Self-assessed quality of life after acoustic neuroma surgery

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Object. The aim of this study was to determine if factors such as postoperative hearing, facial function, headaches, or other factors have an impact on self-assessed quality of life (QOL) after acoustic neuroma surgery.

Methods. The SF-36 and seven additional questions on the impact of surgery on the QOL were sent to 135 consecutive patients who had undergone acoustic neuroma surgery. The Spearman rho correlations were calculated for each of the eight categories of the SF-36 (general health, physical functioning, physical role limitations, emotional role limitations, mental health, energy/vitality, pain, social functioning). The results were correlated with patients’ sex, age, persistent headache, years since surgery, postoperative hearing level, and facial function.

The response rate was 74.8%. The transformed scores of the eight categories of the SF-36 were lower than age-matched healthy controls in approximately half of the categories. The strongest trend toward lower scores with statistical significance in two categories was persistent headaches. Some categories demonstrated trends toward lower scores with females or age older than 55 years. Postoperative hearing and facial functioning, and time since surgery showed no statistically significant impact on QOL measured by the SF-36. Responses to the additional questions indicate that hearing, facial function, and headache influenced people’s feelings about surgery and had an impact on their return to work.

Conclusions. The QOL scores are not consistently lower than population normative values compared with different normative studies. The strongest correlation was between the presence of persistent headache and QOL. Other correlations were not consistent in all categories, and few were statistically significant. These trends in some categories do not explain the difference seen between patients after acoustic neuroma surgery in this study and normal populations in other studies.

KEY WORDS • acoustic neuroma • quality of life • SF-36 test

Recently a body of literature has arisen in which the QOL after surgery for acoustic neuromas is evaluated from the patient’s perspective. Although it has been established that patients after acoustic neuroma surgery have a lower QOL score than population norms, no correlations that may explain this result have been found.1,6,9,13,16,18,19,21,23,27 Although advances in surgical procedures have reduced mortality and morbidity rates, there remain significant postoperative complaints. These postoperative symptoms, as reported in the literature, include ipsilateral hearing loss in 93 to 100% of patients, facial nerve dysfunction in 43 to 63%, headache in 29 to 50%, tinnitus in 49 to 73%, anxiety, sleeping problems, dental problems, and depression.4,15,16,19,20

The SF-36 was designed as a generic indicator of health status and as a measure of outcome after treatment for disease processes; it measures both physical and mental concepts in a variety of ways.2,3,24,25 The aim of this study was to use a single surgeon’s data with more contemporary facial nerve and hearing outcomes to examine the patients’ QOL and determine if there are correlations with surgical morbidities.24 The SF-36 was chosen because of its standardization and previous use in the literature regarding QOL after acoustic neuroma surgery.

Clinical Material and Methods

One hundred thirty-five consecutive patients with acoustic neuromas who had undergone resection performed by a single surgeon at Mt. Sinai Hospital were sent a survey by mail that they were asked to complete and return. All patients had a minimum of 6 months of follow up. Patients had undergone removal of their tumor via either a translabyrinthine or suboccipital approach. Wounds were closed with cranioplasty, fascial closure, and tight skin closure. The questionnaire consisted of the SF-36 QOL measures and seven additional questions (Table 1).

The SF-36 results were tallied as described by Ware, et al.,27 into raw scores for the eight defined categories: physical functioning, social functioning, role limitations due to physical problems, role limitations due to emotional problems, energy and vitality, mental health, pain, and general perception of health. Raw scores were weighted according to a scoring program2 and linearly transformed to scores between 0 and 100. Transformed scores were compared with population means from multiple normative studies.11,17,25 Using a Spearman rho correlation, age, sex, facial function, postoperative hearing, time since surgery, and headaches were assessed for their impact on QOL scores. Postoperative hearing, measured using formal audiology tests, and SDSS, was used in the statistical analysis.

