

# Translabyrinthine surgery for disabling vertigo in vestibular schwannoma patients

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**Objective:** To determine the impact of translabyrinthine surgery on the quality of life in vestibular schwannoma patients with rotatory vertigo.

**Study design:** Prospective study in 18 vestibular schwannoma patients.

**Setting:** The study was conducted in a multispecialty tertiary care clinic.

**Participants:** All 18 patients had a unilateral intracanalicular vestibular schwannoma, without serviceable hearing in the affected ear and severely handicapped by attacks of rotatory vertigo and constant dizziness. Despite an initial conservative treatment, extensive vestibular rehabilitation exercises, translabyrinthine surgery was performed because of the disabling character of the vertigo, which considerably continued to affect the patients' quality of life.

**Main outcome measures:** Preoperative and postoperative quality of life using the Short Form 36 Health Survey (Short Form-36) scores and Dizziness Handicap Inventory (DHI) scores.

**Results:** A total of 17 patients (94%) completed the questionnaire preoperatively and 3 and 12 months postoperatively. All Short Form-36 scales of the studied patients scored significantly lower when compared with the healthy Dutch control sample ( $P < 0.05$ ). There was a significant improvement of DHI total scores and Short Form-36 scales on physical and social functioning, role-physical functioning, role-emotional functioning, mental health and general health at 12 months after surgery when compared with pre-operative scores ( $P < 0.05$ ).

**Conclusions:** Vestibular schwannoma patients with disabling vertigo, experience significant reduced quality of life when compared with a healthy Dutch population. Translabyrinthine tumour removal significantly improved the patients' quality of life. Surgical treatment should be considered in patients with small- or medium-sized tumours and persisting disabling vertigo resulting in a poor quality of life.

Vestibular schwannoma patients usually present with progressive unilateral hearing loss, tinnitus, balance disorder and in some cases vertigo. The incidence of rotatory vertigo in vestibular schwannoma has been reported around 10% of cases, and usually the severity and frequency of complaints are diminished because of adequate vestibular compensation.<sup>1–4</sup> However, some vestibular schwannoma patients continue to experience rotatory vertigo over time.

The unexpected sudden loss of balance or constant illusion of movement, when suffering from rotatory vertigo attacks, may impose a great deal of discomfort on daily life. The vertigo attacks may eventually lead to physical

and social limitations and reduce patients' quality of life. These conditions may reflect on the medical history as perceived by the patient and lead to a discrepancy between the patients' and the clinicians' assessment of the vertigo. When discussing treatment options in cases of vestibular schwannoma and vertigo, the clinician has, besides clinical parameters, to rely heavily on the patients' opinion concerning the incidence or severity of the vertigo. As a result of this, quality of life plays a key role in choice of treatment for these patients.

In vestibular schwannoma literature, most studies focus on vestibular symptoms in general and not specifically on the concomitant vertigo.<sup>3,5,6</sup> Several authors have reported on the quality of life after microsurgery<sup>7–11</sup> or at the degree of vestibular compensation after surgery.<sup>12,13</sup> Vertigo, however, has not been quantified before in vestibular schwannoma patients and using validated quality of life measures. Furthermore, there are few studies in which

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vertigo has been discussed as an indication for (surgical) treatment in vestibular schwannoma.

Recently, an attempt was made to put 'vestibular symptoms' in vestibular schwannoma in a quality of life perspective at the Consensus Meeting on Systems for Reporting Results in Acoustic Neuroma in Tokyo, 2001 and results were published by Kanzaki *et al.*<sup>14</sup> The objective of the meeting was to achieve consensus on a universal reporting system. According to the vestibular symptom grading system (grade I–IV), all patients in this study were classified as grade IV, which is defined as: severe, persistent, or almost persistent dizziness or dysequilibrium incapacitating and severely affecting quality of daily life. All our patients were diagnosed with small non-cystic intracanalicular tumours which were suitable for a watch and scan policy. However, these patients continued to experience rotatory vertigo attacks and intermittent dizziness, despite extensive vestibular rehabilitation exercises during conservative follow-up. Finally, these patients underwent translabyrinthine surgery to primarily achieve tumour removal and with complete transection of both vestibular nerves to relieve them from their vertiginous complaints. This study aimed to evaluate the quality of life results in these patients and the effect of translabyrinthine surgery on the quality of life by using the validated Short Form 36 Health Survey (Short Form-36) and Dizziness Handicap Inventory (DHI).<sup>15,16</sup>

