

# Assessing Impairment and Disability of Facial Paralysis in Patients With Vestibular Schwannoma

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**Objective:** To evaluate facial impairment and disability with respect to quality of life in patients with facial paresis after vestibular schwannoma surgery.

**Design:** Cross-sectional observational study.

**Setting:** Academic, tertiary care hospital.

**Patients:** All consecutive patients during a 5-year period who underwent vestibular schwannoma surgery.

**Main Outcome Measures:** The validated, patient-graded Facial Clinimetric Evaluation (FaCE) scale questionnaire was administered to all study patients. Main outcome measures included total and social function FaCE scores. Subgroup analysis was performed on patient factors (age and sex), surgical factors (tumor size and time since operation), and House-Brackmann grade.

**Results:** A total of 56 FaCE questionnaires were returned (85% response rate): 28 patients (50%) had normal facial function (House-Brackmann grade I), and 28 patients (50%) had abnormal facial function (House-Brackmann grades II-VI). There were no demographic differences between the normal and abnormal groups. The normal group had a total FaCE score of 96.2 compared with 67.1 in the abnormal group ( $P < .05$ ). Subgroup analysis of patients with facial paresis revealed that age, sex, time since operation, tumor size, and House-Brackmann grade were not statistically significant factors predicting the FaCE social function score ( $P < .05$ ).

**Conclusions:** Facial paresis is an important complication of vestibular schwannoma surgery and will impair a patient's quality of life. The level of impairment may not be predicted by a patient's age, sex, tumor size, time since operation, or severity of facial paresis.

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**S**CHWANNOMAS IN THE INTERNAL auditory canal are the most common tumors of the temporal bone, while those in the cerebellopontine angle account for approximately 10% of all intracranial tumors. Commonly referred to as *vestibular schwannomas* (VSs), schwannomas in the cerebellopontine angle usually arise from the vestibular branches of the eighth cranial nerve and reportedly have a histologic incidence rate of 0.8% to 2.7%.<sup>1</sup> Clinically, in patients with non-neurofibromatosis type 2, new spontaneous cases arise at about the rate of 1 per 100 000 persons per year.

Although mortality rates from the surgical removal of VSs are far less than 1%, there is significant morbidity associated with this type of surgery. One of the most challenging aspects of VS surgery is the dissection of the tumor from the facial nerve, especially when the nerve has been thinned out by a larger tumor. Thus, facial nerve injury is one of the more common, and perhaps the most feared, complications of VS surgery.<sup>2-12</sup> Although the rate of ana-

tomical preservation of the facial nerve has been reported to be as high as 95% or more, facial paresis is noted to be one of the most critical handicaps that a patient must potentially face.<sup>3,4,7,10,12-14</sup>

There have been several studies that have objectively quantified the level of facial nerve dysfunction using a combination of clinical assessments and mathematical models.<sup>2,4,5,10,12,15</sup> Although these procedures may provide an accurate depiction of a patient's level of facial paresis, they do not address how this handicap may affect a patient's quality of life. It is this particular aspect of VS surgery that has not been explored thoroughly in the literature.

The largest stumbling block in attempting to investigate this specific complication of VS surgery is the lack of consistency in the materials and methods that are used to assess patients. Recent studies have consistently demonstrated that facial paresis will definitely have an impact on a patient's quality of life after surgery.<sup>3,7-9,11,14,16</sup> Despite this agreement, it is difficult to quantify the level of disability, as each of these studies has used different

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questionnaires, including the Glasgow Benefit Inventory, which measures quality of life after otolaryngological interventions; the Short-Form 36, which assesses universal quality-of-life issues; the Derriford Appearance Scale, which measures psychological distress in persons who are concerned with their appearance; and the Facial Disability Index. Although the Facial Disability Index is more specific for assessing dysfunction in facial movement, none of these questionnaires has been validated formally as an instrument to assess how facial paresis will affect a patient's quality of life. Also, there have been only a handful of studies that have examined the various factors that may predict the level of social distress that can be caused by facial paresis after VS surgery. Therefore, the objectives of the present study are 2-fold: (1) to use a validated instrument to measure the psychosocial impairment of facial paresis after VS surgery; and (2) to assess various patient and surgical factors that may predict the magnitude of this disability.

