ORIGINAL ARTICLE

The Effect of Observation versus Microsurgical Excision on Quality of Life in Unilateral Vestibular Schwannoma: A Prospective Study

Dosh Sandooram, M.B., Ch.B., M.R.C.S.,[1] Rachael Hornigold, M.Sc., M.B.B.S., M.R.C.S.,[1] Beth Grunfeld, Ph.D.,[2] Nicholas Thomas, M.B.B.S., F.R.C.S.,[3] Neil D. Kitchen, M.D.,[3] and Michael Gleeson, M.D., F.R.C.S.[1]

ABSTRACT

With the emergence of three effective management options for vestibular schwannoma and the drastic reduction in mortality rate, the last two decades have seen increasing attention being paid to health-related quality of life. The vast majority of quality of life studies have been retrospective. We prospectively assessed quality of life of vestibular schwannoma patients before and after conservative or microsurgical management. We performed a prospective observational study conducted at a tertiary referral center between October 2001 and October 2003. Patients were divided into two groups: conservative management and microsurgery. Quality of life was assessed using the Medical Outcome Study 36-Item Short Form (SF-36) and Glasgow Benefit Inventory (GBI). The questionnaires were administered at initial assessment, 1 month, 3 months, and 6 months in both groups. Thirty-three patients completed the study, 18 in the conservative group and 15 in the microsurgical group. One month after microsurgery, SF-36 scores were significantly reduced within three of eight domains; however, 3 months after microsurgery, no significant difference existed in patients' scores on any of the SF-36 domains compared with preoperatively, and at 6 months there was a significant improvement in one domain compared with preoperatively. There was no significant difference in overall quality of life alteration (GBI total score) between microsurgery and conservative management. The improved quality of life of patients 6 months after microsurgery (relative to preoperatively, and in comparison with an age- and sex- matched population) is a new finding that has not been previously documented in the literature.

KEYWORDS: Vestibular schwannoma, acoustic neuroma, quality of life, Glasgow Benefit Inventory, SF-36

[1]Department of Otolaryngology and Skull Base Surgery, Guy's Hospital, [2]Department of Clinical Psychology, Guy's, King's and St. Thomas' Medical School, [3]Department of Neurosurgery, King's College Hospital, London, United Kingdom.

Address for correspondence and reprint requests: Michael J. Gleeson, M.D., F.R.C.S., Department of Otolaryngology and Skull Base Surgery, Guy's Hospital, St. Thomas Street, London SE1 9RT, United Kingdom (e-mail: professor.michael.gleeson@gmail.com).

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Table 1 Quality of Life Studies: Method of Management—Microsurgery

Authors	Group Size	Method	Management	Time of Assessment	Assessment Tool	Findings
Irving et al[1] 1995	227	Retrospective	Microsurgery	Posttreatment	EORTC questionnaire	QOL ''excellent'' following microsurgery, small tumors (≤1.5 cm) had significantly better QOL.
Nikolopoulos et al[2] 1998	53	Retrospective	Microsurgery	Posttreatment	GBI	QOL improved in 17%, remained the same in 29%, and worsened in 54%. Younger patients more likely to experience greater decrease in QOL. Tumor size had no impact on QOL.
Santarius et al[3] 2000	71	Retrospective	Microsurgery (retrosigmoid approach)	Posttreatment	GBI	Mild deterioration in QOL following surgery (mean GBI score −6.6). No impact of headache on QOL.
Da Cruz et al[4] 2000	72	Retrospective	Microsurgery (subgroup of Irving et al[1])	Posttreatment	SF-36	QOL reduced in seven of eight domains compared with general population. No difference in QOL with size of tumor.
Martin et al[5] 2001	76	Retrospective	Microsurgery (translabyrinthine approach)	Posttreatment (mean follow-up 18 mo)	SF-36	QOL reduced in five of eight domains compared with general population. Larger tumors (≥2.5 cm) associated with worse scores in physical functioning.
Betchen et al[6] 2003	135	Retrospective	Microsurgery	Posttreatment	SF-36	QOL not consistently lower postsurgery than population normative values. Headache biggest indicator of QOL.
Barré et al[7] 2004	104	Retrospective	Microsurgery	Posttreatment	SF-36	QOL reduced in four of eight domains compared with general population. Women scored worse than men in five of the eight domains.
Bauman et al[8] 2005	42	Retrospective	Microsurgery (middle fossa approach)	Posttreatment	SF-36	QOL reduced in six of eight domains compared with general population.
Tufarelli et al[9] 2006	386	Retrospective	Microsurgery	Posttreatment (mean follow-up 4 y)	SF-36	QOL reduced in all domains compared with general population. Scores worse for women and patients over 45 y.
Nicoucar et al[10] 2006	103	Retrospective	Microsurgery (retrosigmoid approach)	Posttreatment	SF-36	QOL reduced in all domains compared with general population. Larger tumors had worse scores in all categories except pain.
Alfonso et al[11] 2007	95	Retrospective	Microsurgery	Posttreatment	GBI	30% reported improved QOL, 56% reported worse, 14% reported no change.
Browne et al[12] 2008	119	Retrospective	Microsurgery	Posttreatment	SF-36	QOL significantly reduced.

