

HEAD AND NECK

# Long-term outcomes and quality of life following parotidectomy for benign disease

## *Risultati a lungo termine e qualità della vita dopo parotidectomia per patologie benigne*

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### SUMMARY

**Objective.** Parotidectomy worsens quality of life (QoL) in the short-term, but the long-term impact is unknown. In this study, we analysed the long-term effects of parotidectomy on QoL.

**Methods.** In this prospective long-term follow-up study, participants were divided into three groups: short-term (ST) follow-up of six weeks, long-term (LT) follow-up of 13 years and short- and long-term (SLT) follow-up. QoL was assessed using the Parotidectomy Outcome Inventory (POI-8). Parotidectomies were classified based on whether the great auricular nerve (GAN) had been preserved or sacrificed.

**Results.** In total, 164 observations were analysed, 74 in the LT group, 57 in the ST group and 33 in the SLT group. Hypoaesthesia was a major problem and facial palsy was a minor problem. Pain ( $p < 0.01$ ) and hypoaesthesia ( $p < 0.001$ ) were significantly lower after 13 years compared with after six weeks, and QoL was higher after 13 years compared with after six weeks ( $p = 0.04$ ). The disease-specific impairment rate decreased from 70% at short-term follow-up to 30% at long-term follow-up. Removal of the GAN was associated with hypoaesthesia in the ST group ( $p = 0.028$ ).

**Conclusions.** Hypoaesthesia has a long-term impact on the QoL, and this should be emphasised during preoperative discussions.

**KEY WORDS:** parotidectomy, benign disease, long-term outcome, quality of life, POI-8

### RIASSUNTO

**Obiettivi.** La parotidectomia peggiora la qualità della vita (QoL) a breve termine; l'impatto a lungo termine non è noto e abbiamo voluto analizzarlo in questo studio.

**Metodi.** Questo è uno studio prospettico di follow-up a lungo termine. I partecipanti sono stati divisi in tre gruppi: follow-up a breve termine (ST) di sei settimane, follow-up a lungo termine (LT) di 13 anni e follow-up a breve e lungo termine (SLT). La QoL è stata valutata utilizzando il Parotidectomy Outcome Inventory (POI-8). Le parotidectomie sono state distinte in base alla conservazione o al sacrificio del nervo grande auricolare (GAN).

**Risultati.** Sono stati arruolati 164 pazienti, 74 nel gruppo LT, 57 nel gruppo ST e 33 nel gruppo SLT. L'ipoestesia è stato il problema principale, la paralisi facciale un problema minore. Il dolore ( $p < 0,01$ ) e l'ipoestesia ( $p < 0,001$ ) erano significativamente ridotti dopo 13 anni rispetto a dopo sei settimane e la QoL era maggiore dopo 13 anni rispetto a sei settimane ( $p = 0,04$ ). Il tasso di compromissione della malattia è diminuito dal 70% a breve termine al 30% a lungo termine. La rimozione del GAN è stata associata a ipoestesia nel gruppo ST ( $p = 0,028$ ).

**Conclusioni.** L'ipoestesia ha un impatto a lungo termine sulla QoL e dovrebbe essere discussa durante i colloqui preoperatori.

**PAROLE CHIAVE:** parotidectomia, malattia benigna, outcome a lungo termine, qualità della vita, POI-8

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## Introduction

Tumours of the parotid gland constitute approximately 3% of head and neck tumours, and 80% are benign. Benign tumours like pleomorphic salivary adenoma, cystadenolymphoma, and basal cell adenoma are indications for parotid surgery<sup>1,2</sup>. Parotid surgery aims to partially or totally remove the gland while preserving facial nerve function and preventing tumour recurrence<sup>3</sup>. Extracapsular dissection (ECD), partial lateral (superficial) parotidectomy, lateral or superficial parotidectomy (SP) and total parotidectomy with preservation of the facial nerve are the different surgical options used to treat a benign parotid tumour<sup>4</sup>. The overall reported complication rate of parotidectomy is 21.6%<sup>5,6</sup>. Complications such as postoperative numbness, Frey's syndrome, pain, mouth dryness and scar-related problems all affect the quality of life (QoL)<sup>7</sup>. The superficial musculoaponeurotic system (SMAS) flap for reconstruction of the parotid lodge reduces the cosmetic and functional complications following the removal of a benign parotid tumour<sup>8</sup>.

Measuring health-related quality of life (HRQoL) is becoming more important in clinical medicine. The Parotidectomy Outcome Inventory (POI-8) is a reliable and valid instrument for measuring HRQoL in patients after parotidectomy for benign disease<sup>9</sup>. While the short-term effects (usually 6 months to 1 year) of parotidectomy have been well described<sup>3,7,10-13</sup>, little is known about the long-term effects of parotidectomy on QoL.