## Materials and methods

### Participants

A total of 18 vestibular schwannoma patients who had been operated between January 2001 and May 2005 for rotatory vertigo were prospectively studied. Patients were included if they had small non-cystic intracanalicular tumours (with no extrameatal growth) and experienced dysequilibrium with rotatory vertigo or had multiple attacks of vertigo with dizziness during the last year. Our routine neurotologic physical examination included extensive balance testing. They were classified according to the relatively new classification and grading system defined by Kanzaki *et al.* with grade I: indicating no dizziness or dysequilibrium; grade II: occasional and slight dizziness or dysequilibrium; grade III: moderate or persistent dizziness or dysequilibrium and grade IV: severe, persistent or almost persistent dizziness or dysequilibrium incapacitating and severely affecting quality of daily life.<sup>14</sup> All patients were classified as grade IV and had a non-serviceable hearing on the affected ear with an average of 56 dB impairment on pure-tone audiogram (range 30–80 dB). Preoperative balance disorder was also assessed through

electronystagmography which showed a poor vestibular compensation for the majority of the patients that could explain the severe impact of their symptoms ( $n = 15$ ). In three patients preoperative electronystagmography could not be performed because of logistic reasons. After review at our multidisciplinary skull base pathology meeting for all patients, an initial wait and scanning was decided to await improvement of vertigo. However, during follow-up and despite extensive vestibular rehabilitation exercises no improvement of symptoms occurred and patients underwent translabyrinthine vestibular schwannoma excision. There were no postoperative complications in any of the patients. All patients received extensive vestibular rehabilitation exercises preoperatively and postoperatively to stimulate further adaptation of the vestibular systems.

### Materials

Patients were asked to complete our quality of life questionnaire, which included the validated Dutch version of the Short Form-36 and a Dutch translation of the validated DHI, preoperatively and 3 and 12 months postoperatively. Medical data were prospectively collected from the patients' medical records.

### Short Form 36 Health Survey

The Short Form-36 assesses quality of life in the following eight domains: physical functioning, social functioning, role-physical functioning, role-emotional functioning, mental health, general health, bodily pain and vitality. For each domain, there is a series of itemised questions that are scored. Each score is coded, summed and presented on a scale of 0–100, where 0 implies the worst possible health status and 100 the best possible. Mean scores were compared with the scores from an age- and sex-matched Dutch healthy sample ( $n = 1063$ ), in order to assess the postoperative health status of our patients with matched healthy controls. The questionnaire, which included the Short Form-36 and DHI, was given to the patients at the pre-admission clinic after the diagnosis of vestibular schwannoma was confirmed. They were asked to complete the same questionnaire at both 3 and 12 months after surgery.

### The Dizziness Handicap Inventory

The Dizziness Handicap Inventory was developed to assess handicap related to balance problems. It examines the functional, emotional and physical deficits that arise secondary to balance problems and previously used in patients with vertigo.<sup>17,18</sup> The scale has shown its

reliability and validity. The DHI scores range from 0 (best possible measured health) to 100 (the worst possible).

