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ORIGINAL RESEARCH ARTICLE

Facial nerve recovery trajectories and predictors after vestibular schwannoma surgery: a single-centre cohort study of 213 patients

Lina Nord[a], Tobias Hallén[b,c], Linus Köster[b,c], Anna-Lena Roos[b], Lena Kollén[d,e] and Madiha Bhatti-Søfteland[f]

[a]Department of General Surgery, Kungälv Hospital, Gothenburg, Sweden; [b]Department of Neurosurgery, Sahlgrenska University Hospital, Gothenburg, Sweden; [c]Department of Clinical Neuroscience, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; [d]Department of Clinical Neuroscience, Institute of Neuroscience and Physiology, The Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden; [e]Department of Physiotherapy and Occupational Therapy, Sahlgrenska University Hospital, Gothenburg, Sweden; [f]Department of Plastic Surgery, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

ABSTRACT

Background: After tumour control, facial nerve preservation is a primary objective in vestibular schwannoma surgery. Predicting long-term recovery remains challenging, and the prognostic value of the Koos grade is unclear.

Objective: The primary outcome was facial palsy at 12 months (partial or severe). Secondary outcomes included Day 1 function, recovery trajectory, intraoperative signal status, Koos grade, complications and difference in surgical approaches.

Methods: Retrospective cohort study at Sahlgrenska University Hospital (2006–2024). Two reviewers independently extracted clinical data and assigned blinded Koos grades. Predictors were assessed using multivariable logistic regression.

Results: Of 293 surgically treated patients, 213 with complete follow-up formed the study cohort (retrosigmoid 121, translabyrinthine 92). Sixty-four (30.0%) had any palsy at 12 months: 50 (23.5%) partial and 14 (6.6%) severe. Day 1 facial function dominated all models: severe palsy at Day 1 carried an adjusted odds ratio (OR) of 222.08 (95% CI 26.45–1864.44; Firth-corrected OR 128, 21–762), while partial function had an OR of 8.83 (3.93–19.83). Female sex was independently associated with palsy (OR 2.87, $p = 0.013$); surgical approach was not (OR 0.77, $p = 0.550$). Koos grade showed no association (OR 1.19, $p = 0.730$). Among patients with normal Day 1 function, 90% remained palsy free at 1 year; among those with severe palsy, only 4.5% recovered.

Conclusions: A single bedside examination on post-operative Day 1 predicts long-term facial nerve outcome more powerfully than any variable tested, including Koos grade; comparison of surgical approaches remained inconclusive owing to era confounding. Three recovery trajectories provide a framework for tailored post-operative management.

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Vestibular schwannoma; facial nerve; facial palsy; Koos grade; retrosigmoid; translabyrinthe; surgical outcomes

Introduction

Vestibular schwannomas are benign tumours arising from the Schwann cells of the vestibulocochlear nerve, accounting for approximately 6% of all intracranial neoplasms and representing the most common tumour of the cerebellopontine angle. Reported incidence has more than doubled since the 1970s, driven largely by wider use of magnetic resonance imaging [1–4]. Management options include observation (wait and scan), stereotactic radiosurgery and microsurgical resection, with the choice of strategy guided by tumour size, symptoms, hearing status and patient preference [1, 5]. Over the past two decades, there has been a paradigm shift in surgical philosophy from gross total resection towards intentional subtotal resection aimed at preserving cranial nerve function, accepting the need for surveillance for residual disease [6–8].

For patients requiring surgery, the two principal approaches are retrosigmoid and translabyrinthine. The retrosigmoid approach permits hearing preservation; the translabyrinthine provides direct visualisation of the facial nerve at the internal auditory canal fundus, at the cost of ipsilateral hearing [7–9]. Choice of approach remains a subject of debate, and recent meta-analyses have found no significant difference in facial nerve outcomes between the two approaches [9]. Post-operative facial palsy affects expression, communication, eye protection and oral competence, with lasting quality-of-life consequences that may outweigh those of the tumour itself [10, 11]. Yet the literature offers limited help with the practical questions: which patients can be reassured, which require structured surveillance and which should be referred early for facial rehabilitation?