The study aimed to determine the long-term effects of parotidectomy on QoL using the disease-specific POI-8 questionnaire and to compare long-term data with published short-term data. To increase objectivity, we divided our participants into long-term (LT), short-term (ST), and short- and long-term (SLT) groups and analysed the data for each group separately.

## Materials and methods

We used the German version of the POI-8 questionnaire to measure QoL in 199 patients undergoing partial or total parotidectomy for benign disease<sup>9</sup> between 2003 and 2006 in our department. Fifty-seven patients (28.6%) returned their POI-8 questionnaire six weeks after parotid surgery. All histopathological results were retrieved, and patients with malignant diseases were excluded. In 2018, we invited 199 patients from the original retrospective study<sup>9</sup> to participate in this prospective study. Seventy-four of these patients (37.2%) responded (12-16 years after surgery), 108 patients (54.3%) did not respond, 16 patients (8%) had died and one patient (0.5%) actively declined to participate in the study. In total, we obtained data from 164 of the 199

patients, (57 from the original survey in 2006, 74 after the invitation in 2018 and 33 from both groups). Due to the overlap in study cohorts, these observations originated from 98 patients.

We assigned participants to long-term (LT), short-term (ST) and short- and long-term (SLT) groups. The LT cohort comprised 74 patients who participated in our prospective study in 2018 and returned the POI-8 questionnaire 12-16 years after parotidectomy. The SLT cohort comprised 33 patients from the original retrospective study who responded to our 2018 invitation and returned the POI-8 six weeks<sup>9</sup> and 12-16 years after parotid surgery. The ST cohort included 57 patients from the original retrospective study who returned the POI-8 six weeks after surgery<sup>9</sup>.

The POI-8 is a validated and reliable questionnaire for patient-reported QoL after parotid surgery. It consists of eight Likert-scale questions with answers from 0 (no problems) to 5 (the worst problems) with a total possible score of 40. Low POI-8 scores indicate high functionality and high QoL<sup>9</sup>. In addition to the POI-8, patients answered questions about parotidectomy-related impairment (no, low-grade, moderate, severe, and very severe impairment), postoperative satisfaction, and whether they would recommend this operation to friends and family. Participants also answered questions about physician visits, rehabilitative measures and incapacitated workdays in the last six months. Results were compared between the ST and LT groups (intergroup) and within the SLT group (intragroup). Lastly, operative reports and clinical notes were used to classify whether parotidectomies sacrificed or preserved the great auricular nerve (GAN).

### *Statistical analysis*

A certified expert of survey analysis performed the statistical analysis at the GESIS-Leibniz-Institute for the Social Sciences. The data were analysed using R, versions 3.6.1 and 4.0.2. Metric variables are presented as means  $\pm$  standard deviation, while factorial variables are presented as proportional distributions. Additionally, t-statistics were used to compare mean values between variables for the different cohorts (intergroup comparisons). The distribution of particular variables was tested for relatedness/independence using  $\chi^2$ -tests for intragroup comparisons since a) most variables were categorical or nominally distributed, b) the sample size was not too large to lead to false positive results, and c) it is the most commonly used test for such comparisons<sup>14</sup>. Furthermore,  $\chi^2$ -tests are more suitable for multiple comparisons.

For some variables however, Pearson's correlation test was carried out and the correlation coefficient  $r$  was estimated. The non-parametric Wilcoxon test was used to detect

meaningful differences between the POI-8 outcomes dependent of groups and other variables. A  $p$ -value less than 0.05 was considered statistically significant. Graphs were programmed using the ggplot2 library of R.

## Results

### *Patient cohorts*

Seventy-four patients (LT cohort; 41 men, 33 women; mean age  $66.5 \pm 12.3$  years) prospectively completed the POI-8 questionnaire, with a mean follow-up of  $13.3 \pm 1.1$  years (range: 12-16). 51.4% of patients underwent a partial superficial and 48.6% a superficial parotidectomy.

Fifty-seven patients (ST cohort; 27 men, 30 women; mean age  $68 \pm 14.8$  years) from the original retrospective study of Baumann et al.<sup>9</sup> were additionally included herein, of which 47.4% had been operated by partial superficial and 52.6% by superficial parotidectomy.

33 patients (SLT cohort; 16 men, 17 women; mean age  $68 \pm 12.6$  years) prospectively and retrospectively participated in this study. 45.5% of SLT patients underwent a partial superficial parotidectomy, 54.5% of patients a superficial parotidectomy.

Patient details and disease characteristics are shown in Table I.

