

Original Article

Preoperative Quality of Life in Patients with Small Vestibular Schwannomas

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BACKGROUND: Vestibular schwannomas (VS) are benign tumors arising from the eighth cranial nerve. They often cause no symptoms for a long period of time. Due to the improved availability and quality of magnetic resonance imaging diagnostics, even small tumors can be diagnosed at an early stage. The fact that the diagnosis of a VS might negatively affect a patient's quality of life (QoL) should be taken into consideration when informing patients about various treatment options. However, little is known about the level of QoL in patients with small VS prior to scheduled surgery.

METHODS: One hundred forty- one patients with a T1 or T2 VS that had been scheduled for microsurgery via the middle cranial fossa (MCF) approach between 01/2013 and 12/2018 were included. Quality of life was evaluated using the Short-Form-36 (SF-36) survey. Eighty-one patients completed the questionnaire. Additionally, audiological and clinical data were collected.

RESULTS: When compared to the German normative QoL data, VS patients showed a significant deterioration in quality of life in 6 of the 8 SF-36 subscales, whereas only 4 of 8 subscales were affected when compared to the normative group of patients with hearing loss. The analysis of predictors did not show any significant relationship between tumor volume, facial nerve function, and QoL. Only preoperative hearing status and sex had a slight impact on one subscale each (emotional health and physical health, respectively).

CONCLUSION: This study shows that patients with small VS have an impairment in QoL before surgical treatment. Most of the examined clinical predictors did not have a significant impact on the QoL.

KEYWORDS: Acoustic neuroma, middle fossa approach, quality of life, SF-36

INTRODUCTION

Vestibular schwannomas (VS) are generally benign tumors arising from the eighth cranial nerve. Although rare, they are nevertheless the most common type of cerebellar pontine angle tumors. The incidence of VS appears to have increased over time.¹ Even very small VS (as small as 1 mm)² can now be diagnosed due to improved availability and resolution of magnetic resonance imaging (MRI), (Figure 1).

Vestibular schwannomas can present with a wide range of symptoms, including tinnitus, vertigo, facial palsy, headache, or unilateral hearing loss. Some patients may also remain asymptomatic for a long period. Treatment options typically include microsurgery, radiosurgery, or wait-and-scan protocols. Currently, it is not clear whether small tumors need to be treated at all.^{3,4}

However, early detection necessitates early decision-making. Patients are required to make a decision early on in their disease process either for active therapy or typically first for wait-and-scan. Therefore, it is crucial to provide information about functional outcomes and risks of active treatment, as well as about potential changes in daily quality of life (QoL). This information is essential and may influence the patient's decision. Numerous studies have examined functional results^{5,6} or QoL assessments^{7–9} after therapy.

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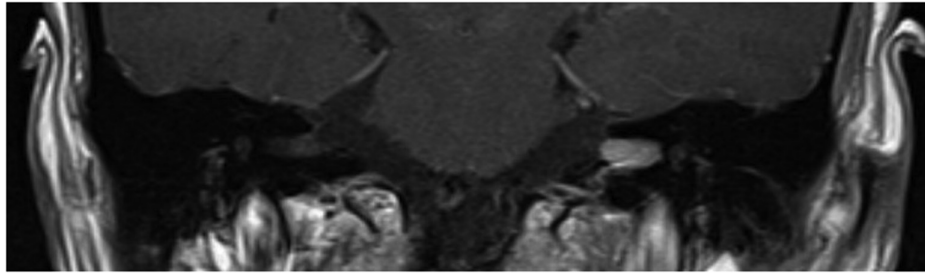


Figure 1. Coronal T1-weighted magnetic resonance imaging scan with contrast enhancement of a T1 vestibular schwannoma.

However, there is a general lack of directly preoperative data that provides detailed information about the QoL in patients diagnosed with a VS and that can be used as a baseline for post-surgical follow-up.

The aim of this present study was to compare the preoperative QoL of patients with small VS with a control group of normative Germans and patients with hearing impairment.

METHODS

Patient Data

Between January 2013 and December 2018, 141 patients with a unilateral sporadic VS were operated on in our department using the MCF approach. The patients' ages ranged from 16 to 78 years (average = 52.0). Of the patients, 69 were female and 72 were male. No patients with previous treatment or neurofibromatosis type 2 were included in the survey.

Tumor Size

Each patient underwent an MRI scan for diagnostic purposes. The scans were conducted either in the Department of Neuroradiology at our hospital or were brought in by the patients. All MRI was evaluated by an independent neuroradiologist and discussed in our skull base conference. Of the 141 patients, 61 (43%) had an intracanalicular (T1) tumor, while 80 (57%) had a tumor with extrameatal extent without contact to the brainstem (T2). Tumor volume was measured using a rotation ellipsoid.¹⁰ The mean tumor volume was 156 mm³ (range 6–680 mm³).