While facial nerve outcomes after vestibular schwannoma surgery are a major focus of clinical research, the longitudinal trajectory of recovery remains poorly defined. Most series report function at a single time point, which fails to distinguish between transient and permanent deficits [12, 13]. A recent meta-analysis of delayed facial palsy shows high variability, with reported incidences ranging from 1 to 38%, largely attributed to differences in tumour size and surgical

CONTACT Madiha Bhatti-Søfteland madiha.bhatti@vgregion.se Department of Plastic Surgery, Sahlgrenska University Hospital, Gothenburg, Sweden
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Table 1. Baseline characteristics and facial nerve outcomes of the study cohort ($n = 213$).

Variable	RS ($n = 121$)	TL ($n = 92$)	All ($n = 213$)	p
Female sex	64 (52.9%)	52 (56.5%)	116 (54.5%)	0.787
Age, median (IQR)	53 (46–63)	56 (45–64)	54 (45–64)	0.541
Subtotal resection†	**75/117 (64.1%)**	**28/89 (31.5%)**	**103/206 (50.0%)**	< 0.001
Koos grade available	118/121 (97.5%)	89/92 (96.7%)	207/213 (97.2%)	
Koos 1	0	1	1	
Koos 2	8	7	15	
Koos 3	19	11	30	
Koos 4	91	70	161	
Pre-operative hearing				0.001
Normal	6 (5.0%)	1 (1.1%)	7 (3.3%)	
Serviceable	68 (56.2%)	31 (33.6%)	99 (46.5%)	
Deaf	47 (38.8%)	60 (65.2%)	107 (50.2%)	
Facial nerve outcomes				
Day 1: normal	69 (57.0%)	63 (68.5%)	132 (62.0%)	
Day 1: partial	41 (33.9%)	18 (19.6%)	59 (27.7%)	
Day 1: severe palsy	11 (9.1%)	11 (12.0%)	22 (10.3%)	0.068‡
Palsy at 6 months	49 (40.5%)	29 (31.5%)	78 (36.6%)	
Any palsy at 12 months	41 (33.9%)	23 (25.0%)	64 (30.0%)	0.105
Partial palsy	31 (25.6%)	19 (20.7%)	50 (23.5%)	0.494
Severe palsy	10 (8.3%)	4 (4.3%)	14 (6.6%)	0.281*

†Denominator excludes seven patients with missing extent of resection data.
‡Overall chi-squared across all three Day 1 categories. *Fisher's exact.

technique. Specifically, the analysis identified early post-operative function as the strongest predictor of long-term outcomes, yet the dynamic evolution of recovery throughout the first year requires further characterisation [14, 15]. Additionally, vestibular schwannomas are commonly staged using the Koos classification, which reflects tumour size and brainstem compression, yet it remains unclear whether Koos grade provides independent prognostic information for long-term facial nerve outcome beyond early post-operative function. This need for better trajectory and prognostic data is supported by population data such as the Swedish national registry study of 348 patients, which documented new deficits in 29% of surgically treated cases; however, these registry data did not provide the granular, temporal detail necessary to map specific recovery patterns [13]. Without such trajectory data, both patients and physicians lack a reliable roadmap for recovery, which is fundamental for making informed decisions for effective rehabilitation and surgical reconstruction for facial palsy [16, 17].

We therefore set out to trace facial nerve recovery from Day 1 to 12 months in a single-centre surgical cohort, to identify independent predictors of long-term palsy in two different approaches and to determine whether Koos grade adds prognostic value beyond early post-operative function. We also sought to translate the findings into a framework for post-operative management and rehabilitation referral.

Methods

Study design and population

We reviewed records from the multidisciplinary skull base conference at Sahlgrenska University Hospital (2006–2024, ICD code D33.3) and included all patients who underwent primary vestibular schwannoma resection via retrosigmoid or translabyrinthine approach at this centre. As the conference database captured patients still under surveillance for previously treated tumours, surgery dates extended from 1991 to 2025, though the majority were after 2006.

Patients with pre-operative facial palsy or non-standard approaches were excluded.

The primary outcome was any facial palsy at 12 months (partial or severe). The secondary outcomes were Day 1 function, 6-month palsy, recovery trajectory, intraoperative facial nerve signal status, prognostic evaluation of Koos grade, complication rates and differences between surgical approaches.