### *Intergroup differences in POI-8 outcomes between ST and LT cohorts*

Six weeks after parotidectomy, 77.2% of patients in the ST cohort referred hypoesthesia as the most disturbing problem, followed by xerostomia (47.4%) and the scar (45.6%). Facial palsy was reported to be a minor problem by 87.7% of patients. In the LT cohort, hypoesthesia was reported as a major problem by 54.1% of patients, followed by fear of revision surgery (44.6%) and the scar (39.2%). Most patients in this group (95.9%) did not think facial palsy was problematic.

Patients in the ST cohort had significantly more pain at the site of surgery than patients in the LT cohort did (mean POI-8 score: 0.93 in the ST cohort and 0.34 in the LT cohort;  $p = 0.002$ ). In the LT group, 77% of patients reported no pain or painful sensations at 13 years after parotidectomy. Hypoesthesia had improved significantly over the years but was still a problem: 77.2% of ST patients were disturbed by hypoesthesia at six weeks after surgery (mean POI-8 score: 1.86), and 54.1% of LT patients reported sensation loss as a problem 13 years after surgery (mean POI-8 score: 0.88;  $p < 0.001$ ).

POI-8 scores were not different between the ST group and LT group for the scar ( $p = 0.07$ ), facial palsy ( $p = 0.21$ ), substance loss ( $p = 0.37$ ), Frey's syndrome ( $p = 0.64$ ),

xerostomia ( $p = 0.14$ ) and anxiety about revision surgery ( $p = 0.73$ ). However, the mean POI-8 scores were significantly different between the two groups to describe QoL based on symptoms after parotidectomy (POI-8 score: 7.47 for ST group, 5.15 for LT group;  $p = 0.04$ ) (Fig. 1).

In the ST cohort, 64.9% of patients reported that their disease-specific QoL was slightly affected after parotid surgery, and 68.4% said they were "very satisfied" with the results of their operation. In the LT cohort, 27% of patients still reported impairment after parotidectomy, which was described as "severe" by 4.1% of patients. The long-term satisfaction rate was 81.8%. Negligible physician visits (6.8%), days of incapacitation (2.7%) and no rehabilitative measures (0%) were also reported by the LT cohort.

POI-8 scores for postoperative impairment, operation satisfaction and parotidectomy recommendation were significantly different within the ST cohort ( $p < 0.001$ ), whereas POI-8 scores for hypoesthesia were not, indicating that hypoesthesia POI-8 scores best reflect the QoL six weeks after parotidectomy. Within the LT cohort, POI-8 scores for postoperative impairment, operation satisfaction and operation recommendation were all significantly different ( $p < 0.001$ ), demonstrating that the influence of parotidectomy on QoL decreased over time.

### *Intragroup differences in POI-8 outcomes in the SLT cohort*

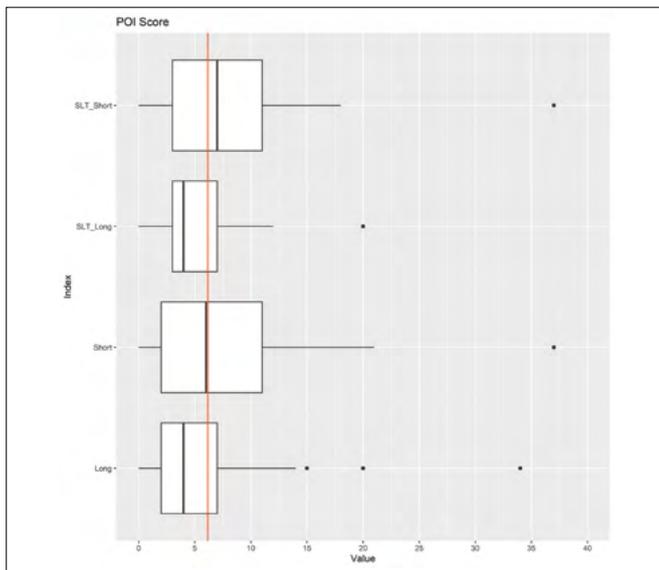
Six weeks after parotidectomy, 84.8% of the SLT cohort characterised hypoesthesia as their most disturbing problem, followed by the scar (54.5%) and pain (51.5%). Facial palsy was reported to be a minor problem (87.9%). At the 13-year follow-up, hypoesthesia was still a problem for 60.6% of patients, but only 3% described this problem as severe. Frey's syndrome (48.5%) and fear of revision (42.4%) were also reported as problems in this group, whereas facial palsy was not referred. Patients reported that problems with hypoesthesia ( $p < 0.001$ ) and pain ( $p = 0.004$ ) improved from six weeks to 13 years after surgery. Problems caused by the scar ( $p = 0.13$ ), postoperative appearance ( $p = 0.17$ ), Frey's syndrome ( $p = 0.36$ ), xerostomia ( $p = 0.09$ ), fear of revision surgery ( $p = 0.75$ ) and facial palsy ( $p = 0.08$ ) did not significantly ameliorate after surgery. The total POI-8 score significantly decreased from 8.24 at 6 weeks after surgery to 5.15 at 13 years after surgery, indicating increasing satisfaction over time ( $p = 0.04$ ; Fig. 1).