Surgery

All patients were operated on using the MCF approach as first described by William House in 1961,¹¹ and modified by Fisch in 1969 and Brackmann in 1994.¹² Following the opening of the internal auditory canal, the tumor was debulked using a contactless flexible CO₂ laser before complete resection of the tumor.¹³

Questionnaires

The preoperative QoL was assessed using the general Short-Form-36 (SF-36) Health Survey.¹⁴ The SF-36 is a well-established generic tool

that is used to measure QoL for various diseases. It consists of 36 items that are mathematically converted into 8 subgroups: physical functioning (pf), role limitations due to physical health (rp), bodily pain (bp), general health perception (gh), vitality (vt), social functioning (sf), role limitations due to emotional health (re), and mental health (mh).¹⁵ The 8 subscales result in linear scores from 0 to 100, corresponding to the level of QoL. The German version, translated and validated by Bullinger et al,¹⁶ was used. Disease-specific questions were also included.

Audiological Data

Prior to surgery, a pure-tone audiometry that included 10 frequencies (125 Hz, 250 Hz, 500 Hz, 1 kHz, 1.5 kHz, 2 kHz, 3 kHz, 4 kHz, 6 kHz, and 8 kHz), as well as a monosyllabic speech audiogram, were conducted. A good hearing status was defined as ≤50 dB and ≥50% according to AAO-HNS class A+B¹⁷ or as class 1+2 described by Gardner and Robertson.^{18,19} Hundred and eleven patients were classified in category A or B, which was defined as a good hearing status in the study.

Facial Nerve Function

The House-Brackmann (HB) classification²⁰ was used to evaluate facial nerve function. All patients had intact facial nerve function and were assigned to category I preoperatively.

Predictors

To analyze predictors that could impact QoL, patients were separated by age and tumor volume near the median (≥55 years; ≥140 mm³). Facial nerve function was compared between patients with HB 1+2 and those with HB ≥ 3. For hearing status, we compared good hearing (AAO-HNS class A+B) with poor hearing (C+D).

Statistics

We performed all statistical analyses using SPSS 29 (IBM SPSS Statistics for Windows). In order to detect the influence of various factors on QoL, a multiple regression analysis was done. To compare the mean SF-36 values of our patient group with those of the general population (as described in the SF-36 manual), a 2-sample z-test was performed. Statistical significance was defined as $P < .05$.

Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Local Ethics Committee of the University of Würzburg (#97/17).

Informed consent was obtained from all individual participants included in the study.

MAIN POINTS

- Quality of life in patients with small vestibular schwannomas is reduced prior to surgery.
- Preoperative hearing status and sex had a slight impact on quality of life.
- Tumor volume and facial nerve function had no impact on preoperative quality of life.

RESULTS

Response Rate

Out of the 141 eligible patients, 81 voluntarily completed the questionnaire 1 day before their scheduled surgery, resulting in a response rate of 57%.

Clinical Data

After completing and returning the questionnaire, these 81 patients were enrolled in the study. The mean age was 53 years, with the youngest patient being 16 and the oldest patient 76. Fifty percent of the patients were women (n=41). Forty percent of the participants had tumor classified as T1, and 60% classified as T2. The mean tumor volume was 143 mm³. Preoperatively, 60 patients had a good hearing status (AAO-HNS A+B).

Symptoms

Patients were asked about their symptoms and the duration of those symptoms. Of 141 patients, 102 reported hearing loss. The mean duration before surgery was 26 months (range 2-240 months). Seventy patients noticed tinnitus with a mean duration of 17 months (range 1-68 months). Vertigo was present in 68 patients for a mean period of 9 months (range 1-72 months) prior to surgery.

Quality of Life

Table 1 and Figure 2 present the SF-36 scores in comparison to the German normative population (n=2914), as described in the SF-36.²¹ In 6 of 8 subscales (pf, rp, vt, sf, re, and mh), VS patients had significantly lower scores in the questionnaire, which shows a deterioration in QoL in these subscales. The SF-36 manual also includes scores of a subgroup of Germans with hearing loss (n=147) regardless of its cause. Compared to this group, 4 of the 8 subscales showed significant differences (Table 1, Figure 3). Our patients showed better scores in 3 subscales (pf, bp, and gh) and significantly lower scores in 1 subscale (sf).

Predictors

The preoperative hearing status had an impact on the subscale “role limitations due to emotional health” (re; *P* = .01) but not on the other 7 subscales. Patients with poor hearing (>50 dB; <50%) had better scores (mean=88.9) than patients with good hearing (mean=60.2). Gender also had an impact on one subscale: “physical role limitation” (rp; *P* = .047). Men had a higher score (mean=73.7) than women (mean=54.7). Further analysis of predictors did not show

any significant influence of tumor volume, tumor stage, age, or facial nerve function on QoL.