Data collection

Two independent reviewers extracted clinical data from electronic medical records (neurosurgeon and general surgeon); discrepancies were resolved by a third reviewer (plastic surgeon). Baseline variables included sex, age, hearing status and surgical approach. Intraoperative data comprised facial nerve signal monitoring (present or absent) and extent of resection (subtotal or gross total). Facial nerve function was assessed at three time points: Postoperative Day 1, 6 months and 12 months. Due to lack of documented House-Brackmann grading, function was graded as normal, partial and severe palsy. Complications noted were cerebrospinal fluid fistula, haemorrhage, hydrocephalus and infection. Pre- and post-operative hearing was classified as normal, serviceable (residual hearing with functional utility) based on chart review.

Koos grading

Pre-operative tumour size was classified using the Koos grading system: grade 1, purely intracanalicular tumour; grade 2, tumour protruding into the cerebellopontine angle without brainstem contact; grade 3, tumour occupying the cerebellopontine cistern with brainstem contact but no displacement and grade 4, tumour compressing and displacing the brainstem [18]. Two reviewers independently graded each tumour from pre-operative magnetic resonance imaging (MRI) reports, blinded to facial nerve outcome. Disagreements were resolved by consensus. Maximum tumour diameter was also extracted from radiology reports and tested as a continuous predictor (per millimetre) to assess whether a dose–response relationship existed beyond the Koos categories.

Statistical analysis

Continuous variables were summarised as median and interquartile range; categorical variables as counts and percentages, compared by Mann–Whitney U, chi-squared or Fisher's exact test as appropriate.

Two multivariable logistic regression models were fitted. The primary model included six a priori predictors: approach, age, sex, extent of resection and day 1 function (partial and severe palsy, with normal as reference). A total-effect model excluded day 1 function to estimate the effect of each surgical variable without conditioning on this post-operative mediator.

A penalised regression (Firth's method) was fitted as a sensitivity check, as nearly all patients with severe day 1 palsy developed long-term palsy, which can inflate odds ratios (ORs) in standard logistic regression. Discrimination was assessed by the C-statistic with optimism correction via 2000-iteration bootstrap. Variance inflation factors were computed for multicollinearity. Univariable models were fitted for each predictor separately. Koos grade was evaluated in a pre-planned sensitivity analysis in three forms: as a binary variable (Koos 4 vs. lower grades); as the ordinal 1–4 scale; and as a three-level category. Each was added to the primary model and compared with

it using a likelihood ratio test and ΔAIC.

During the study period, institutional practice shifted from combined ENT and neurosurgery-led translabyrinthine surgery to entirely neurosurgery-led retrosigmoid approach, creating a strong correlation between surgical approach and era (r = -0.70). An exploratory model including era as a covariate was fitted to evaluate this temporal confounding.

Complication rates and loss to follow-up were compared by Fisher's exact test. Analyses were performed in Python 3.12 (statsmodels, SciPy). Two-sided $p < 0.05$ was considered significant; the Holm-Bonferroni step-down procedure was applied as a sensitivity check for multiple comparisons.

Results

Study population

Of 957 patients with vestibular schwannoma, 293 underwent primary surgery, 449 were managed conservatively and the rest received radiotherapy. After excluding patients operated at other centres, those with neurofibromatosis type 2, other tumour types, pre-operative facial palsy (n = 24) or non-standard surgical approach, 226 remained. Of these, 213 (94.2%) had a complete 12-month follow-up and formed the study cohort (retrosigmoid 121, translabyrinthine 92; Table 1). All analyses use this 213-patient cohort unless stated otherwise. Loss to follow-up was differential by approach (retrosigmoid 8.3% vs translabyrinthine 2.1%; p = 0.079).

Temporal shift

The translabyrinthine approach accounted for 79% of operations before 2011; the retrosigmoid approach accounted for 84–85% from 2011 onward (Supplementary Table S1). Median surgery year was 2017 for retrosigmoid and 2006 for translabyrinthine ($p < 0.001$), an 11-year gap that is inseparable from any comparison of technique (Figure 1A).

Primary outcome

Sixty-four of 213 patients (30.0%) had any facial palsy at 12 months: 50 partial, 14 severe. Crude rates were 33.9% for retrosigmoid and 25.0% for translabyrinthine. Recovery pattern trajectory from Day 1 to 12 months is shown in Figure 2A.