Six weeks after parotidectomy, 72.7% of patients reported slight impairment and 69.7% were satisfied. At the 13-year follow-up, 33.3% of patients still felt impaired after parotid surgery and 78.8% were satisfied. No incapacitated work-days, no rehabilitative measures and very few medical visits (6.1%) were reported in the last six months.

All group comparisons are illustrated in Figure 2.

**Table I.** Surgical and clinico-pathological characteristics of the three study cohorts.

Characteristics	ST - cohort (n = 57)	LT - cohort (n = 74)	SLT - cohort (n = 33)
<b>Age</b> (years): time of operation	55 ± 14.9 (range: 17-78)	53 ± 12.2 (range: 28-76)	55 ± 12.7 (range: 30-76)
<b>Age</b> (years): time of survey	68 ± 14.8 (range: 31-92)	66.5 ± 12.3 (range: 40-90)	68 ± 12.6 (range: 45-90)
<b>Gender</b>			
Female	30 (52.6%)	33 (44.6%)	17 (51.5%)
Male	27 (47.4%)	41 (55.4%)	16 (48.5%)
<b>Operation extent</b>			
Extracapsular dissection	0 (0%)	0 (0%)	0 (0%)
Partial superficial parotidectomy	27 (47.4%)	38 (51.4%)	15 (45.5%)
Superficial parotidectomy	30 (52.6%)	36 (48.6%)	18 (54.5%)
Total parotidectomy	0 (0%)	0 (0%)	0 (0%)
<b>Complication of facial paralysis</b>			
Permanent	0 (0%)	0 (0%)	0 (0%)
Temporary	18 (31.6%)	18 (24.3%)	13 (39.4%)
<b>Operation site</b>			
Left	32 (56.1%)	43 (58.1%)	20 (60.6%)
Right	25 (43.9%)	31 (41.9%)	13 (39.4%)
<b>Histopathological diagnoses</b>			
Cystadenolymphoma	21 (36.8%)	30 (40.5%)	12 (36.4%)
Pleomorphic adenoma	20 (35.1%)	21 (28.4%)	10 (30.3%)
Parotid cyst	4 (7%)	5 (6.8%)	4 (12.1%)
Chronic sialadenitis	5 (8.8%)	5 (6.8%)	2 (6.1%)
Basal cell adenoma	2 (3.5%)	3 (4.1%)	1 (3%)
Epitheloid cell granuloma	1 (1.8%)	2 (2.7%)	1 (3%)
Haemangioma	1 (1.8%)	1 (1.4%)	1 (3%)
Myoepithelioma	1 (1.8%)	1 (1.4%)	1 (3%)
Oncocytoma	0 (0%)	2 (2.7%)	0 (0%)
Morbus Sjögren	2 (3.5%)	2 (2.7%)	1 (3%)
Lymphadenitis	0 (0%)	2 (2.7%)	0 (0%)
<b>Marital status</b>			
Married	39 (68.4%)	26 (35.1%)	25 (75.8%)
Separated	17 (29.8%)	7 (9.5%)	7 (21.2%)
Widowed	1 (1.8%)	1 (1.4%)	1 (3%)
No data	/	40 (54.1%)	/
<b>Graduation</b>			
Secondary school	25 (43.9%)	12 (16.2%)	12 (36.4%)
Junior high school	11 (19.3%)	8 (10.8%)	7 (21.2%)
High school	19 (33.3%)	13 (17.6%)	13 (39.4%)
No data	2 (3.5%)	41 (55.4%)	1 (3%)
<b>Professional activities</b>			
House work	12 (21.1%)	6 (8.1%)	6 (18.2%)
Job seeking	2 (3.5%)	0 (0%)	0 (0%)
College student	2 (3.5%)	0 (0%)	0 (0%)
Retirement	20 (35.1%)	11 (14.9%)	11 (33.3%)
Employed	18 (31.6%)	14 (18.9%)	13 (39.4%)
No data	3 (5.3%)	40 (54.1%)	3 (9.1%)
<b>Smoking history</b>			
Currently	14 (24.6%)	9 (12.2%)	9 (27.3%)
Former	19 (33.3%)	11 (14.9%)	10 (30.3%)
Never	23 (40.4%)	13 (17.6%)	13 (39.4%)
No data	1 (1.8%)	41 (55.4%)	1 (3%)



**Figure 1.** Group comparison of the total Parotidectomy Outcome Inventory (POI-8) score. The red line represents the overall mean POI-8 score of the combined results at both time points. The bold line shows the median whereas the box represents the interquartile range. Dots resemble outliers.