## METHODS

The protocol for this cross-sectional, point-in-time observational study was designed in accordance with the Office of Research Ethics, University of Western Ontario, London (Review 8338).

### DESIGN

A retrospective review was performed of all relevant patient charts to determine subject eligibility and to collect demographic and baseline clinical data. Eligible subjects were recruited by mail and asked to complete the Facial Clinimetric Evaluation (FaCE) questionnaire; a subsequent follow-up postcard was sent to the patients who did not initially respond. This was a modified Dillman method of contacting patients to maximize the return rate.

### INCLUSION CRITERIA

The sampling frame for the current study was the list of all consecutive patients who underwent surgery for a VS at the London Health Sciences Centre between January 1996 and December 2000. From this list, all eligible patients were recruited by mail. The information was acquired at the start of the year 2002, thus allowing for a minimum 1-year follow-up period from surgery to survey to prevent early symptoms, including transient facial paralysis, from acting as confounders during the assessment.<sup>17</sup> All included patients were English speaking and had no previous facial abnormality from causes other than VS surgery, which prevented other causes of facial paresis or asymmetry from influencing a patient's response to the questionnaire. The level of facial nerve function (House-Brackmann grade [HBG]) was recorded from the medical chart using the 1-year follow-up assessment routinely performed by one of us (L.S.P.).

### THE FaCE QUESTIONNAIRE

The FaCE questionnaire is a validated quality-of-life instrument that is used to assess facial impairment and disability after facial paralysis. It involves 15 statements, each using a 5-item Likert scale. A participant circles the most appropriate response to a given statement, whereby 1 corresponds to the lowest function and 5 corresponds to the highest function. These statements are subsequently grouped into 6 independent do-

**Table 1. Facial Clinimetric Evaluation Instrument: Social Function Statements**

<p>I act differently around people because of my face or facial problem</p> <p>People treat me differently because of my face or facial problem</p> <p>My appearance has affected my willingness to participate in social activities or to see family or friends</p> <p>Because of difficulty with the way I eat, I have avoided eating in restaurants or in other people's homes</p>
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main: social function, facial movement, facial comfort, oral function, eye comfort, and lacrimal comfort. An overall score incorporates all of these domains. Using a specific formula, a score from 0 (worst) to 100 (best) is calculated. The FaCE questionnaire has been validated formally with respect to its ability to accurately and reliably measure these aspects of facial paralysis and has demonstrated excellent internal consistency as well as test-retest reliability.<sup>18</sup>

## ANALYSIS

Although the FaCE questionnaire measures 6 domains of facial dysfunction as they relate to facial paralysis, the most relevant domain for the purposes of this study was social function. Most definitions of quality of life have emphasized the importance of understanding a patient's physical impairment in the context of his or her social well-being.<sup>19</sup> We believed that this aspect of quality of life was represented best in the statements that were used to assess the social function domain (**Table 1**). The other FaCE domains address the physical impairment issues of facial nerve dysfunction, which were not the specific objectives of our study. Therefore, we decided a priori that the most important outcome measure from the FaCE questionnaire should be the social function score.

To address the first objective of our study, all recruited patients were categorized into those with normal facial function (HBG I) and those with abnormal facial function (HBG II-VI). This initial stratification allowed us to apply the FaCE questionnaire to each population and hence to determine whether facial paralysis did affect a patient's quality of life. A 1-tailed *t* test was used to compare means because we assumed that facial paralysis could not result in improved social function. To address the second objective, a subgroup analysis was performed on the abnormal facial function group. Variables assessed include patient age and sex, tumor size, time since operation, and severity of facial paresis. Univariate and multivariate regression analyses were performed to determine the predictive value of the variables on the FaCE social function score.

Power analyses revealed that to detect a difference in FaCE social function scores between the normal facial function and abnormal facial function groups with 95% confidence and 90% power, a sample of size of 34 patients, 17 per group, would be required. To detect an association between the level of social function and each of the various predictor variables investigated using a univariate model, with a correlation coefficient greater than or equal to 0.3, a sample size of 22 would be required to achieve 95% confidence limits and 90% power.<sup>20</sup>

## RESULTS

A total of 56 of 66 eligible patients were recruited for this study (85% response rate). This sample size met the minimum required as determined by our power analysis for the first part of our study. All surgical procedures were completed by 1 or both senior authors (S.P.L. and L.S.P.).