Predictors of 12-month palsy

Seven patients with missing resection data were excluded, yielding n = 206 (62 events; events per variable = 10.3).

A total-effect model excluded the Day 1 function to estimate the effect of each surgical variable without conditioning on this post-operative mediator. Because 21 of 22 patients with Day 1 severe palsy developed 12-month palsy (quasi-complete separation), Firth's penalised likelihood regression [19, 20] was fitted as a sensitivity analysis.

The primary model achieved a Pseudo R^2 of 0.356 and AIC of 176.2. The total-effect model, excluding Day 1 function, performed poorly (Pseudo R^2 0.038, AIC 252.5, optimism-corrected C-statistic 0.590, 95% CI 0.520–0.662), confirming that pre-operative and surgical variables alone carry little prognostic information.

Primary model (n = 206, 62 events; Table 2): Day 1 facial function dominated. Compared with normal function, partial function carried an adjusted OR of 8.83 (95% CI 3.93–19.83, $p < 0.001$), and severe palsy had an OR of 222.08 (26.45–1864.44, $p < 0.001$). Quasi-complete separation inflated the latter estimate; Firth's penalised regression yielded OR 128 (21–762). Female sex was independently associated with palsy (OR 2.87, 1.25–6.58, p = 0.013), surviving Holm-Bonferroni correction. Approach was not significant (OR 0.77, p = 0.550), nor were age or extent of resection. The optimism-corrected C-statistic was 0.849 (0.793–0.910); all variance inflation factors were below 1.15.

Firth's penalised regression confirmed a similar effect. Bold indicates $p < 0.05$. OR: odds ratio.

Total-effect model. Excluding Day 1 function, only female sex was significant (OR 2.04, 1.09–3.84, p = 0.026). Discrimination was poor

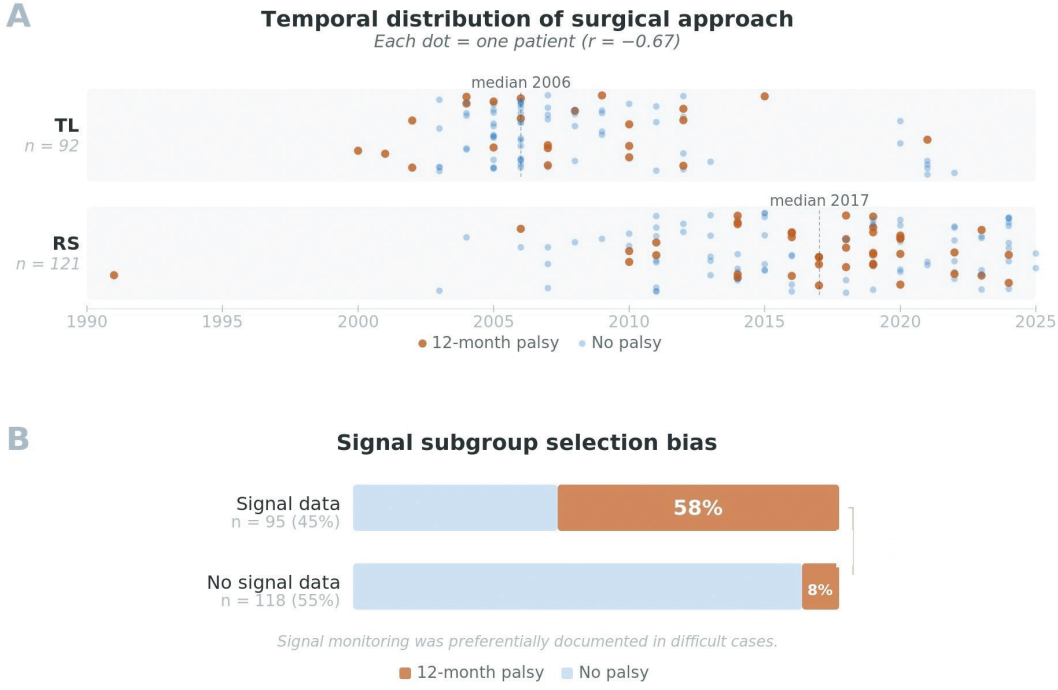

Figure 1. (A) Temporal distribution of surgical approach. (B) Perioperative signal subgroup selection bias: palsy rates by perioperative signal monitoring data availability.