A chart review of the patients who responded to the ques-

Abbreviations used in this paper: QOL = quality of life; SDS = speech discrimination score.
Self-assessed quality of life

TABLE 1
Additional questions used with the SF-36 to measure QOL in patients who underwent acoustic neuroma surgery

1. What influences most how you feel about surgery?
   a. facial function
   b. length of hospital stay
   c. relationship with doctor
   d. hearing
   e. headaches
2. What other options were you considering/offered as treatment?
   a. radiosurgery
   b. radiation
   c. watch and wait with repeat magnetic resonance imaging
   d. no other options were presented
3. I am happy with my decision to undergo surgery.
   a. definitely
   b. somewhat
   c. would choose another option if had to do it again
4. If a friend with an acoustic neuroma called I would suggest they have surgery.
   a. definitely
   b. maybe
   c. would choose another option
5. I was able to return to work in….
   a. less than 6 months
   b. between 6 months and 1 year
   c. greater than 1 year
   d. unable ever to return to work
6. I had to change my job.
   a. yes
   b. no
7. I had to change my job or was unable to return to work because of….
   a. headache
   b. facial dysfunction
   c. hearing
   d. lethargy
   e. other

Fig. 1. Bar graph showing the mean values of the transformed scores in the eight categories of the SF-36 according to the sex of the patient (*p < 0.05). BP = bodily pain; GH = general health; MH = mental health; PF = physical functioning; RE = emotional role limitations; RP = physical role limitations; SF = social functioning; V = energy and vitality.

Fig. 2. Bar graph showing the mean transformed QOL scores and age (*p < 0.05).

Results

Of 135 sent, 101 questionnaires were returned (74.8% response rate). Figures 1 through 6 outline the results of each of the variables discussed later; the results of the additional questions are listed in Table 2.

Patients’ QOL Compared With General Population

Our scores are detailed and compared with other studies in Table 3. Scores were lower in all categories except energy and vitality in patients undergoing acoustic neuroma surgery, compared with the study by Jenkinson, et al.11 Statistical significance was found in only half of the SF-36 categories when we compared the population normative values with the SF-36 scores in our study. When compared with the Rand study,17 five of the questionnaire categories had statistically significantly lower scores than in our study and one statistically significantly higher score, which is the opposite of what we see in comparison with the first set of normal values. Compared with a US-based study, only three categories from the SF-36 were significantly higher than our values. The last column represents SF-36 scores in a small study in which the scores of patients undergoing serial imaging were compared with those in surgically treated patients.13

Sex and QOL

There were 48 men and 53 women who completed the questionnaire. In all eight categories, the trends showed that women scored lower than men (Fig. 1). Nevertheless, only in physical functioning and physical role limitations were the women’s scores statistically significantly lower than the men’s (p = 0.012 and p = 0.016, respectively).

Age and QOL

The mean age of the respondents was 52 years (range 23–79 years). Age was dichotomized into two categories: 55 years of age or younger, and older than 55 years. In six of the categories the trend was that patients older than 55 years of age had lower scores in general health, physical functioning, physical role limitations, emotional role limitations, social functioning, and pain than patients who were 55 years of age or younger (Fig. 2). In only two of these categories that showed a difference, however, were the probability values statistically significant: general health (p = 0.032) and physical functioning (p = 0.003).
Facial Function and QOL

Eighty-six patients had a postoperative House–Brackmann Grade I, seven patients had a Grade II, three had a Grade III, two had a Grade IV, none had a Grade V, and three had a Grade VI outcome. Facial function was divided into two categories, patients with House–Brackmann Grades I through III and those with Grades IV through VI. None of the SF-36 categories showed any significant difference between the two groups, and the correlation coefficients did not demonstrate a strong trend in either direction (Fig. 3).

Postoperative Hearing and QOL

Postoperative SDSs ranged from 0 to 100%, with a mean of 15.2 and a median of 0. Hearing was dichotomized into patients with some function (20%) and those with no function (80%). Although it was not statistically significant in any category, seven of eight categories in the SF-36 (all categories but emotional role limitations) showed a trend that patients with SDSs of zero had lower SF-36 scores than patients with some hearing function (Fig. 4).

Headache and QOL

Eleven patients (10.9%) experienced persistent postoperative headaches. All eight categories showed a trend that patients with persistent headaches had lower SF-36 scores than those without headaches (Fig. 5). Patients in two of these categories had statistically significant probability values (p < 0.05): physical role limitations (p = 0.039) and pain (p = 0.038).

Time Since Surgery and QOL

The time elapsed since surgery ranged from 6 months to 7 years (mean 3.2 years). Years since surgery were divided into three categories, 6 to 18 months, 19 months to 3 years, and more than 3 years. There were 30 patients in whom between 6 and 18 months had elapsed since surgery, 20 patients in whom between 19 months and 3 years had elapsed, and 52 patients in whom more than 3 years had gone by. Time elapsed since surgery did not affect patients’ SF-36 scores (Fig. 6).