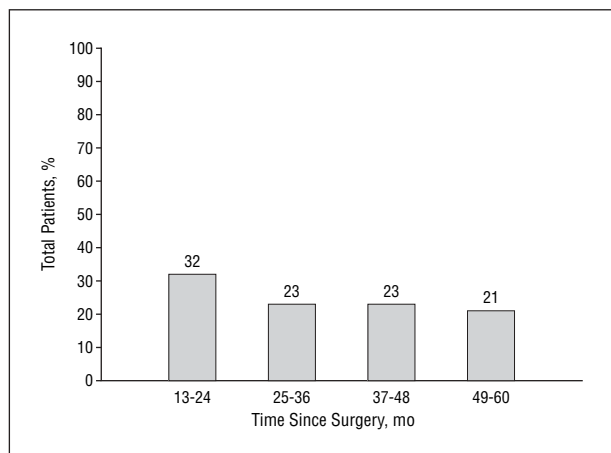


Figure 1. Time since surgery.

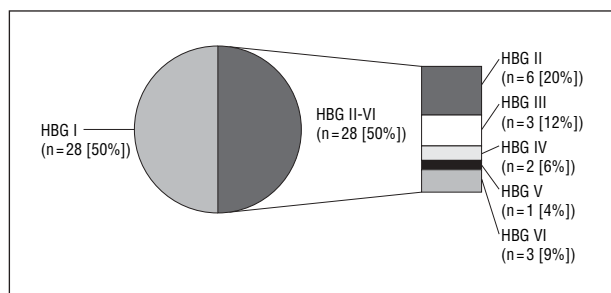


Figure 2. Patients grouped according to House-Brackmann grade (HBG).

By far, the main surgical approach for the VS excision was translabyrinthine. The study population was composed of 30 men (54%) and 26 women (46%). The mean  $\pm$  SD age at diagnosis was  $54.9 \pm 1.7$  years; the mean follow-up time was 38.9 months (range, 12-60 months); and the mean  $\pm$  SD tumor size was  $2.4 \pm 0.2$  cm.

Approximately the same proportion of patients were recruited from each year of the study period (Figure 1). In terms of severity of facial paresis (HBG), there were 28 patients (50%) who had normal facial function (HBG I) and 28 patients (50%) who had some level of facial paresis (HBG II-VI). The distribution of severity of facial paresis is shown in Figure 2, with patients representing all levels of the HBG scale. Again, the sample size in the abnormal facial function group satisfied the minimum required, as determined by our power analysis, to meet the second objective of our study.

When we compared the normal group with the abnormal group, there were statistically significant differences across all of the FaCE domains, with the latter group universally scoring lower ( $P < .05$ ) (Figure 3). With respect to quality of life, the normal group averaged 99.6 in social function, with the abnormal group averaging a score of only 84.5 ( $P < .05$ ). As expected, the total FaCE score for the abnormal group (67.1) was significantly lower than that of the normal group (96.2), as this score incorporates all of the FaCE domains ( $P < .05$ ).

Table 2 demonstrates the results from univariate regression analysis of our abnormal facial function group. We found that the severity of facial paresis, or HBG, was not a predictor of the FaCE social function score. Simi-

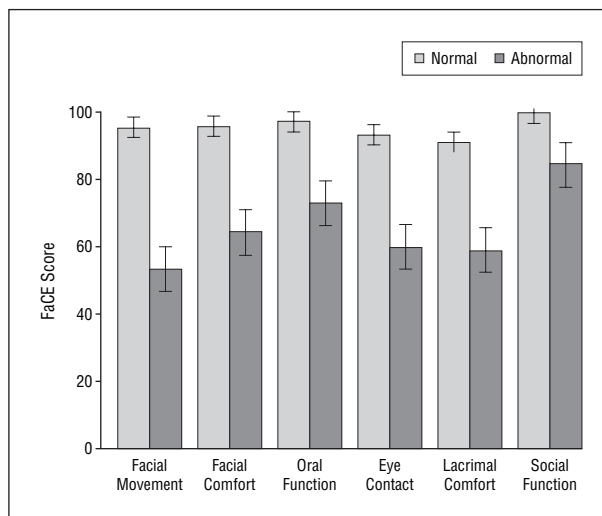


Figure 3. Normal vs abnormal facial nerve function (Facial Clinimetric Evaluation [FaCE] scores). The error bars represent the standard deviations of the means.

