Preoperative Audiovestibular Handicap in Patients with Vestibular Schwannoma

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ABSTRACT

Objectives: To evaluate preoperative hearing, dizziness, and tinnitus handicap in patients with unilateral vestibular schwannoma (VS). **Design:** Prospective administration of the Hearing Handicap Inventory (HHI), Dizziness Handicap Inventory (DHI), and Tinnitus Handicap Inventory (THI), prior to surgical intervention. **Setting:** A tertiary referral neuro-otology clinic. **Participants:** A total of 145 consecutive patients who were admitted for excision of their vestibular schwannomas between May 1998 and July 2002. **Main Outcome Measures:** HHI, THI, and DHI scores. **Results:** HHI, THI, and DHI scores were all found to be significantly correlated. There was no significant association between tumor size and any of the questionnaire scores. When data were categorized to give a measure of handicap severity, 68% had mild to significant hearing handicap, 30% had mild to severe tinnitus handicap, and 75% had mild to severe dizziness handicap. Eighty-eight percent of patients had some handicap in at least one domain, and 23% had some handicap in all three domains. Seven percent of patients had severe or significant handicap in all three domains. **Conclusions:** A considerable proportion of patients with unilateral VS have hearing, tinnitus, and dizziness handicap. These patients should optimally be offered appropriate rehabilitation, something that is especially important as conservative management by “watch, wait, and rescan” becomes more common.

KEYWORDS: Vestibular schwannoma, acoustic neuroma, hearing handicap, tinnitus handicap, dizziness handicap, conservative management

Vestibular schwannoma (VS) patients have a variety of symptoms at presentation. Hearing loss

has been found in 39 to 95% of patients,^{1–5} tinnitus in 45 to 75%,⁶ and dizziness in 49 to 66%.^{2,7–9}

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Other presenting complaints include facial numbness, headache, and otalgia.² Although a patient may have several symptoms, the degree of handicap experienced may not always be associated with that individual's symptomatology. For example, in patients with conditions of varying etiology, pure tone audiometry has been shown to correlate only weakly with disability,^{10,11} tinnitus intensity does not correlate with tinnitus handicap,¹² and there is no relationship between vestibular test results and dizziness handicap.¹³

Although there have been several papers considering handicap, disability, and quality of life experienced by VS patients^{14–22} these have all concentrated on the patient's condition postoperatively. The authors are unaware of any studies looking at preoperative handicap. With the growing evidence that a conservative management strategy may be optimal for quality of life for some patients,^{23,24} a "watch, wait, and rescan" strategy is becoming more popular as the first line treatment for VS.²⁵ The study of preoperative handicap is therefore now of paramount importance: patients may potentially need to be followed up for life or in some cases for several years before treatment becomes necessary, with the concomitant demand for appropriate rehabilitation. This is especially important in the light of evidence that auditory function deteriorates even in the absence of tumor growth.^{23,26}

Three previous studies by this unit have looked at handicap in VS patients.^{27–29} These studies explored changes in hearing, dizziness, and tinnitus handicaps following surgery. Although each of these studies mentioned preoperative handicap, each handicap domain was examined separately, making a holistic view of preoperative audiovestibular handicap very difficult.

The aim of the present article, therefore, was to consider preoperative hearing, tinnitus, and dizziness handicap together so that the overall audiovestibular handicap associated with the presence of a VS prior to intervention might be determined. The well-validated and widely used questionnaires of the Hearing Handicap Inventory (HHI),³⁰ Dizziness Handicap Inventory (DHI),³¹ and Tinnitus Handi-

cap Inventory (THI)^{32,33} were used as outcome measures.

METHOD

The study group consisted of a consecutive series of 145 patients with unilateral sporadic VS who were admitted for the excision of their tumor between May 1998 and July 2002.

Each patient was asked to complete an HHI,³⁰ DHI,³¹ and THI^{32,33} preoperatively. These questionnaires were administered either at admission (usually the day before the operation) or at a dedicated preadmission clinic (usually 1 month before surgery). Patients in this latter group were given the flexibility to complete the questionnaires at any stage prior to surgery. Questionnaires were received from all 145 patients.

Tumor size was determined by measurement of maximum tumor diameter on magnetic resonance imaging (MRI) (T1-weighted scans with gadolinium DTPA enhancement), including the intracanalicular portion. This will usually be the mediolateral diameter along the line of the internal auditory canal.

Statistical Analysis

StatView (version 4.5) statistical software (SAS Institute Inc., Cary, North Carolina, USA) was used to perform nonparametric statistical tests. Comparison of continuous variables was made using the Kruskal-Wallis test. Spearman's correlation coefficient was used in calculating correlations. DHI scores were classified in accordance with quartiles. A 5% level of significance was used.

RESULTS

The study group consisted of 145 patients with a mean age of 55.3 years (SD, 12.0 years; age range,

Table 1 Tumor Sizes in the Study Group

Tumor Size (cm)	Number of Patients
< 1.5	47
1.5–2.4	55
2.5–3.4	23
3.5–4.4	13
> 4.4	6

22 to 80 years). There were 61 females and 84 males. Tumor sizes are given in Table 1.