EORTC, European Organization for Research into the Treatment of Cancer; GBI, Glasgow Benefit Inventory; SF-36, Medical Outcome Study 36-Item Short Form; QOL, quality of life. Shaded studies revealed no change in QOL, unshaded revealed significant worsening after treatment.

With the emergence of three effective management options for vestibular schwannoma and the drastic reduction in mortality rate, the last two decades have seen increasing attention being paid to health-related quality of life. There are many methods of measuring quality of life, and several validated questionnaires have been developed to allow accurate assessment. A large number of authors have published on this topic, and following a Medline search (1949 to 2009, search terms "vestibular schwannoma," "acoustic neuroma," and "quality of life") a comprehensive review of the literature is summarized in Tables 1–5.[1–18] Only studies that used a validated method of assessing quality of life were included in this review.

There are, however, several problems related to previously published studies. Not all authors used the same measures of quality of life scoring system; for example, the European Organization for Research into the Treatment of Cancer questionnaire used by Irving et al[1] was designed for cancer patients, who tend to have different symptomatology and a relatively poor prognosis. When the disease-specific module of the questionnaire was used to measure quality of life, tumor size was no longer found to be a significant determinant of outcome. Several authors have called for a standardization of quality of life scoring systems to allow future meta-analysis to obtain higher levels of evidence.

Table 2 Quality of Life Studies: Method of Management—Conservative

Authors	Group Size	Method	Management	Time of Assessment	Assessment Tool	Findings
MacAndie and Crowther[13] 2004	42	Retrospective	Conservative	Following period of serial screening	SF-36	No difference in QOL compared with age- and sex-matched group.

This study revealed no change in QOL.

Table 3 Quality of Life Studies: Microsurgery versus Radiosurgery

Authors	Group Size	Method	Management	Time of Assessment	Assessment Tool	Findings
Van Roijen et al[14] 1997	145	Retrospective	Microsurgery versus radiosurgery	Up to 4 y follow-up	SF-36, EuroQol	Radiosurgical patients had better quality of life than microsurgical in three of eight domains. EuroQol confirmed improved QOL in radiosurgical patients.
Myrseth et al[15] 2005	189	Retrospective	Microsurgery versus radiosurgery	Mean follow-up 5.9 y	GBI, SF-36	GBI scores significantly worse in microsurgery group. SF-36 lower in microsurgical group.
Pollock et al[16] 2006	82	Prospective	Microsurgery versus radiosurgery	Assessed pretreatment, at 3 mo, at 1 y, and at last follow-up	HSQ (modified SF-36)	Microsurgical group showed significantly worse QOL posttreatment. Radiosurgical group showed no decline in QOL posttreatment.