### Statistical methods

The descriptive statistics are presented as mean values with standard deviations. For the analysis of the Short Form-36, raw scores were calculated for each scale by adding the responses for all items on that dimension; each raw score was then transformed into a 0–100 point scale using the formula described in the Short Form-36 scoring manual.<sup>19</sup> Non-parametric test was used, because of the non-parametric nature of the data. Comparison of continuous variables was made using the Wilcoxon signed rank test. A 5% level of significance was used. The analysis of DHI scores, used total scores rather than the emotional, physical and functional subscales. This is because, earlier studies have shown by factor analysis that the original subscale structure of the DHI is of questionable validity.<sup>20</sup>

### Results

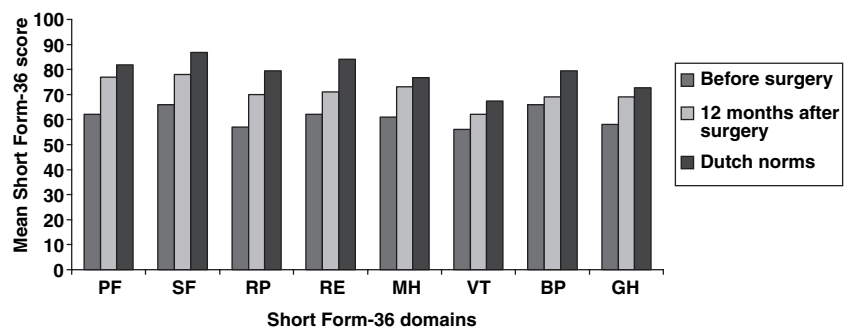
A total of 17 patients (94%) completed the questionnaire preoperatively and 3 and 12 months postoperatively. This

group comprised 10 women and seven men with a mean age of 55.9 years at diagnosis (range 41–69 years). Seven patients had right sided tumours and 10 patients had left sided tumours, which were all intracanalicular. Average time interval between diagnosis and surgery was 8.4 months. The score distribution of the Short Form-36 is listed in Table 1. Mean preoperative scores were significantly lower on all eight scales of the Short Form-36 when compared with the mean scores of the healthy Dutch population sample ( $P < 0.05$ ). There was no significant difference between preoperative scores and 3 months postoperative scores ( $P > 0.05$ ). Scores for physical and social functioning, role-physical functioning, role-emotional functioning, mental health and general health were significantly improved at 12 months postoperatively when compared with preoperative scores ( $P < 0.05$ ). No significant differences were found between preoperative and 12 months postoperative scores for vitality and bodily pain. To illustrate the effects of preoperative vertigo and of translabyrinthine surgery on the Short Form-36 scales, scores were plotted in relation to the scores of individuals from the Dutch general population (Fig. 1.). Twelve months after surgery, mean scores were significantly improved compared with the preopera-

**Table 1.** Mean Short Form 36 Health Survey (Short Form-36) scores of operated patients before and 3 and 12 months after translabyrinthine surgery ( $n = 17$ )

Short Form-36 scales	Before		After 3 months		After 12 months		Dutch controls	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PF	61.5	11.0	67.1	15.7	77.1*	12.8	81.9	23.2
SF	65.7	14.3	70.0	9.9	79.4*	17.1	86.9	20.5
RP	54.4	20.2	58.8	23.2	70.6*	20.2	79.4	35.5
RE	60.7	27.0	66.6	28.9	72.5*	29.4	84.1	32.3
MH	60.2	23.7	60.0	15.6	72.9*	19.6	76.8	18.4
VT	57.9	19.8	62.6	12.3	62.1	17.0	67.4	19.9
BP	65.6	25.4	67.9	24.2	69.7	22.7	79.5	25.6
GH	60.0	12.7	60.0	12.8	70.6*	13.7	72.7	22.7

PF, physical functioning; SF, social functioning; RP, role-physical functioning; RE, role-emotional functioning; MH, mental health; VT, vitality; BP, bodily pain; GH, general health; SD, standard deviation. \* $P < 0.05$ .



**Fig. 1.** Impact of treatment on Short Form 36 Health Survey scores in vestibular schwannoma patients with disabling vertigo.