#### *Non-neoplastic versus neoplastic parotid diseases*

We further divided our patient cohorts according to their neoplastic or non-neoplastic parotid disease profile. Most patients (ST cohort: 80.7%, LT cohort: 81% and SLT cohort: 78.8%) suffered from neoplastic parotid diseases. For the ST, LT and SLT cohorts, we did not find any evidence that the POI-8-score is affected by the type of histology. Information regarding the POI-8 results of both groups according to the different observation interval is presented in Table II.

#### *Preservation of the facial nerve*

Permanent facial paralysis occurred in no patient, whereas 31.6% of ST, 24.3% of LT, and 39.4% of SLT patients had a postoperative temporary facial palsy. There were no statistically significant correlations between the temporary facial paralysis and the fourth question of the POI-8 questionnaire (about facial nerve) or with the surgical type.

#### *Preservation of the great auricular nerve (GAN)*

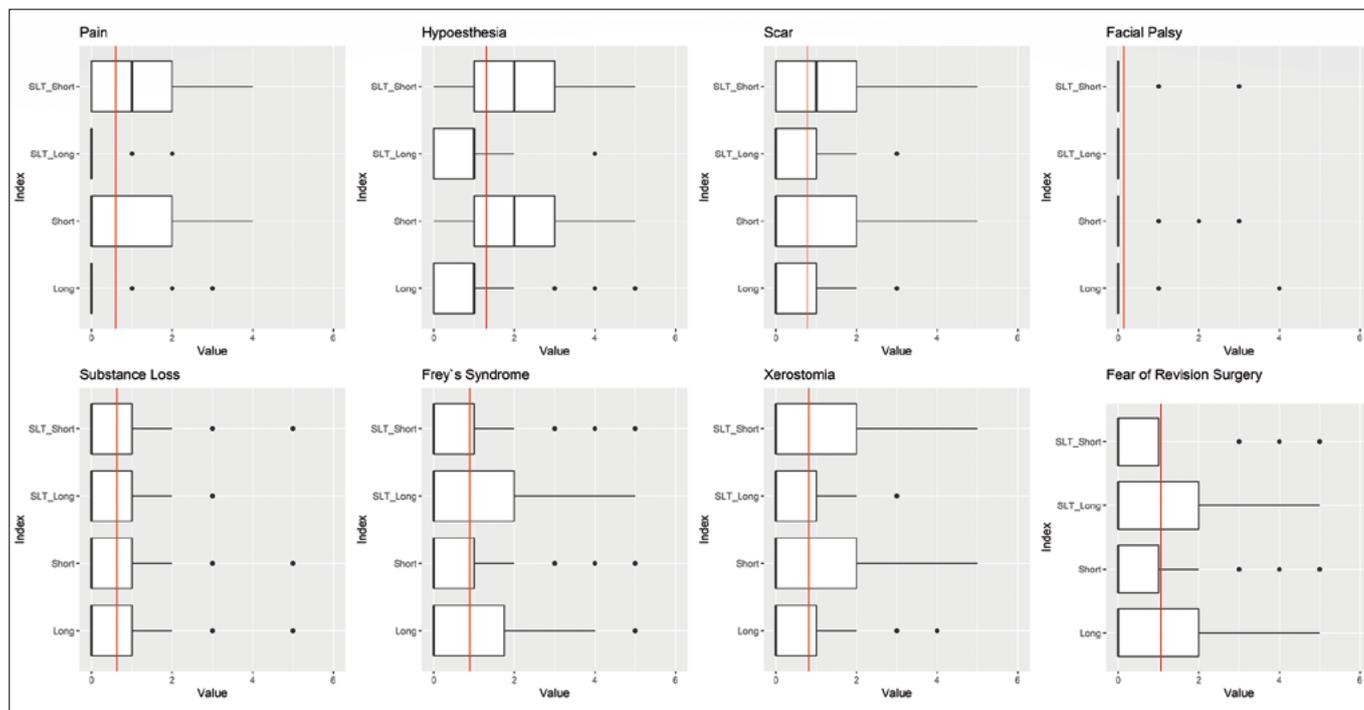
Based on the available surgical reports ( $n = 98$ ), the GAN was preserved in 45.9% of cases, sacrificed in 33.7% of cases and not reported in 20.4%.