EuroQOL, European Quality of Life; HSQ, Health Status Questionnaire; GBI, Glasgow Benefit Inventory; SF-36, Medical Outcome Study 36-Item Short Form; QOL, quality of life.

Table 4 Quality of Life Studies: Microsurgery versus Conservative Management

Authors	Group Size	Method	Management	Time of Assessment	Assessment Tool	Findings
Kelleher et al[17] 2002	47	Retrospective	Microsurgery versus conservative	Posttreatment	SF-36	QOL in conservative group no different from general population. QOL in microsurgical group worse in two of eight domains.

SF-36, Medical Outcome Study 36-Item Short Form; QOL, quality of life.

Table 5 Quality of Life Studies: Microsurgery versus Radiosurgery versus Conservative Management

Authors	Group Size	Method	Management	Time of Assessment	Assessment Tool	Findings
Sandooram et al[18] 2004	165	Retrospective	Microsurgery versus radiosurgery versus conservative	Median follow-up: 4.8 y for microsurgery, 2.1 y for conservative, and 1.8 y for radiosurgical	GBI	Conservatively managed group achieved significantly higher GBI scores than radiosurgical or microsurgical group. No statistical difference between radiosurgical and microsurgical group. Microsurgical patients received significantly greater support from friends and family than conservative group. QOL deteriorated slightly after microsurgical resection (GBI median −4.3).

GBI, Glasgow Benefit Inventory; QOL, quality of life.

The main criticism of many outcome studies was the lack of a control group. With an increasing number of reports about positive outcomes of radiosurgery and conservative management in the 1990s, it became important to compare the results of the various management options, both from the physician's and the patient's perspective. However, in many cases radiosurgery and microsurgery are not offered in the same treatment center or even the same country, and this may be a source of error when comparing the quality of life between the two groups.

The vast majority of quality of life studies have been retrospective. Myrseth et al[15] showed that following the diagnosis of vestibular schwannoma, and before any subsequent treatment, patients had lower quality of life scores on six of eight domains of the Medical Outcome Study 36-Item Short Form (SF-36) questionnaire, compared with an age- and sex-matched population. They suggested that it was possible that the reduced quality of life among vestibular schwannoma patients as reported by many authors was brought about mostly by the disease and that treatment did not alter it. A further limitation of retrospective studies is that microsurgical patients often have had longer follow-up compared with those who had undergone radiosurgery or conservative management, and therefore a retrospective study may be distorted by changes in the quality of life during the early postoperative recovery phase.

The aim of this study was to prospectively assess quality of life of vestibular schwannoma patients, before and after treatment. The purpose was to evaluate changes occurring during the early stages after treatment and to find out whether any differences existed in short-term outcomes between conservative management and active microsurgical treatment. It was hoped that the results would provide fresh insight into patients' experiences of the disease and its management.

METHODS

Study Design

A prospective observational study was conducted at a tertiary referral center between October 2001 and October 2003.

Patient Selection

Patients referred to the unit with a new diagnosis of unilateral vestibular schwannoma were invited to take part in the study. Following assessment, the risks and benefits of three management options (microsurgery, radiosurgery, wait-and-rescan policy) were discussed, and a management plan was formulated.

Treatment

Patients were divided into two groups: those who opted for conservative management and those who opted for microsurgery. Patients who opted for radiosurgery were not included in this study. Patients undergoing observation were booked for T1-weighted gadolinium-enhanced magnetic resonance imaging of the internal auditory meatus and cerebellopontine angle in the axial, coronal, and sagittal planes, a year after the initial diagnostic scan. A follow-up appointment was arranged for within a month after that scan. Patients were advised to contact the treating surgeon ahead of that appointment if they developed any new worrying symptom. Those who decided to undergo microsurgery were added to the waiting list, with consideration being given to

convenient timing, on the patient's part, for the operation and postoperative recovery.