Figure 2. (A) Facial nerve recovery trajectory from Day 1 to 12 months by surgical approach (translabyrinthine, $n = 92$; retrosigmoid, $n = 121$). Each band represents a group of patients transitioning between palsy categories. (B) Forest plot of adjusted odds ratios from multivariable logistic regression ($n = 206$, 62 events). Day 1 facial nerve status was the dominant predictor of 12-month palsy.

(optimism-corrected $C = 0.592$), confirming that surgical and demographic variables alone carry little prognostic information.

Era adjustment. Adding era (≥ 2011) to the primary model yielded no independent effect for era (OR 0.87, $p = 0.801$) or approach (OR 0.70, $p = 0.538$). Given collinearity ($r = -0.70$) based on the shift from one approach to the other, the model cannot separate technique from period effects; the approach comparison should be read as inconclusive, not negative.

Univariable analyses. Female sex was associated with palsy (OR 1.95, $p = 0.034$). The subtotal rate rose from 33% in the early era to 61% in the modern era ($r = 0.28$), and subtotal cases involved larger tumours (median 27 vs 22 mm, $p < 0.001$), consistent with confounding by surgical indication.

Table 2. Multivariable logistic regression models for 12-month facial palsy.

Predictor	OR	95% CI	*P*
Primary model (n = 206, 62 events, EPV = 10.3)			
Translabyrinthine (vs retrosigmoid)	0.77	0.33–1.80	0.550
Age (per year)	1.00	0.98–1.03	0.763
Female sex	**2.87**	**1.25–6.58**	**0.013**
Subtotal resection (vs GTR)	1.89	0.83–4.29	0.127
Day 1: partial (vs normal)	**8.83**	**3.93–19.83**	**< 0.001**
Day 1: severe palsy (vs normal)	**222.08†**	**26.45–1864.44**	**< 0.001**
Total-effect model (n = 206, 62 events)			
Translabyrinthine (vs retrosigmoid)	0.71	0.37–1.37	0.307
Age (per year)	1.01	0.98–1.03	0.646
Female sex	**2.04**	**1.09–3.84**	**0.026**
Subtotal resection (vs GTR)	1.65	0.87–3.13	0.128

†Quasi-complete separation: 21 of 22 patients with severe Day 1 palsy had palsy at 12 months;

Koos grade

Koos grades were available for 207 patients (97.2%). Among these, 78% were Grade 4. Palsy rates by grade were Grade 1, 1/1; Grade 2, 4/15 (27%); Grade 3, 11/30 (37%); Grade 4, 48/161 (30%); no significant trend ($\chi^2 = 0.68$, $p = 0.713$). Adding Koos 4 (binary) to the primary model made no contribution (OR 1.19, $p = 0.730$; ΔAIC = +1.9). The result was unchanged when Koos was coded as ordinal (OR 0.95, $p = 0.876$), three-level categorical or on univariable analysis. As seen in Figure 3, the highest palsy rate fell in Grade 3 (37%), not Grade 4 (30%), the opposite of a dose–response relationship. Patients with and without Koos data did not differ on key characteristics (all $p > 0.06$).

Continuous tumour diameter, available for 162 patients, told the same story as seen in Figure 3: OR 1.01 per mm (0.97–1.04, $p = 0.775$), with no gradient across size categories (35% for <15 mm, 23% for

