
<td>68.8</td>
<td>79.8*</td>
<td>65.8</td>
</tr>
</tbody>
</table>

* Statistically significantly different from the results in the present study (p < 0.05).

The postoperative loss of facial nerve function is a major sequela of surgery for large vestibular schwannomas. In our series, facial nerve dysfunction occurred in 78% of the cases. As mentioned in previous studies, the patient’s perception of facial movement is likely to be worse than the clinician’s determination based on the House–Brackmann method of classification. The physician has a tendency to underestimate the handicap of the patient. From the clinician’s point of view, no patient presented with complete facial nerve paralysis, perhaps because 10% (seven patients)

patients who had undergone surgery via the retrosigmoid approach had significantly more severe headaches than patients in whom other approaches were used. Our results could be explained by the time elapsed since surgery at the time of questionnaire completion. It is striking to note the lack of reports on patients’ assessments of postoperative symptoms. Indeed, most studies have limited their focus to the potentially biased determination of functional outcomes by the clinician. Psychological problems such as nervousness, anxiety, and depression, as mentioned by Pellet and colleagues, seem to be common symptoms, although they are less frequent than tinnitus and headache. Patients must be informed that they will continue to have similar symptoms to those experienced preoperatively, and that their QOL may be worse even though total tumor removal will be achieved.

Working Capacity

Regarding working capacity, most (62%) of our patients returned to work, and 54% of those did so within 6 months. These figures represent lower recovery rates than those cited by Tos and associates (76% of patients returned to work within 6 months). In our study, patients who had harbored a large tumor prior to surgery resumed their occupations significantly later than patients who had undergone surgery for a small tumor. Thus, despite varying tumor sizes, social security systems, and labor market legislations, the rates of recovery of preoperative working capacity suggest that surgery for a large vestibular schwannoma remains economically advantageous. Among the 22% of patients who never returned to work, most of them were retired at the time of questionnaire completion; if this had not been the case, the rate of recovery in our study could have been even higher.

Facial Nerve Function

The postoperative loss of facial nerve function is a major sequela of surgery for large vestibular schwannomas. In our series, facial nerve dysfunction occurred in 78% of the cases. As mentioned in previous studies, the patient’s perception of facial movement is likely to be worse than the clinician’s determination based on the House–Brackmann method of classification. The physician has a tendency to underestimate the handicap of the patient. From the clinician’s point of view, no patient presented with complete facial nerve paralysis, perhaps because 10% (seven patients)
underwent plastic surgery to recover facial motion corresponding to House–Brackmann Grades III and IV. In our experience (four cases), an end-to-end facial nerve anastomosis produced an acceptable recovery of facial motion 2 years after surgery (House–Brackmann Grade III). This suggests that immediate end-to-end facial nerve anastomosis, when possible, is a useful procedure. The policy of the senior author (N.D.T.) is always to attempt total resection for large vestibular schwannomas. Taking into account the results of the present study and the results of radiosurgery presented in other studies,\textsuperscript{11,22,24,32} however, surgeons may consider the option of subtotal removal, with the goal of preserving complete facial nerve function. This could be followed by radiosurgery in cases in which a small amount of residual tumor is tightly adherent to or infiltrates the facial nerve.

\begin{center}
\textbf{Quality of Life}
\end{center}

We compared QOL scores in our patients with normative data provided by the study conducted by Leplege and coworkers.\textsuperscript{17} The scores of our patients were computed as percentages of these normative data. We found significantly reduced values in all SF-36 categories, in particular, physical ability (70\%, \textit{p} < 0.001), social functioning (81.5\%, \textit{p} < 0.001), emotional status (83\%, \textit{p} < 0.01), and vitality (90\%, \textit{p} < 0.01). Compared with surgically treated patients described in other studies,\textsuperscript{2,14} our patients had lower scores for all SF-36 categories except physical pain. This finding may be due to different patient populations (in our study, we included only patients harboring large vestibul\-lar schwannomas) and different surgical approaches used (in our study, we exclusively used the retrosigmoid approach). Supported by other studies,\textsuperscript{2,18} women scored lower in all SF-36 categories. They also had significantly more balance problems, more psychological difficulties, and overall more symptoms than men. This difference has been also noted by Cross and colleagues,\textsuperscript{4} who measured the psychological distress in patients after vestibular schwannoma surgery and found that women experienced more distress. This finding may well explain the higher prevalence of other postoperative symptoms in women. The finding that patients 55 years of age or younger had lower SF-36 scores than older patients differs from the findings of other studies.\textsuperscript{2,10} This could be explained by the fact that younger patients may not have had important medical problems previously (they probably had not undergone a major surgery in the past), whereas older patients may have already experienced more medical problems and therefore were able to cope better with a new loss of capacities.