Assessment Tool

Quality of life was assessed using the SF-36 and Glasgow Benefit Inventory (GBI). The questionnaires were administered at initial assessment in both groups. Conservatively managed patients were called back for repeat investigations 1 month (TP1), 3 months (TP2), and 6 months (TP3) after baseline investigations (TP0). Microsurgical patients attended for repeat investigations 1 month (TP1), 3 months (TP2), and 6 months (TP3) after active treatment. Ethical approval was sought and granted prior to the commencement of this study.

RESULTS

Patients

Thirty-nine patients who had been consecutively referred to the tertiary center were approached by the researcher. As participation in the study entailed four extra visits to the hospital to meet the researcher, one patient living abroad was excluded because of the excessive traveling that would have been required. One patient declined to participate in the study. Among the 35 patients who agreed to take part, 17 had opted for microsurgery, and 18 were to be conservatively managed. Two patients in the microsurgical group were lost to follow-up.

The mean age of the study population at initial assessment was 51.2 years (range 18.4 to 84.3). The median tumor diameter was 1.5 cm (mean 1.8, range 0.3 to 4.0). Twenty-two male and 15 female patients participated in the study. The mean age of the male population at TP0 was 49.6 years (range 18.4 to 70.1), and that of the female population was 53.7 years (range 31.7 to 84.3; $t = 0.84$, $df = 35$, $n = 37$, $p = 0.41$). The median tumor diameters of male and female patients were 1.5 cm and 1.0 cm, respectively ($Z = -1.3$, $n = 37$, $p = 0.21$). There was a moderate negative correlation between age at TP0 and tumor size, showing that younger patients tend to present with larger tumors ($r_s = -0.55$, $n = 37$, $p < 0.001$).

Effects of Microsurgery and Conservative Management on Quality of Life

SF-36

The results are summarized in Table 6. Microsurgery resulted in significantly higher energy levels (SF-36 energy/vitality score) at TP3 than at TP0, when compared with conservative management ($Z = -2.26$, $n = 33$, $p < 0.05$). Microsurgical patients also showed a trend toward less emotional handicap (SF-36 role-emotional score) at TP3 than at TP0, when compared with conservative management ($Z = -1.89$, $n = 33$, $p = 0.06$).

Microsurgical patients perceived a significant improvement in their health from TP0 to TP3 (SF-36 health perception score), compared with conservatively managed patients ($Z = -2.62$, $N = 33$, $p < 0.01$).

GBI

Microsurgical patients reported a significant increase in support from family and friends (GBI social support score) from TP0 to TP3, compared with conservatively managed patients ($Z = -2.82$, $n = 32$, $p < 0.01$). There was no significant difference in overall quality of life alteration (GBI total score) between microsurgery and conservative management ($Z = -0.11$, $n = 32$, $p = 0.91$). Similarly, there were no significant differences in the GBI general and GBI physical health scores achieved by microsurgical and conservatively managed patients ($Z = -1.12$, $n = 32$, $p = 0.26$ and $Z = -1.42$, $n = 32$, $p = 0.16$, respectively).

DISCUSSION

Myrseth et al[15] showed that following the diagnosis of vestibular schwannoma, and before any subsequent treatment, patients had lower quality of life scores on six of eight domains of the SF-36 questionnaire, compared with an age- and sex-matched population. They suggested that it was possible that the reduced quality of life reported in vestibular schwannoma patients was brought about mostly by the disease and that treatment did not alter it. Unfortunately, they analyzed their study group as a whole and did not differentiate between patients who were about to be treated conservatively and those who were due to receive active treatment.