Discussion

Many studies have demonstrated a significant impact on QOL in patients undergoing surgery for acoustic neuromas.9,12,18,19,21,23 A variety of questionnaires has been used to evaluate lifestyle after surgery because of reliability and validity. The SF-36 is most commonly used. Lower scores on the SF-36 for patients undergoing acoustic neuroma surgery than for the general population undergoing surgery have been published in the past.6,13,16 The previous studies analyzed one other value of normative data from a population in the United Kingdom.6,16 No correlation has been found that can account for the lower scores that have been documented in subsequent studies.

Use of the SF-36 as a Measurement of QOL

Studies in which a variety of scales were used have been criticized in the past for not being standardized or not adequately measuring QOL.11 The SF-36 is a widely used QOL measurement that has normal values that have been used for comparison in previous studies to elucidate differences.3,11,16,17 Nevertheless, the population normative data is from a study conducted in 1993 in the United Kingdom. In our study we looked at two other sets of means that have been documented. A current study of population normative values within the US might be helpful in comparing more recent data on QOL.

In our study, not all categories are significantly lower when compared with the results reported by Jenkinson, et al.11 and in fact, vitality is higher in our postoperative population. When compared with normative values in the Rand study,17 our patients score higher in our postoperative population. When compared with the US-based study, our data had statistical significance in only three categories, and still our results yielded a higher score for vitality. The findings in our study call into question whether postoperative scores on the SF-36 are different from population normative values. Perhaps the wrong comparisons have been made.

Correlation of SF-36 Categories With Postoperative Results

Our study shows several trends but only a handful of categories that have any statistically significant results. Fe-
male sex and persistent headaches both trend toward lower scores, with two categories in each group reaching statistical significance. It is intuitive that patients with headaches will score worse in pain and physical role limitations categories. Our rate of postoperative headaches was lower than many reported in the literature. Levo, et al.,15 reported that 37% of their 251 patients still had headaches 8.9 years after acoustic neuroma surgery, with higher rates at shorter follow-up intervals. Controversy exists in the literature as to the cause of headache after acoustic neuroma surgery. There are several reports that detail a lower incidence of postoperative headache after cranioplasty than after craniectomy without cranioplasty.7,14,22,26 Other authors have compared cranioplasty alone with the same procedure completed using intradural drilling, in which intracranial bone dust is present. They have found that the presence of bone dust and the use of intradural drilling increased headaches more than the absence of cranioplasty.4,10 Reducing bone dust and using cranioplasty may lower the incidence of headache and increase positive QOL outcomes.

Women in our study scored lower in physical role limitations and physical functioning, similar to a study by Martin, et al.,16 in which women scored significantly lower in vitality, physical functioning, and pain. Looking at population normative data, the same trend is seen in which women score lower in both physical functioning and physical role limitations. In fact, women in a normal population scored statistically significantly lower in all categories except for general health.11 This explains why the trend is seen within our study, but not why the scores are even lower after acoustic neuroma surgery.

Less robust trends were observed in age and postoperative SDSs. Patients 55 years old or younger scored higher in six of the eight categories, all but vitality/energy and emotional functioning. Only two categories were statistically significant (general health and physical functioning), similar to a previous study in which physical functioning and physical role limitations were significantly higher.16 The scores in these two categories are not surprising, given that more health problems arise with aging. These trends were identified in the normal population as well; however, the values were not statistically significant.

Forty-nine patients identified postoperative hearing as the most influential factor in how they felt about surgery. All categories except emotional role limitations trended toward patients with no hearing scoring lower. Nonetheless, none of these results was statistically significant. It is interesting and difficult to reconcile that a quality rated this highly by patients did not influence their QOL scores.

One might expect that with time off from work, returning facial function, and adjusting to the loss of hearing and balance, people’s scores might improve as more time elapses after surgery. Longer postoperative follow up showed no consistent trend or statistical significance. Although 24 patients reported being unable to work for more than 6 months and some never resumed employment, no differences in QOL scores were seen between them and the patients who returned to work within 6 months. It would be important to give these tests to the same patients at many intervals to evaluate whether differences are seen in their responses over time.

In many of the earlier studies higher rates of facial dys-

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<th>c.</th>
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<td>12</td>
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* NA = not applicable.