All patients in the LT cohort who reported sensation loss in their first POI-8 questionnaire ( $n = 40$ ; 23 men, 17 women) were contacted again and asked about the location of numbness. The area overlying the parotid gland and at the angle of the mandible were slightly more affected than the

auricle and along the anterior border of the sternocleidomastoid muscle (55 vs 45%). In general, patients did not feel that their QoL was limited; 55% described the hypoesthesia as “marginal”, 35% as “slight” and 10% as “moderate”, “severe” or “very severe”. Of these 40 patients, no significant correlations were detected between GAN sacrifice, hypoesthesia, operation procedure (partial vs. total) and the location of numbness using the chi-square and Wilcoxon test. According to the chi-square test, sacrifice of the GAN was associated with hypoesthesia in the ST cohort ( $p = 0.028$ ). Using the Wilcoxon test, we detected significant differences in the ST cohort between GAN sacrifice and hypoesthesia ( $p < 0.001$ ) and GAN sacrifice and facial palsy ( $p < 0.001$ ); and in the LT cohort between GAN sacrifice and pain ( $p < 0.001$ ), GAN sacrifice and facial palsy ( $p < 0.001$ ), and GAN sacrifice and substance loss ( $p < 0.04$ ). However, the Wilcoxon test had little informative value for this calculation as it does not meet the test conditions.

## Discussion

This study provides the first data on the short-term (six weeks after surgery) and long-term (13 years after surgery) HRQoL after parotidectomy using the validated POI-8 questionnaire. A key goal of parotid surgery to treat benign lesions is to remove the tumour, minimise morbidity and maintain patients’ QoL. In the literature, QoL is scaled corresponding to the type of surgery, although the width of parotid gland surgery differs for each patient according to tumour location, size of the tumour, course of the facial nerve and surgeon’s preference<sup>15</sup>. Partial superficial parotidectomy was associated with fewer complications, especially temporary facial paralysis and Frey’s syndrome, with a recurrence rate comparable to that of superficial parotidectomy<sup>16</sup>. In our study, only benign parotid tumours were included, 3-4 selected surgeons performed the operations and the majority of parotidectomies were superficial or partial superficial. To compare functional and aesthetic results, regardless of the type of surgery, Aydin et al. established the amount of residual parotid tissue remaining after parotid surgery as a new objective parameter and reported that the maximum amount of disease-free tissue of the parotid gland should be left in place to increase patients’ QoL as well as to minimise complications<sup>15</sup>. Generally, only few studies have addressed the patients’ perspective on HRQoL<sup>7,10-12,15,17-19</sup>. Most of these have only reported short-term results, i.e., from 6 months to 1-2 years after surgery, and have used different symptom-specific QoL assessments. Beutner et al.<sup>11</sup> used the EORTC QLQ-C30 and EORTC QLQ-H&N 35 and reported no changes in QoL one



**Figure 2.** Group comparison of the different Parotidectomy Outcome Inventory (POI-8) items. The red line represents the overall mean of an item of the combined results, measured at both time points. The bold line represents the median whereas the box represents the interquartile range. Dots resemble outliers.

**Table II.** Group Classification of the non-neoplastic (parotid cyst, chronic sialadenitis, Morbus Sjögren and Lymphadenitis) versus neoplastic (cystadenolymphoma, pleomorphic adenoma, basal cell adenoma, epitheloid cell granuloma, hemangioma, myoepithelioma and oncocytoma) parotid disease profile according to the short (ST)-, long (LT)-, and to the short- and long-term (SLT) observation interval.

POI-8 results	ST neoplastic (n = 46)	ST non-neoplastic (n = 11)	LT neoplastic (n = 60)	LT non-neoplastic (n = 14)	SLT_short neoplastic (n = 26)	SLT_short non-neoplastic (n = 7)	SLT_long neoplastic (n = 26)	SLT_long non-neoplastic (n = 7)
POI-8 mean score	7.3	8.27	5.02	5.71	7.96	9.29	4.65	7.0
Major problem	1.76 (hypoesthesia)	2.27 (hypoesthesia)	1.1 (fear of revision surgery)	1.5 (Frey's syndrome)	2.0 (hypoesthesia)	2.29 (hypoesthesia)	1.04 (fear of revision surgery)	2.29 (Frey's syndrome)
Minor problem	0.26 (facial palsy)	0.91 (pain) / 0.91 (substance loss)	0.1 (facial palsy)	0 (facial palsy)	0.23 (facial palsy)	0 (facial palsy)	0 (facial palsy)	0 (facial palsy)

year after superficial parotidectomy compared with before surgery. Nitzan et al. used a modified version of the University of Washington Quality of Life Questionnaire during a 1-year follow-up period and detected that the sequelae did not significantly affect QoL<sup>12</sup>. Bulut et al. made use of the POI-8 and measured QoL based on sensory dysfunction due to GAN sacrifice and described a significant increase in long-term QoL (100 months postoperatively) compared with short-term QoL (two weeks post-operatively) after parotid surgery<sup>19</sup>. Since most studies only performed a short