The current study showed that, following diagnosis and decision about a conservative management approach (TP0), patients had significantly lower SF-36 scores on the role-emotional and social functioning domains ($p < 0.05$) compared with those from an age- and sex- matched population. On the other hand, following diagnosis and while awaiting microsurgery (TP0), patients showed a trend toward lower SF-36 scores on the role-physical domain, compared with the general population ($p = 0.06$). These findings would be broadly in agreement with Myrseth et al's results.[15]

Changes in Quality of Life after Microsurgery

Changes in vestibular schwannoma patients' quality of life following treatment have, so far, been prospectively evaluated at only one other institution. Between 2000 and 2005, Pollock et al[16] assessed the quality of life of 36 microsurgical and 46 radiosurgical patients at 3 months, at 12 months, and at the last follow-up

Table 6 The Effect of Microsurgery and Conservative Management changed SF-36 Scores from TP0 to TP3

	Mean	Median	Range
Change in physical functioning score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	4.0	0.0	−25.0–60.0
Observation	−0.6	0.0	−30.0–55.0
Change in role-physical score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	11.7	0.0	−100–100
Observation	9.7	0.0	−50.0–100
Change in role-emotional score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	20.0	0.0	−66.7–100
Observation	1.9	0.0	−66.7–66.7
Change in social functioning score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	−6.7	0.0	−66.7–44.4
Observation	0.6	0.0	−22.2–44.4
Change in bodily pain score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	−3.7	0.0	−55.6–55.6
Observation	−1.2	0.0	−44.4–55.6
Change in mental health score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	3.5	4.0	−28.0–36.0
Observation	1.8	4.0	−20.0–44.0
Change in energy/vitality score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	7.7	15.0	−35.0–30.0
Observation	−3.6	−10.0	−35.0–35.0
Change in health perception score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	9.3	10.0	−20.0–37.0
Observation	−6.7	−5.0	−32.0–15.0
Change in change in health score from TP0 to TP3 (TP3 minus TP0)			
Microsurgery	18.3	25.0	−50.0–100
Observation	1.4	0.0	−50.0–50.0

SF-36, Medical Outcome Study 36-Item Short Form; TP0, baseline; TP3, 6 mo.

appointment, which they compared with pretreatment quality of life. At 3 months, microsurgical patients had a significant reduction in the Health Status Questionnaire scores on the physical functioning, role-physical, and energy/vitality domains. At 12 months, microsurgical patients' scores on the physical functioning and bodily pain domains were significantly reduced compared with preoperatively. At the last follow-up appointment, patients still reported significantly more bodily pain on the HSQ. In comparison, radiosurgical patients showed no significant change on any of the components of the HSQ after treatment compared with before treatment.

The current study showed that a month after microsurgical tumor resection, patients' SF-36 scores were significantly reduced within the physical functioning, social functioning, and energy/vitality domains, compared with before surgery—findings that one might have expected. In addition, there was a trend for poorer scores within the role-physical and bodily pain domains ($p = 0.07$). However, 3 months after microsurgery, no significant difference existed in patients' scores on any of the SF-36 domains compared with preoperatively—findings that contradict Pollock et al's results.[16]

Six months after microsurgery, patients' scores on the physical functioning, social functioning, mental health, bodily pain, role-physical, and energy/vitality domains were similar to the preoperative figures. However, the health perception scores were significantly better compared with before microsurgery ($p < 0.05$). In addition, patients showed a trend toward improved emotional well-being compared with preoperatively (role-emotional domain, $p = 0.09$). Again, these results would appear to be at variance with Pollock et al's findings,[16] although the latter authors did not measure quality of life at 6 months.

When compared with an age- and sex- matched population, microsurgical patients fared significantly worse on the physical functioning, role-physical, social functioning, energy/vitality, and pain domains 1 month after surgery. Three months after surgery, there was a trend for poorer scores on the role-physical ($p = 0.06$) and social functioning ($p = 0.08$) domains compared with the general population. However, by 6 months postsurgery, the picture was different: patients' SF-36 scores on the health perception domain were significantly higher than those of an age- and sex- matched population ($p < 0.05$). Microsurgical patients also

showed a trend toward improved emotional well-being compared with the general population (role-emotional domain, $p = 0.08$). These findings are at significant variance with several retrospective studies showing poorer quality of life among postoperative microsurgical patients compared with the general population.[4–9,15,17] The median GBI total score achieved by microsurgical patients in this study was 5.6, showing that more than half of the microsurgical group reported an improvement in quality of life 6 months after tumor resection, compared with preoperatively—a result that again contradicts findings from previous studies.[2,3,15,18]