**Table 2.** Mean total scores of the DHI of operated patients before and 3 and 12 months after translabyrinthine surgery ( $n = 17$ )

DHI total	Mean	Minimum	Maximum	SD
Preoperative	51.3	42	84	13.1
3 months postoperative	38.1	20	52	9.1
12 months postoperative	19.4	12	40	9.5

DHI, Dizziness Handicap Inventory.

**Table 3.** Number of patients with significant changes in Dizziness Handicap Inventory scores

Change period	No		
	Better	change	Worse
Preoperative to 3 months postoperative	5	12	0
Three months postoperative to 12 months postoperative	8	9	0
preoperative to 12 months postoperative	15	2	0

tive mean scores, but still reduced when compared with the mean scores of a healthy Dutch sample. The score distribution for the DHI is given in Table 2. Total scores showed no significant difference in preoperative scores, and scores at 3 months after surgery ( $P > 0.05$ ), but significant differences were found between preoperative scores and 12 months postoperatively ( $P < 0.05$ ). Analysis was performed to look at possible drivers for significant change. For an individual's DHI score to have changed significantly, the change has to be at least 18 points.<sup>16</sup> Data were recoded and the patients experiencing significant change in DHI scores were included in the analysis and listed in Table 3. When this 18-point criterion is used, DHI scores were significantly improved in 30% of the patients and no significant improvement was observed in 70% of the patients at 3 months post-surgery. There were no significantly worse DHI scores at 3 or 12 months after surgery. At 12 months postoperatively, 88% of patients had significant improvement in DHI scores when compared with preoperative scores. Hence, for most patients, significant improvement in the quality of life and vertigo can be expected only after 3 months postsurgery. Age or sex did not significantly correlate with changes in Short Form-36 or DHI scores.

## Discussion

Our study showed that patients with small tumours but with persistent and disabling vertigo complaints have reduced quality of life, which significantly improved after translabyrinthine surgery. It has become clear in personal

communication with colleagues from respected centres that, these kind of vestibular schwannoma patients are seldomly observed and ultimately most of these patients require surgical intervention. It was also concluded that despite numerous quality of life reports in vestibular schwannoma literature, no previous study reported on treatment options (i.e. microsurgery, intra-tympanic gentamycin application) when vertigo continues to affect the patients' quality of life. There is little evidence concerning the effects of intra-tympanic gentamycin on vertigo in vestibular schwannoma patients. A (chemical) labyrinthectomy using intra-tympanic gentamycin is mainly performed in patients with Meniere's disease and high success rates are reported. Brantberg *et al.* proposed gentamycin as a treatment in vestibular diseases other than Meniere's disease, however, only one vestibular schwannoma patient in their series was treated with intra-tympanic gentamycin. They concluded that the intra-tympanic instillation with gentamycin may further increase symptoms as hearing loss and tinnitus in these patients. Moreover, the underlying mechanism of vertigo attacks in vestibular schwannomas is still not completely understood.<sup>21</sup>

Generally, patients with small-sized tumours are recommended a wait and scan policy, especially when symptoms are mild and quality of life is not severely affected. All of our patients had small-sized tumours, but experienced rotatory vertigo grade IV (according to the classification proposed by Kanzaki *et al.*<sup>14</sup>), despite extensive rehabilitative therapy during follow-up. To relieve them from their vertigo and to achieve tumour removal, translabyrinthine surgery was finally undertaken. Transsection of both the vestibular nerves and/or tumourexci-sion resulted in stability of incoming signals in the vestibular nuclei. Immediately after vestibular schwannoma surgery, patients experienced vestibular crisis, but this acute stage was followed within days or weeks with gradual improvement of symptoms due to proper compensation and adaptation of the vestibular nuclei. Most of our patients, experienced these symptoms only for a few weeks or months postoperatively, but instability of balance has been reported after surgery.<sup>3,5,22,23</sup> Two patients continued to experience instability of balance even after 12 months post-surgery and reported no significant change in DHI scores (Table 3). This relative imbalance is induced by the ablation of the vestibular function in the operated ear. Every patient must be informed about this sequelae before surgery, especially in whom the surgery is performed to control the vertigo.