DISCUSSION

The diagnosis of VS has improved over time, enabling the detection of very small VS even before they cause symptoms. The primary goal in selecting the appropriate treatment is to preserve function.^{22,23} The present study aims to show the QoL in untreated patients immediately prior to surgery. To measure QoL, we used the SF-36 questionnaire, which is 1 of the most widely used instruments for determining generic health-specific QoL worldwide. The SF-36 includes a large international and German normative collective, as well as a normative group of patients with hearing loss that can be used for comparison. However, it is important to note that this data is over 20 years old and may no longer be representative.²⁴ Recent studies on QoL of VS patients use the Penn Acoustic Neuroma Quality of Life Scale (PANQOL), which includes disease-specific data. The original English version of the PANQOL was published in 2010 by Shaffer et al²⁵ and then translated into Dutch in 2013²⁶ and Spanish in 2015.²⁷ A German version was adapted by Kristin et al in 2017.²⁸ However, the German version was not available at the start of this prospective trial in 2013. In 2023 Carlson et al²⁹ even introduced a further development of the PANQOL, the Mayo Clinic Vestibular Schwannoma Quality of Life Index (VSQOL) but no reliable data for comparison exists.

The response rate was quite acceptable at 57%.

The preoperative QoL of our patients was significantly reduced in 6 of the 8 SF-36 subscales (pf, rp, vt, sf, re, and mh) compared to the German general population. Similar results were previously published by Vogel et al,³⁰ who investigated 90 consecutive patients included before treatment or proposed treatment. The SF-36 data were compared with Dutch population norms and with patients suffering from other diseases such as COPD, chronic pain, or head and neck cancer. The study demonstrated that patients with VS have a lower QoL compared to both the general population and patients with other diseases. The authors assume that even asymptomatic VS patients perceive their illness as a threatening event from the moment of diagnosis. A statistically significant reduction in only 1 subscale (mh) compared to (American) normative data was also described by Klersy et al.² The authors suggest that knowledge of suffering from a brain tumor may impact QoL.

Table 1. Mean Results of SF-36

SF-36 Item	VS Patients (Mean) n=81	SD	German Normative Collective (Mean) n=2914	SD	German Normative with Hearing Loss n=147	SD
pf	80.33	23.71	85.56*	22.32	66.25*	29.89
rp	64.20	42.37	82.96*	32.59	63.61	42.03
bp	75.55	25.67	79.08	27.36	63.05*	31.5
gh	65.08	17.11	67.92	20.27	54.33*	23.59
vt	56.23	18.80	63.21*	18.46	53.24	20.54
sf	69.75	24.83	88.76*	18.39	80.42*	23.14
re	67.11	40.45	89.97*	26.25	75.52	40.56
mh	64.83	17.83	73.76*	16.57	67.91	17.31

bp, bodily pain; gh, general health perception; mh, mental health; pf, physical functioning; re, role limitations due to emotional health; rp, role limitations due to physical health; SD, standard deviation; sf, social functioning; vt, vitality. *Significant (*P* < .05).

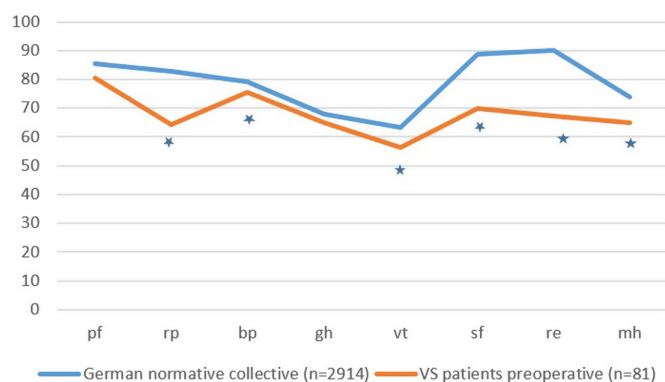


Figure 2. Short-form-36 scores compared to the German normative population.

Deberge et al¹ used the SF-36 to compare the QoL of patients with untreated VS to a group of patients who underwent microsurgery. They also showed that QoL was reduced in some subscales (pf, sf, and vt). According to the authors, choosing an observation approach could pose a psychological burden for patients due to the knowledge that the VS was still present and potentially growing.

No difference in preoperative QoL across all SF-36 domains between VS patients (n=42) and a healthy control group (n=40) was determined by MacAndie and Crowther.³¹ Similarly, Kelleher et al³² did not observe a difference in QoL between treated and untreated VS patients compared to an age-matched control group. They examined 70 patients with small skull base tumors, including 54 T1 and T2 VS, using the SF-36. Of the VS patients, 29 opted for wait-and-scan, 19 underwent surgery, and 6 patients were treated with stereotactic radiation. The authors note that the small size of the tumor and a lack of symptoms may explain the absence of a difference in QoL compared to the normative group. Since all of our patients were symptomatic, this could account for our divergent findings.