The discrepancy between patients’ and clinicians’ estimations of facial nerve function, as reported in other studies,\textsuperscript{14,18,31} is also present in our study. When such a discrepancy exists, an underlying psychological disorder must be suspected. Statistically significant associations have been found between the presence of House–Brackmann Grades IV to VI facial nerve dysfunction and effects on general health, emotional status, and mental health. It is well known that patients with facial disfigurement will experience various psychological problems that affect their general health. A correlation exists between the patient’s self-estimation of facial nerve function and the presence of psychological difficulties, but facial nerve function is not a contributing factor to the occurrence of psychological disorders. This finding is different from that of Cross and associates,\textsuperscript{4} who found no statistically significant association between the level of psychological distress and the grade of facial palsy. In an attempt to find a reason for this difference, we graded facial nerve function during a clinical examination; when such an examination was not possible, we referred to the patient’s medical record. In the study conducted by Cross and colleagues, facial nerve function grading was performed in most cases (74 of 103) by the patients themselves who used a facial nerve function questionnaire. This bias probably explains the finding of Cross and coworkers. It is well known that postoperative facial nerve function also depends on tumor size with better preservation shown for small tumors.\textsuperscript{27}

Balance problems are prominent postoperative symptoms; this seems to be especially the case for large vestibular schwannomas. Our study makes this observation objective by showing lower scores in all seven categories of the SF-36 questionnaire in patients with balance problems, with statistically significant probability values for vitality and social functioning.\textsuperscript{18} The severity of balance problems is correlated with a short period since surgery. This finding was clearly demonstrated in the study of Wiegand and Fickel,\textsuperscript{31} in which balance problems tended to diminish with time after surgery.

Headaches affected six of the seven SF-36 scores with the most significant impact on physical pain. The rate of postoperative headache is the same as that in other studies in which a different surgical approach (via the translabyrinthine and middle fossa) was used,\textsuperscript{18,21} but differs from the findings of Tos and colleagues,\textsuperscript{28} who noted that patients who underwent surgery for large tumors had better outcomes, notably regarding headaches, than patients who underwent surgery for small tumors.

Patients with psychological problems showed significantly lower scores in all SF-36 categories except social functioning, but no contributing factor for psychological difficulties could be identified. Our study confirms that tinnitus may be of relatively minor importance in the overall QOL of patients after surgery for large acoustic neuromas.\textsuperscript{7} In our opinion, tinnitus, which was present at approximately the same rate before and after surgery, is a factor in worsened psychological problems and headaches. The results of our study suggest that tinnitus diminishes with time following surgery. Although hearing loss was a frequent postoperative complaint, it was not correlated with any other QOL parameter, indicating that hearing loss may also be of relatively minor importance in the overall QOL of patients after surgery for large vestibular schwannomas.

In our series, there was a trend for patients unable to work for longer than 6 months to have lower scores in all seven SF-36 categories. In addition to those who never returned to work, some patients retired after surgery and were therefore considered nonworkers.

Our results regarding the patients’ overall postoperative global QOL in comparison with their preoperative statuses are better than those reported in the study of Nikolopoulos and coworkers,\textsuperscript{19} who assessed QOL after surgery for acoustic neuromas of various sizes. During the follow-up period, 27 patients (38\%) reported a worse overall QOL, and 45 patients (62\%) reported having the same or better QOL. These percentages contradict results reported by Irving and coworkers,\textsuperscript{15} who found that patients with tumors
smaller than 1.5 cm had a better postoperative QOL than patients with tumors larger than 1.5 cm. One possible explanation of why operating on larger tumors can have a better impact on QOL could be that patients may believe that they have escaped death, despite the fact that the mortality rate has declined during the past 20 years to less than 1% in most large centers.

Facial function is a contributing factor to global QOL. Plastic surgery is sometimes useful, as demonstrated in seven patients who underwent voluntary plastic surgery with satisfactory functional outcomes. The presence of psychological difficulty is a major worsening factor for global QOL. Hence, a reduction in anxiety and depression is supposed to improve the patient’s global QOL. To reach this goal, patients need support from a psychologist or psychiatrist. Nevertheless, patient associations sometimes provide adequate support to people who want to share and discuss common problems and receive advice. In accordance with our study, young women were particularly susceptible to psychological problems and have a corresponding reduction in their global QOL following this type of surgery.

Our results regarding overall postoperative activities compared with preoperative status showed that 100% of patients reported unchanged or impaired postoperative activities. These findings are similar to those mentioned in the report of Nikolopoulos and coworkers, which suggests that such patients who underwent surgery are unlikely to improve their QOL in the short or medium term; and that additional new symptoms resulting from surgery will always be a source of disappointment for these patients. In our series, no patient mentioned participation in more activities after the operation; this result highlights the negative effect of the operation on a patient’s social life. An interesting piece of information was provided by the analysis of the number of daily activities affected. The impairment that affected most daily activities, facial nerve dysfunction, was not a contributing factor to the patient’s daily QOL. Again, the presence of psychological problems is the factor that contributed most to the daily QOL; successful treatment of this factor will improve the daily QOL.

Conclusions

Although some methods used to define and measure QOL can be criticized from a technical point of view, our study indicates that QOL questionnaires are useful tools for assessing the patient’s point of view. To obtain a more accurate assessment of the overall condition, however, patients should participate in an interview and undergo a clinical examination to evaluate their complaints. Postoperative psychological problems seem to affect global and daily QOL much more than previously thought, which suggests that, for some patients, especially young women, the early involvement of a clinical psychologist may be very helpful. Facial nerve dysfunction reduces the global QOL at a lower rate, but it affects a significant number of daily activities. In contrast to psychological difficulties, however, patients seem to cope reasonably well with facial nerve dysfunction.

Surgery is indicated for the treatment of small- and medium-sized vestibular schwannomas (Grades I–III). The resulting QOL matches that after radiosurgery. Surgery remains a necessary treatment for vestibular schwannomas, especially Grade IV lesions. However, it has a significant impact on a patient’s QOL. Patients must be well informed of the consequences of such a surgery. As an alternative, fractionated stereotactic radiotherapy shows encouraging preliminary results.

References


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