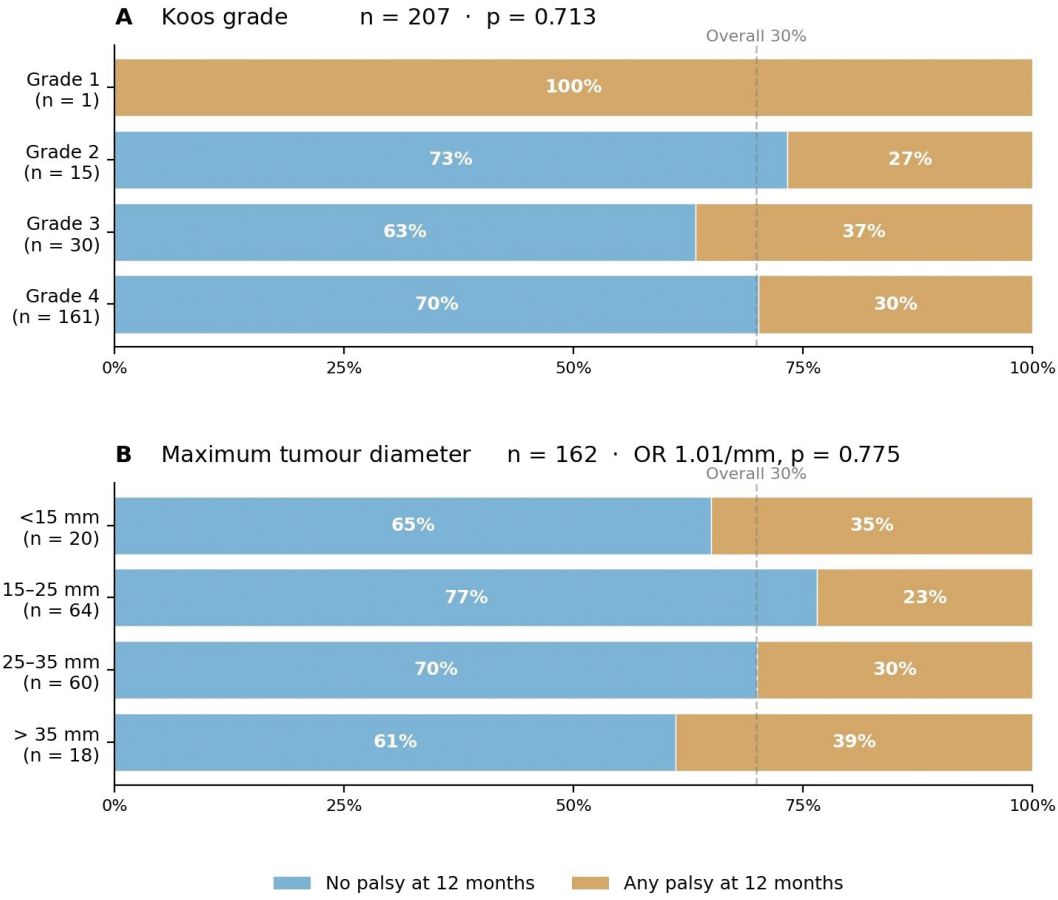

Figure 3. (A) Distribution of Koos grade ($n = 207$) and 12-month facial palsy rate by grade. (B) Distribution of maximum tumour diameter ($n = 162$) and 12-month palsy rate by size category. Neither Koos grade ($p = 0.713$) nor tumour diameter (OR 1.01/mm, $p = 0.775$) predicted palsy, confirming a null dose–response.

15–25 mm, 30% for 25–35 mm, 39% for >35 mm).

At baseline, 7 patients (3%) had normal hearing, 99 (46.5%) had serviceable hearing and 107 (50.2%) were deaf (Table 1). Of the 106 patients with pre-operative hearing (normal or serviceable), 103 (97%) became deaf after surgery. The three patients who retained serviceable hearing had all undergone a retrosigmoid approach. Post-operative deafness was universal among translabyrinthine cases.

Recovery trajectories

Three distinct patterns emerged (Table 3). Among 132 patients with normal Day 1 function, 119 (90.2%) remained palsy free at 12 months, but 13 (9.8%) developed delayed-onset palsy, all of whom had palsy at 6 months, placing the onset in the first six post-operative months. Of 59 patients with impaired Day 1 function, 29 (49.2%) recovered to normal. Of 22 with severe palsy, only 1 (4.5%) recovered. Among 78 patients with palsy at 6 months, 15 (19.2%) recovered by 12 months. Recovery rates did not differ significantly between approaches.

Intraoperative facial nerve monitoring signal

Signal data were available for only 95 patients (45%), and this subgroup was not representative: their 12-month palsy rate was 58 versus 8% in patients without signal data (Figure 1B). Within this subgroup, all 11 patients with absent signal had palsy at 12 months, compared with 44 of 84 (52%) with signal present ($p = 0.002$).