Questionnaire results are illustrated in Figure 1 and summarized in Table 2. Multiple regression revealed all three questionnaires to be significantly correlated ($p < 0.0001$). Gender had no significant effect upon THI scores (Mann-Whitney U test, $p = 0.2596$). However, women were found to have significantly higher DHI scores than men (Mann-Whitney U test, $p = 0.0070$) and men

were found to have significantly higher HHI scores than women (Mann-Whitney U test, $p = 0.0187$). Tumor size was found to have no effect upon any of the three handicap scores (Kruskal-Wallis test, $p > 0.05$). No significant correlations were found between age and any of the three handicap scores (Spearman correlation, $p > 0.05$).

Data were then categorized to give a measure of handicap severity. The criteria used and the resulting categorized data are given in Table 3. Sixty-eight percent of patients had mild to significant hearing handicap, 30% of patients had mild to severe tinnitus handicap, and 75% of patients had mild to severe dizziness handicap. One-hundred twenty-eight patients (88%) had some handicap (mild to significant or severe) in at least one domain and 33 patients (23%) had some handicap in all three domains. Ten patients (7%) had severe or "significant" handicap in all three domains.

Figure 1 Frequency distributions for total questionnaire scores. (A) Hearing Handicap Inventory (HHI) scores. (B) Tinnitus Handicap Inventory (THI) scores. (C) Dizziness Handicap Inventory (DHI) scores.

Table 2 Descriptive Statistics for Questionnaire Results (Total Scores)

	HHI	THI	DHI
25th percentile	13.5	0.0	1.5
Median	24.0	8.0	14.0
75th percentile	48.0	22.5	34.0
Interquartile Range	34.5	22.5	32.5

HHI, Hearing Handicap Inventory; THI, Tinnitus Handicap Inventory; DHI, Dizziness Handicap Inventory.

DISCUSSION

The robust and well-validated questionnaires of the HHI, THI, and DHI have been used in this study to look prospectively at handicap in patients with unilateral VS. This is the first study to look at audiovestibular handicap in VS patients prior to intervention.

The present study has determined that 68% of patients had mild to significant hearing handicap, 30% of patients had mild to severe tinnitus handicap, and 75% of patients had mild to severe dizziness handicap. Eighty-eight percent of patients had some handicap in at least one domain and 23% had some handicap in all three domains. A significant number of VS patients, therefore, have a handicap which has the potential of being improved with appropriate rehabilitative strategies. If one considers that all three questionnaires were found to be significantly correlated, it then follows that many

patients are likely to need rehabilitative intervention in all three audiovestibular domains.

This investigation looked at only those patients already selected for surgery. However, if these findings are extrapolated to a potential group of patients undergoing a conservative management strategy over several years, then the need for appropriate rehabilitative intervention becomes clear. Such an extrapolation would seem valid because although a "watch, wait, and rescan" group are likely to have smaller tumors, the present study has shown that tumor size has no effect upon preoperative handicap. These findings are consistent with Stipkovits and colleagues,³⁴ who failed to find a correlation between preoperative audiometric findings and tumor size, and with previous studies that have failed to find a relationship between tumor size and functional vestibular compensation status.^{7,27,35,36}

As a result of the findings of the present study, the authors would advocate appropriate rehabilitative intervention for all VS patients who show any degree of handicap, regardless of the subsequent management strategy for that patient. Those patients with significant hearing handicap will almost certainly benefit from appropriate counseling and may also benefit from having a hearing aid (either a conventional contralateral routing of signal or a bone-anchored hearing aid device) or other assistive listening devices. Patients with

Table 3 Criteria Used for Classifying Questionnaire Results

Questionnaire	Handicap Level	Criteria	Number of Patients	Source of Criteria
HHI	None	0–16	46 ³²	Newman et al ¹¹
	Mild to moderate	18–42	56	
	Significant	> 42	43 ³⁰	
THI	Slight	0–16	102	Newman et al ³³
	Mild	18–36	24 ¹⁷	
	Moderate	38–56	9 ⁶	
	Severe	> 56	10 ⁷	
DHI	None	0–2	36 ²⁵	Quartile data, present study
	Mild	2–14	40 ²⁸	
	Moderate	15–34	34 ²³	
	Severe	> 34	35 ²⁴	

HHI, Hearing Handicap Inventory; THI, Tinnitus Handicap Inventory; DHI, Dizziness Handicap Inventory.

Figure 2 Proposed flowchart for rehabilitation of vestibular schwannoma patients.

tinnitus are likely to benefit from counseling; and patients with significant dizziness handicap are likely to benefit from vestibular rehabilitation. Figure 2 offers a flow chart for patient referral.

Although this article has reported on patient handicap in the audiovestibular domain, in retrospect, it would have benefited from the inclusion of a quality-of-life measure. This would have provided a more holistic view of each patient and taken into account other aspects of living such as

pain, headache, facial symptoms, sleep, concentration, memory, activities of daily living, and work.^{14,17,19} Another potential problem with the present study was the choice of questionnaires. All three questionnaires were normed using populations of symptomatic patients. There is therefore a potential floor effect, as demonstrated by skewed distributions illustrated in Figure 1, in that patients with very mild handicaps can potentially go undetected.

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