### TABLE 3
Comparison of mean QOL scores according to various studies of patients who underwent acoustic neuroma surgery*

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<td>Conservative Tx (28 patients)</td>
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<td>mental health</td>
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* Tx = treatment.
† Statistically significantly different from the present study (p < 0.05).
function were found than in this report; those rates ranged from 43 to 63\%. Their analysis did not account for facial function as a factor. Also, 41 patients answered that facial function was important to how they felt about surgery. In our series by a single surgeon there was only a 15\% dysfunction rate, with only 5\% severe dysfunction (Grades IV–VI). Nevertheless, there were no differences found in QOL as measured using the SF-36 in our study. This might be because there were so few patients with poor House–Brackmann scores (seven patients with Grade II, three with Grade III, two with Grade IV, none with Grade V, and three with Grade VI).

**Results of the Additional Questions**

The results of the seven additional questions are interesting to review. In contrast to the SF-36, our questions have not been used before in similar populations. Because they have not been shown to reproduce the same results in a single population, their reliability has not been determined; validity is established when the answers to the new questions show a consistent and significant correlation to established measurements. Statistical analysis was not run on these questions because their reliability and validity have never been tested in normal or similar populations. Nevertheless, they do reveal the patients’ feelings about the surgery itself. Our patients most frequently said that facial function and hearing influenced their feelings about surgery (41 and 49 patients, respectively). The most frequent answer to the last question was that hearing loss and headache (12 and 10 patients, respectively) made it hard to return to work. Only nine patients responded that they had to change jobs or stop working after surgery; 75 patients were able to return to work in less than 1 year after surgery. This is in contrast to the study by Martin, et al., in which it was reported that 32\% of respondents had a change in employment; 66 who replied reported being presented with other options. Interestingly, although patients scored significantly lower on the SF-36 than their controls, 77 were happy with their decision to have surgery, and 62 said they would recommend surgery to a friend. These results are similar to those of an earlier study, in which a customized survey sent to 200 patients demonstrated little adverse effect in their daily activities, employment, or social interactions.

Nevertheless, why are people answering positively about the outcome of surgery and yet scoring so poorly on the SF-36 for no reason based on sex, age, facial function, hearing, time elapsed since surgery, or headache? One obvious solution is that the SF-36 is not the appropriate measure of outcome in these patients. Nonetheless, this test was used in our study because of the vast experience in the literature with the SF-36 and its consistent validity and reliability in measuring QOL. Another possibility is that the variables that were analyzed do not explain the difference seen and that there is another explanation for the results. Preoperative scores might be lower to begin with, and the age at which surgery occurred and the presence of economic and social stability all may impact these patients’ QOL, and were not independently accounted for in the analysis. Perhaps more recent normative studies would show less of a difference. It is hard to believe that normative values from 10 years ago in another country represent the appropriate controls for these patients. In a time when people live longer with more medical problems and medications, and with the social issues that surround us today, it seems that a better set of control values is needed. Giving patients the test preoperatively would obviate that need and allow them to serve as their own controls.

Our present study includes only surgically treated patients. A study by Kelleher, et al., compared patients in whom tumors were removed and those in whom interval magnetic resonance images were obtained with no surgical intervention. The sample size was small, consisting of only 47 patients with acoustic neuromas. These authors found that patients who underwent conservative therapy had QOL scores similar to the normal population, whereas surgically treated patients had lower scores in only two categories. Nevertheless, when we compared those values with our results (Table 3), the scores in their conservative treatment group were lower than our surgical scores in five of eight categories, from which we infer that other factors may influence scores. Data from studies measuring QOL in larger populations of patients who are being followed with serial imaging or who are undergoing radiosurgery would be helpful to have when clinicians are discussing options with their patients. All studies completed to date have focused on postoperative scores. It would be helpful to have patients complete the SF-36 before and after surgery to assess the effects of treatment on QOL.

As discussed earlier, further research with better control values is needed to clarify whether radiosurgery or resection result in a better QOL. Some might believe that this and other studies like it support radiosurgery. On the contrary, our paper introduces the idea that only a few SF-36 categories show a statistically significantly lower score than normative values, if those normative values are believed to be reflective of the appropriate control group.

**Conclusions**

In this study we have questioned a body of literature in which patients score lower on QOL indices after surgery for acoustic neuroma. There was no consistent picture of significantly lower scores across the board when we compared QOL normative values and our postoperative data. Although in this study we looked closely for a reason, minimal correlations can be found when analyzing the effects of age, sex, time since surgery, hearing levels, or facial function. Headache had the clearest trend and was only statistically significant in two categories, despite the fact that these are the issues that affected peoples’ return to work and their outlook on the surgery. This is clinically important when discussing with patients the options currently available: surgery compared with radiation or serial imaging studies. Although all the options are not appropriate in many situations, the QOL after surgery should be taken into consideration.

**References**

Self-assessed quality of life


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