follow-up, we still do not know which factors affect patients' QoL in the long-term after parotidectomy. To our knowledge, the present study is the most extended follow-up reported after parotid surgery for benign tumours. We found that hypoesthesia was perceived as the most significant long-term problem after parotid surgery followed by fear of revision surgery, whereas facial palsy posed a minor problem. In the literature, hypoesthesia is described as the greatest concern of patients at short- (about six months)<sup>7,10,12,17,20</sup> and long-term (about

two years) <sup>10,19,21,22</sup> after parotidectomy. Most sensory improvements occurred in the first six months after surgery <sup>23</sup> and after two years, when symptoms are either no longer present or have stabilised <sup>24</sup>. The GAN innervates the skin overlying the lower aspect of the pinna and angle of the mandible and is divided into anterior and posterior branches. The anterior branch is usually sacrificed during parotid surgery, whereas the posterior branch can technically be preserved <sup>7</sup>, explaining why the areas overlying the parotid gland and at the angle of the mandible were slightly more affected than the auricle and along the anterior border of the sternocleidomastoid muscle. GAN preservation can significantly improve short-term but not long-term sensation, and does not increase the patient's QoL in the long term <sup>19</sup>. Our data showed that hypoaesthesia significantly improved, but was still present 12-16 years after parotidectomy and that QoL was not affected by hypoaesthesia. Indeed, 77.2% of patients in the ST group were affected by hypoaesthesia at six weeks after surgery and 64.9% reported impairment, whereas 54.1% of patients in the LT group referred that sensation loss was a problem and 27% reported impairment. These findings suggest that patients should be preoperatively informed about the possibility of prolonged or permanent hypoaesthesia. In agreement with Bulut et al. <sup>19</sup>, we only found a positive association between GAN preservation and improved hypoaesthesia in the ST cohort, but not in the LT cohort.

We found that patients adapted to postoperative functional impairment over time and focused less on the reduced ability to feel temperature and pain on the facial skin over the parotid gland and auricle. In agreement with our findings, Wolber et al. <sup>10</sup> and Nitzan et al. <sup>12</sup> reported a 30-40% incidence of postoperative pain during short follow-up. In accord with Kaya et al. <sup>13</sup>, we argue that pain is an important early complication following parotidectomy that improves in the long-term. The total POI-8 score significantly improved from six weeks after surgery to 13 years after surgery, indicating that parotidectomy does not impair QoL in the long term. Specifically, problems associated with hypoaesthesia and pain improved significantly from the patient's perspective over time. Strikingly, problems associated with postoperative scars, facial palsy, substance loss, xerostomia, anxiety about revision surgery and Frey's syndrome were not significantly different between the ST and LT groups. In our study, 82.5% of ST and LT patients reported no or only "marginal" to "slight" post-parotidectomy Frey's syndrome complaints, although Frey's syndrome is the best described and more frequent complication following parotidectomy with a clinical incidence as high as 50% <sup>25</sup>. One explanation could be that the short follow-up period was too short (6 weeks) to show the occurrence of

symptoms related to this syndrome, whereas the long-term follow-up period was probably too long (13 years after surgery) to have a significant residual impact on quality of life of patients. Moreover, about 50% of patients did not respond to the questionnaire.

There are some limitations to the present study. Global QoL is a multidimensional construct affected by economic, social, interpersonal, physical and psychological aspects <sup>11</sup>, and the subjective perception of post-parotidectomy complications in our study might also be influenced by these factors <sup>3</sup>. However, there is no objective method to evaluate QoL in the head and neck region <sup>19</sup>. Another limitation of our study is the different group sizes, and further prospective studies with larger sample sizes are needed. There are also strengths to our study. To our knowledge, this is the most extended follow-up study assessing HRQoL in patients undergoing parotidectomy. It uses a validated tool (the POI-8) to measure patient-reported QoL and compares these findings between LT, ST and SLT groups.

## Conclusions

Patients perceived hypoaesthesia and fear of revision surgery as the most significant long-term impairments, whereas facial palsy was considered a minor problem. Despite being a major problem, hypoaesthesia significantly improved over the years and did not affect QoL in the LT group. Our findings indicate that hypoaesthesia should be discussed when asking patients for informed consent.

### *Conflict of interest statement*

The authors declare no conflict of interest.

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### *Authors' contributions*

All authors made substantial contributions to the study. MP: designed and coordinated the study, participated in data acquisition and analysis, interpreted the data, and drafted the manuscript; MS: participated in data interpretation and statistical analysis; CC: participated in data interpretation and revision of the manuscript; PKP: participated in data interpretation; IB: participated in data interpretation; KZ: designed and coordinated the study, and participated in data acquisition and analysis, critically revised the manuscript for important intellectual content.

### Ethical consideration

This study was approved by the Ethics Committee of the Medical Faculty at the University of Heidelberg granted permission to conduct the study (Project Trial No: S-300/2007 and S-443/2018).