Complications

Complication rates did not differ between approaches (all 226 eligible patients). CSF fistula: retrosigmoid 6.8%, translabyrinthine 12.8% ($p = 0.161$). Hydrocephalus: one patient per group. Infection: 2.3 vs 4.3% ($p = 0.449$). *No post-operative* haemorrhages occurred.

Discussion

In this single-centre cohort of 213 patients followed for 12 months after vestibular schwannoma surgery, 30% had any facial palsy at 1 year. The majority of these were partial (23.5%); severe palsy developed in 6.6%, which is within the range of the 7–15% reported in recent literature [21]. The primary model, which included Day 1 facial function, demonstrated excellent discrimination (C-statistic 0.849), whereas the total-effect model, restricted to pre-operative and surgical variables, performed only marginally better than chance (C-statistic 0.592). This difference indicates that lasting facial palsy cannot be meaningfully predicted before surgery and may depend

Table 3. Twelve-month outcome by Day 1 facial nerve function ($n = 213$).

Day 1 function	No palsy at 12m	Partial palsy	Severe palsy	Any palsy
Normal ($n = 132$)	119 (90.2%)	7 (5.3%)	6 (4.5%)	13 (9.8%)
Partial ($n = 59$)	29 (49.2%)	24 (40.7%)	6 (10.2%)	30 (50.8%)
Severe palsy ($n = 22$)	1 (4.5%)	19 (86.4%)	2 (9.1%)	21 (95.5%)

on factors encountered intraoperatively. Tumour size, nerve adhesion and surgical difficulty have been proposed as key determinants of nerve injury [22–24], and Day 1 facial function seems to act as a mediator that signals the downstream consequence of these factors. While previous reports identified Day 1 status as a predictor [23, 25], few have quantified the magnitude of this effect or demonstrated that adding Koos grade provides no additional predictive value once Day 1 function is known. Xu et al. showed that a nomogram based on pre-operative and intraoperative variables can predict outcomes with 81% accuracy [26], but our findings suggest that a Day 1 clinical exam is arguably more powerful because of its simplicity, integrating these surgical variables into a single bedside assessment without the need for specialised imaging or scoring systems.

Based on postoperative Day 1 function, three clinically actionable recovery patterns emerged, providing a roadmap for post-operative management. Patients with normal Day 1 function did well: 90.2% remained palsy free at 1 year and can be reassured accordingly. However, 9.8% developed delayed-onset palsy, all detectable by 6 months (13 of 13 affected patients), supporting routine surveillance at 6 and 12 months even when the initial examination is normal. Our palsy rate is consistent with the 12.3% reported in a large meta-analysis [14, 15]. Our follow-up schedule (Day 1, 6 and 12 months) is too broad to separate classic delayed palsy by definition (onset within 30 days), but the overall frequency of new deficits matches the literature.

The impaired Day 1 group carried a 50.8% recovery rate and represents the population most likely to benefit from early intervention. Emerging evidence supports neuromuscular retraining for partial facial palsy [16], and early physiotherapy referral during this recovery window that we found was low in our cohort (unpublished data). Patients with severe palsy at Day 1 had a persistent deficit in 95.5% of cases (adjusted OR 222, 95% CI 26.45–1864.44), and this finding alone accounts for nearly all the model's discriminative power (C-statistic 0.849). Jain et al. reported similar outcomes, with only 1.5% of grade VI patients regaining normal function [12]. Beyond functional deficit, persistent facial palsy has been associated with high psychological distress and reduced quality of life [27]. These patients would benefit from early referral to a multidisciplinary facial team where eye protection, physiotherapy and timely evaluation for reanimation surgery can be coordinated to improve both function and quality of life [17, 28].

Intraoperative signal data were available for only 95 patients (45%) (Figure 1B), suggesting documentation biased towards difficult cases and limiting interpretation. Nevertheless, all 11 patients without a recorded signal had palsy at 12 months, compared with 52% of those with a signal present ($p = 0.002$), supporting the prognostic value of intraoperative monitoring [29].