Changes in Quality of Life after Conservative Management

Kelleher et al[17] found that, after a median follow-up of 3.1 years, conservatively managed patients reported a quality of life similar to that of the general population their study, and 93% of conservatively managed patients did not require further active treatment. The current study showed that, at TP0, conservatively managed patients had significantly lower SF-36 scores on the role-emotional and social functioning domains compared with those from an age- and sex- matched population. Six months into the conservative management period (TP3), patients' SF-36 scores on the social functioning domain were still significantly below the expected norm ($p < 0.01$). Within-group comparison showed that conservatively managed patients experienced no significant change in SF-36 scores on any of the domains at any time point after the beginning of the observation period.

It is possible that normal quality of life and successful conservative management are interrelated, in that conservatively managed patients whose quality of life is maintained might agree to continue with such a treatment policy (despite tumor growth), and patients whose tumors are proven to remain static on serial scanning might enjoy an improvement in quality of life (relative to an initially impaired quality of life following diagnosis and prior to follow-up scans). The median GBI total score achieved by conservatively managed patients in the study group was 2.8, showing that overall quality of life changed little during the 6-month period of observation, thus reflecting the findings from the SF-36 questionnaire.

Comparison of Microsurgery and Conservative Management

Microsurgery resulted in significantly higher energy levels (SF-36 energy/vitality score) at TP3 than at TP0, when compared with conservative management ($p < 0.05$). Microsurgical patients perceived significant improvement in their general health from TP0 to TP3 (SF-36 health perception score), compared with conservatively managed patients ($p < 0.01$). However, there was no significant difference in the GBI total scores achieved by microsurgical and conservatively managed patients (median: 5.6 and 2.8 respectively; range: −30.6 to 44.4 and −13.9 to 22.2 respectively, $n = 32$, $p = 0.91$). This could be related to the relatively small sample size, but could also reflect the fact that overall differences in quality of life of microsurgical and conservatively managed patients were minor, at the end of the study period.

This study demonstrates that, following diagnosis, the average vestibular schwannoma patient's quality of life is poorer than that of the general population—a finding that clinicians need to acknowledge. Patients managed conservatively continue to experience the same reduced quality of life during, at least, the first 6 months of the observation period. Perhaps this is due to the fact that they are anxious about subsequent tumor growth and/or the development of new symptoms; however, this may simply be a reflection of the persistence of impairments, disabilities, and handicaps that led patients to seek medical attention in the first place. Therefore, it is important for clinicians to address the specific problems that conservatively managed patients initially presented with. For example, patients may require referral for auditory rehabilitation, physiotherapy, or tinnitus retraining therapy, depending on their disabilities and handicaps. On the other hand, patients about to undergo microsurgery need to be aware that they are likely to endure a further decline in quality of life immediately after treatment. However, they can be reassured that the decline is probably going to last less than 3 months in the majority of cases.

A source of error in this study is the fact that the two groups were not randomized, and clinician guidance and patient choice guided the group selection. This may have introduced a bias, as patients undergoing microsurgery tended to be younger, with larger tumors. Patient personality traits may influence the decision to undergo microsurgery or observation, and these may also influence quality of life. However, this source of error is inevitable in this study.

CONCLUSION

The improved quality of life of patients 6 months after microsurgery (relative to preoperatively, and in comparison with an age- and sex-matched population) is a new finding that has not been previously documented in the literature. This finding may have important clinical implications for the patient; however, before any definite positive medium-term quality of life benefit from microsurgery can be claimed, further prospective studies, comprising a larger cohort of patients and followed up over a longer period, need to be conducted.

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