Table 2. Univariate Linear Regression Analysis of Patients' Social Function Score With Demographic and Clinical Factors

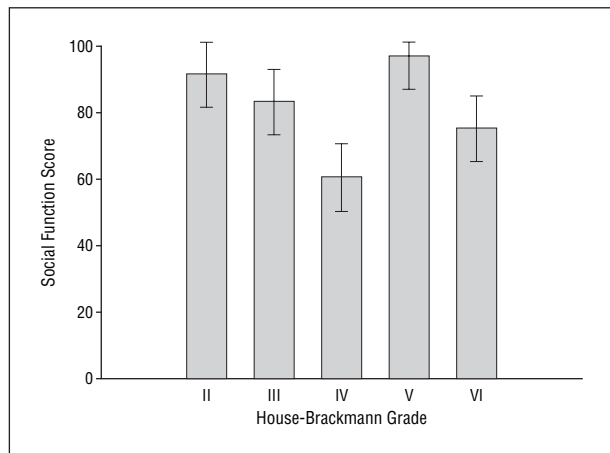
Factor	Coefficient	SE	P Value
Severity of facial nerve paresis*	-3.7	3.0	.24
Age	0.5	0.3	.15
Sex	7.1	9.0	.44
Time since operation	-0.2	0.4	.67
Tumor size	-1.2	3.9	.75

\*House-Brackmann grade.

larly, we found that age, sex, postsurgical time interval, and tumor size were not predictors of a patient's level of overall social function or quality of life.

## COMMENT

Over the last 10 years, much attention has been placed on assessing physical impairments and how they affect a patient's quality of life. The World Health Organization now defines overall health as a "state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Therefore, assessing quality of life should encompass a patient's perception of his or her own well-being and ability to achieve social usefulness or normalcy in the context of his or her own disability. In the area of VS surgery, there have been relatively few studies that have investigated how the potential complication of facial paresis will affect a patient's quality of life. Also, it has been difficult to draw definitive conclusions from the literature, because of the wide variety of questionnaires that have been used for these investigations.<sup>3,7-9,11,14,16</sup> The many problematic issues relating to quality-of-life assessments have been well documented, and it has been suggested that "disease-specific instruments are most appropriate for clinical trials in



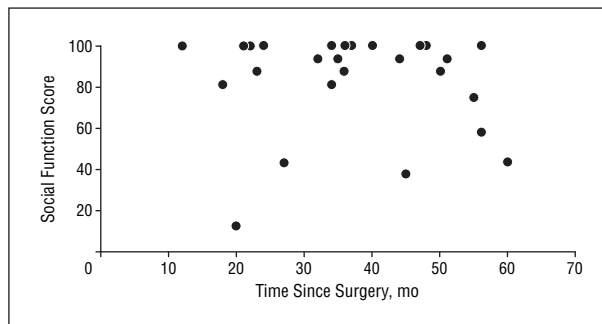
**Figure 4.** Social function score vs facial nerve function (House-Brackmann grade). The error bars represent the standard deviations of the means.

which specific therapeutic interventions are being evaluated.”<sup>19</sup> Clearly then, our choice of a validated questionnaire for facial paralysis is most appropriate for assessing this specific complication of VS surgery.

Before attempting to describe and analyze the various predictors of facial disability, we wanted to establish and confirm the previously published conclusion that facial paresis does affect quality of life. Our results clearly show that the normal facial function group achieved a higher level of social function than our abnormal facial function group. This finding only serves to reaffirm the accepted notion that facial paresis is a significant complication of VS surgery and will indeed affect a patient’s quality of life in the postoperative period.