Comparing surgical approaches, crude palsy rates were 33.9% for retrosigmoid and 25.0% for translabyrinthine, with no significant difference. This is consistent with the meta-analysis by Gibbon et al., which found no significant difference across 21 studies and 4572 patients [9] and with the systematic review by Ansari et al. [8]. However, interpretation is fundamentally limited by the near-complete temporal separation of the two approaches ($r = -0.70$): the translabyrinthine approach predominated in the combined ENT neurosurgery era (before 2010, 79%), while the retrosigmoid approach predominated in the neurosurgery-led era (after 2011, 84–85%). The higher rate of subtotal resection in the retrosigmoid group (64 vs 31%) reflects the growing trend towards nerve-centred surgery [6]. The non-significant difference in palsy rate in the subtotal group (35.9 vs 24.3%; adjusted OR 1.89, $p = 0.127$) may partly reflect confounding by indication, as subtotal resection is more likely to be chosen when the nerve is at risk. The shift to subtotal resection parallels the shift to retrosigmoid (subtotal rate 33% early vs 61% modern, $r = 0.28$), with subtotal cases involving larger tumours (median 27 vs 22 mm, $p < 0.001$). Because approach, era and resection extent are intertwined in our data, their individual effects cannot be separated, and the approach comparison remains inconclusive.

Koos grade, widely regarded as a predictor of facial nerve outcome [8, 22, 23], was not significant in our analysis regardless of how it was coded: non-significant as binary (OR 1.19, $p = 0.730$), ordinal (OR 0.95, $p = 0.876$) or categorical. Tumour diameter, available for three-quarters of the cohort, showed no dose–response (OR 1.01 per mm, $p = 0.775$), suggesting that tumour size alone does not capture the full picture of nerve injury risk.

Female sex was independently associated with 12-month palsy (OR 2.87, $p = 0.013$) and remained significant after correction for multiple comparisons (Holm-Bonferroni). This is at odds with the largest surgical cohort (1118 patients), which found no sex difference [30]. Recent registry data, however, confirm that women are more likely to undergo surgery for vestibular schwannoma than men [13, 31], but whether this reflects a true biological difference in both treatment selection and outcome remains unclear.

Finally, the near-universal loss of hearing (97%) is consistent with the existing literature on large vestibular schwannomas and underscores that facial nerve preservation, rather than hearing salvage, remains the primary functional goal in this tumour size category.

Limitations

Almost all patients with severe Day 1 palsy went on to have long-term deficits (21 of 22), which makes it difficult to estimate the true risk with precision. Firth's correction gives an odds ratio of 128, but the confidence interval is inevitably wide (21–762). Selective attrition is a potential bias, as loss to follow-up was higher in the retrosigmoid group (8.3 vs 2.1%). The retrospective design limits the precision of clinical grading. House-Brackmann scoring was not routinely performed, precluding granular comparison with other series. Koos grading was based on clinical MRI reports rather than standardised volumetry. Continuous tumour diameter, a known driver of surgical difficulty, was available for only 76% of patients and thus was not included in the primary regression model, leaving unmeasured confounding possible.

Conclusion

Day 1 facial function after vestibular schwannoma surgery predicts 12-month outcome with a strength that renders all other tested variables, including pre-operative Koos grade, statistically marginal. Patients with normal Day 1 function can be reassured but should return at 6 months (1 in 10 will develop delayed-onset palsy). Those with impaired function should know that nearly half will recover. Those with severe palsy face a greater than 95% chance of persistent deficit and should be referred early to a multidisciplinary facial team. Taken together, these three trajectories translate a single bedside assessment into a practical framework for post-operative management, counselling and timely intervention.

Ethics approval

This study was approved by the Swedish Ethical Review Authority (Etikprövningsmyndigheten; registration number [2024-0873801]). The requirement for individual informed consent was waived owing to the retrospective design and the use of de-identified data from medical records.

Conflicts of interest

The authors declare no conflicts of interest.

Author contributions

Madiha Bhatti-Søfteland: Study design, data collection, grading, results and manuscript drafting

Lina Nord: Building database, data collection, grading and manuscript drafting

Linus Köster: Data collection and grading

Tobias Hallén: Identification of neurosurgical study variables, manuscript review and editing

Anna-Lena Roos: Identification of ENT study variables, manuscript review and editing

Lena Kollén: Identification of physiotherapy study variables, manuscript review and editing.

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