The DHI total scores showed significant improvement after surgery in 88% of our patients at 12 months after surgery, resulting in a postoperative score of 19.4 points. When compared with other reported DHI scores of

**Table 4.** Dizziness Handicap Inventory (DHI) scores as reported by other investigators

Author	Mean age (years)	Population	Mean scores
Humphriss <i>et al.</i> <sup>6</sup>	56	After vestibular schwannoma surgery	21.0
El-Kashlan <i>et al.</i> <sup>5</sup>	53	After vestibular schwannoma surgery	17.0
Kinney <i>et al.</i> <sup>24</sup>	50	Meniere's disease	41.0
Enloe <i>et al.</i> <sup>25</sup>	56	General vestibular dysfunction	53.6
Lopez-Escamez <i>et al.</i> <sup>17</sup>	50	Posterior canal benign paroxysmal positional vertigo	18.1
Present study	56	After vestibular schwannoma surgery	19.4

patients with general vestibular dysfunction or Meniere's disease, our patients scored significantly better.<sup>24,25</sup> Comparison of DHI scores with a general vestibular schwannoma population after surgery or with benign paroxysmal positional vertigo patients showed no large differences (Table 4).<sup>5,6</sup> Short Form-36 results showed that the quality of life in vestibular schwannoma patients suffering from vertigo was significantly reduced on all eight scales when compared with Dutch healthy sample. Postoperatively, scores were significantly improved for almost all of the Short Form-36 scales when compared with preoperative scores. However, Short Form-36 results were still lower in patients than that of the healthy control sample, which is in agreement with the results of previous studies.<sup>8,9,10</sup> To our knowledge, there is no previous evidence which reported on the quality of life or any (surgical) intervention in a comparable patient sample. This may be due to the fact that the treatment of vestibular schwannoma has focused on tumour excision or preservation of cranial nerve function instead of relieving symptoms reported by patients.

#### Comparison with other studies

Recently, a prospective study was performed by Myrseth *et al.*<sup>26</sup> who tried to identify a relationship between cochleovestibular symptoms and quality of life in vestibular schwannoma by using the Short Form-36 and visual analogue scales. They found that vertigo strongly affects the quality of life and suggested that this symptom should play a key role in discussing treatment options in small- and medium-sized vestibular schwannomas. However, they concluded that more clinical evidence is needed to confirm this hypothesis. The results of our study seem to contribute to this hypothesis, but the relatively small sample size of the study should be taken into consideration when interpreting the study results. Most of our patients reported major differences between preoperative and postoperative quality of life and Short Form-36 and DHI scores were statistically significant. The study was conduc-

ted in a prospective manner and by using validated and widely used generic and disease-specific questionnaires. In addition, the Short Form-36 and the DHI have been previously used in studies reporting on efficacy of treatment of vestibular dysfunction. Enloe *et al.*<sup>25</sup> described a general correlation between the two scales before and after vestibular rehabilitation intervention and recommended using the two scales together for optimal quality of life assessment in patients with vestibular disorders.

#### Conclusions

Quality of life in vestibular schwannoma patients with disabling vertigo symptoms has not yet been investigated. It concerns a small cohort of patients within our vestibular schwannoma population with vertigo symptoms that are classified as grade IV according to the classification of Kanzaki *et al.*<sup>14</sup> This study found that the quality of life is reduced in these patients despite rehabilitation exercises to control the vertigo. Finally, translabyrinthine surgery was performed and postoperative results show that at 12 months after surgery, quality of life and vertigo were significantly improved for most patients. Until now, evidence for other possible treatment options in these patients is limited. These findings suggest that surgical treatment should be considered in patients with small- or medium-sized tumours and persistent disabling vertigo resulting in poor quality of life.

#### Conflict of Interest

None to declare.

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