However, our data unexpectedly suggest that a patient’s level of facial paresis, or HBG, is not a predictor of his or her self-reported level of social disability. In fact, **Figure 4** clearly demonstrates that there was not even a trend toward patients with a worse HBG score reporting a lower level of social function. This finding is remarkable, because it is intuitive to assume that those patients with complete facial paralysis will suffer more angst in social situations than those with only a minor deterioration in facial nerve function. Our results are consistent with those recently published by Cross et al,<sup>14</sup> who stated that there is no association between the level of psychological distress and the level of facial paresis. Clearly then, physicians must realize that any level of facial paresis will have an impact on a patient’s quality of life. However, the magnitude of this impact cannot be predicted by the severity of facial nerve dysfunction.

Subgroup analysis allowed us to further investigate other predictors of facial disability. We found that sex played no role in determining the level of social function after the development of facial paresis. This finding is surprising because, given our culture’s emphasis on female appearance, it would have been normal to assume that women would have lower score after developing this complication. According to da Cruz et al,<sup>3</sup> a person’s sex has no influence on quality of life after VS surgery, while Cross et al<sup>14</sup> suggested that women fare worse than men after developing facial paresis. Despite these conflicting results, we suggest that the importance of facial nerve func-



**Figure 5.** Social function score vs time since surgery.

tion, as it relates to appearance, may not be as sex specific as we once believed.

We were unable to find any association between level of social function and age, which suggests that physicians should not assume that older patients will not be as concerned with their appearance as their younger counterparts. Again, there are conflicting reports found in the literature on the impact of age, but we continue to emphasize the importance of not making stereotypical presumptions regarding how facial paresis may affect a patient’s quality of life.<sup>3,11,14</sup>

Before initiating the study, we had hypothesized that patients would learn to adapt to their facial impairment over time. This ability to adapt would then lead to a higher level of social function and, correspondingly, to a better quality of life. However, our data show that the length of time in the postoperative period is not a significant factor in predicting level of social function ( $P = .67$ ). This lack of an association is demonstrated clearly in **Figure 5**. Therefore, we believe that patients with facial paresis who demonstrate any level of social distress should undergo counseling as early as 1 year after VS surgery, as their distress is unlikely to improve over time.

Finally, we found that the size of tumor was not a factor in predicting how well patients will be able to cope with their facial paresis. We wanted to ascertain whether patients who receive a diagnosis of a smaller tumor would be less accepting of their facial paresis as a complication of VS surgery. Clearly, this acceptance was not shown in our study, which may indicate that the ability to cope with facial paresis after surgery is independent of the tumor size at the time of diagnosis.

One of the limitations of this cross-sectional observational study is that it did not account for the patients’ level of baseline social function before surgery. It is reasonable to assume that, without any facial nerve dysfunction, all patients should have scored quite high on the quality-of-life instrument before surgery. However, our study did not take into account the patients’ level of self-esteem, which may undoubtedly influence their perception of their own appearance. Ideally, this questionnaire should have been administered before the surgery so that patients could serve as their own controls.

## CONCLUSIONS

It always has been important to inform patients regarding the potential complications of a surgical intervention. In the area of VS surgery, facial nerve dysfunction

is commonly discussed as a possible outcome after tumor removal. Our findings suggest that this impairment is an important complication and will indeed have an impact on a patient's quality of life. Understanding the significance of this impairment will allow clinicians to better inform and educate their patients before surgery. However, we also discovered that the magnitude of this impact on quality of life may not be predicted by the severity of facial paresis, the patient's age or sex, the time since the operation, or the tumor size. Instead, we believe that there may be other factors that play a role in determining how well a patient is able to accept and cope with facial paresis after VS surgery. These factors may include adequate preoperative education and expectations, preoperative self-esteem, and adequate support from family and friends after surgery.

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**Author Contributions:** Dr Lee had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Lee, Fung, Lownie, and Parnes. *Acquisition of data:* Lee, Fung, Lownie, and Parnes. *Analysis and interpretation of data:* Lee, Fung, and Parnes. *Drafting of the manuscript:* Lee. *Critical revision of the manuscript for important intellectual content:* Fung, Lownie, and Parnes. *Statistical analysis:* Lee and Fung. *Administrative, technical, and material support:* Lownie and Parnes. *Study supervision:* Fung, Lownie, and Parnes.

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