Compared to the normative group of patients with hearing loss, our patients reported a significantly better QoL in 3 out of the 8 subscales (pf, bp, and gh) and a significantly lower score in 1 subscale (sf). This finding contradicts results published by other authors. Vogel et al³⁰ reported that patients with VS had lower QoL scores even when compared to patients with other diseases, such as head and neck cancer.

Finally, we attempted to identify clinical predictors that could explain the decreased QoL in our patients prior to surgery. Our analysis

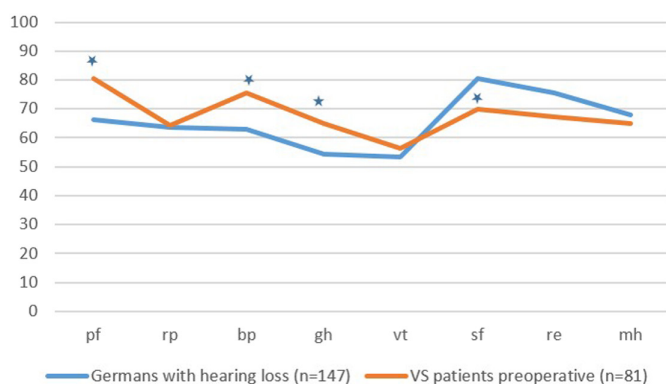


Figure 3. Short-form-36 scores compared to a subgroup of Germans with hearing loss.

revealed that only 2 predictors had a significant impact on preoperative QoL: sex and hearing status each had an influence on 1 subscale. Specifically, men had a better score in “role limitations due to physical health” (rp) compared to women in our group. Notably, there was no difference between men and women in rp in the normative collective. However, the SF-36 handbook also contains data on men and women separately, which shows that women generally have a lower QoL in all subscales than men. This difference in QoL between genders may directly explain the impact of sex on QoL in our study. Machetanz et al³³ also found worse preoperative QoL in women in 4 subscales (pf, bp, vt, mh), but interestingly not in rp. Tufarelli et al³⁴ conducted a study that showed that women suffer more than men from a decrease in their QoL after VS surgery. They also investigated different predictors of QoL and demonstrated that hearing loss was perceived as the most disabling symptom after surgery. This may suggest that a good preoperative hearing status leads to a better QoL, as shown by Glaas et al.³⁵ However, our study’s results contradict this finding. In 7 of the 8 subscales, there was no difference between good and poor preoperative hearing status. Nevertheless, we found that patients with poor hearing status had significantly better scores in the “role limitations due to emotional health” (re). Normally, a preoperative poorer hearing status would be expected to result in a decrease in QoL. However, our results suggest that there may be an absence of anxiety about subsequent hearing loss or the development of new symptoms caused by tumor growth. It is possible that patients who already have a poorer hearing status are not as concerned about this symptom worsening as patients with a normal hearing status.

All of these findings indicate a significant change in a patient’s QoL when diagnosed with VS, independent of most possible symptoms. Vogel et al³⁰ state that “VS patients seem to be a group of patients that suffer from the moment of diagnosis.” Nevertheless, it should be noted that all patients were included in the study directly before surgery. It is possible that they opted for microsurgery due to a worsening of their existing symptoms.

One limitation of the study is the specific moment of the survey. It is possible that patients may have been more stressed on the day prior to intracranial surgery. However, it is important to note that the SF-36 questionnaire defines a time period of 4 weeks prior to completion and that this was communicated to the patients.

CONCLUSION

Patients diagnosed with VS experience a significantly reduced QoL before starting surgical treatment, regardless of most clinical predictors. The fact of knowing the diagnosis may have an impact on their QoL. It is important to inform patients about the possible negative impact on their QoL due to the diagnosis in order to enable them to make an informed decision. This study represents a further step in the assessment of QoL at different points in time. Long-term research with frequent collection of QoL data from the beginning of the diagnosis throughout the course of therapy is necessary to gain a better understanding of these changes in QoL.

Ethics Committee Approval: This study was approved by the Ethics Committee of Würzburg University (Approval No: #97/17, Date: 6.7.2017 and 31.7.21).

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Peer-review: Externally peer reviewed.

Author Contributions: Concept – M.S., L.S.; Design – M.S., M.St.; Supervision – M.S., M.B.; Resources – M.B., R.H.; Materials – M.B., M.S.; Data Collection and/or Processing – L.S., M.St.; Analysis and/or Interpretation – L.S., J-H.K.; Literature Search – L.S., M.S.; Writing – L.S., M.S.; Critical Review – R.H., S.H.

Declaration of Interests: The authors have no conflicts of interest to declare.

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