The research was conducted ethically, with all study procedures being performed in accordance with the requirements of the World Medical Association's Declaration of Helsinki.

All patients were informed about the study aims and protocol, and participants were enrolled after giving informed written consent.

### Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

## References

- 1 Bradley PJ. Pleomorphic salivary adenoma of the parotid gland: which operation to perform? *Curr Opin Otolaryngol Head Neck Surg* 2004;12:69-70. <https://doi.org/10.1097/00020840-200404000-00002>
- 2 Berretti G, Colletti G, Parrinello G, et al. Pilot study on microvascular anastomosis: performance and future educational prospects. *Acta Otorhinolaryngol Ital* 2018;38:304-309. <https://doi.org/10.14639/0392-100X-1583>
- 3 Gunsoy B, Vuralkan E, Sonbay ND, et al. Quality of life following surgical treatment of benign parotid disease. *Indian J Otolaryngol Head Neck Surg* 2013;65:105-111. <https://doi.org/10.1007/s12070-012-0585-7>
- 4 Quer M, Vander Poorten V, Takes RP, et al. Surgical options in benign parotid tumors: a proposal for classification. *Eur Arch Otorhinolaryngol* 2017;274:3825-3836. <https://doi.org/10.1007/s00405-017-4650-4>
- 5 Kilavuz AE, Songu M, Pinar E, et al. Superficial parotidectomy versus partial superficial parotidectomy: a comparison of complication rates, operative time, and hospital stay. *J Oral Maxillofac Surg* 2018;76:2027-2032. <https://doi.org/10.1016/j.joms.2018.04.001>
- 6 Leverstein H, van der Wal JE, Tiwari RM, et al. Surgical management of 246 previously untreated pleomorphic adenomas of the parotid gland. *Br J Surg* 1997;84:399-403.
- 7 Ciuman RR, Oels W, Jaussi R, et al. Outcome, general, and symptom-specific quality of life after various types of parotid resection. *Laryngoscope* 2012;122:1254-1261. <https://doi.org/10.1002/lary.23318>
- 8 Dell'Aversana Orabona G, Salzano G, Abbate V, et al. Use of the SMAS flap for reconstruction of the parotid lodge. *Acta Otorhinolaryngol Ital* 2015;35:406-11. <https://doi.org/10.14639/0392-100X-395>
- 9 Baumann I, Cerman Z, Sertel S, et al. Development and validation of the Parotidectomy Outcome Inventory 8 (POI-8). Measurement of quality of life after parotidectomy in benign diseases. *HNO* 2009;57:884-888. <https://doi.org/10.1007/s00106-009-1991-3>
- 10 Wolber P, Volk GF, Horstmann L, et al. Patient's perspective on long-term complications after superficial parotidectomy for benign lesions: prospective analysis of a 2-year follow-up. *Clin Otolaryngol* 2018;43:1073-1079. <https://doi.org/10.1111/coa.13104>
- 11 Beutner D, Wittekindt C, Dinh S, et al. Impact of lateral parotidectomy for benign tumors on quality of life. *Acta Otolaryngol* 2006;126:1091-1095. <https://doi.org/10.1080/00016480600606731>
- 12 Nitzan D, Kronenberg J, Horowitz Z, et al. Quality of life following parotidectomy for malignant and benign disease. *Plast Reconstr Surg* 2004;114:1060-1067. <https://doi.org/10.1097/01.prs.0000135326.50939.c1>
- 13 Kaya BV, Kilic C, Ozlugedik S, et al. Long-term effects of parotidectomy. *Eur Arch Otorhinolaryngol* 2016;273:4579-4583. <https://doi.org/10.1007/s00405-016-4173-4>
- 14 Hazra A GN. Biostatistics series module 4: comparing groups - categorical variables. *Indian J Dermatol* 2016;61:385-392. <https://doi.org/10.4103/0019-5154.185700>
- 15 Aydin S, Erbay MF, Kizilay A. The effects of residual parotid volume on symptom-specific quality of life and complications in patients undergoing parotid surgery. *Eur Arch Otorhinolaryngol* 2021;278:5003-5011. <https://doi.org/10.1007/s00405-021-06742-4>
- 16 Mlees MA, Elbarbary AH. Superficial or partial superficial parotidectomy for the treatment of primary benign parotid tumors. *J Surg Oncol* 2020;122:1315-1322. <https://doi.org/10.1002/jso.25970>
- 17 Fiacchini G, Cerchiai N, Trico D, et al. Frey syndrome, First Bite syndrome, great auricular nerve morbidity, and quality of life following parotidectomy. *Eur Arch Otorhinolaryngol* 2018;275:1893-1902. <https://doi.org/10.1007/s00405-018-5014-4>
- 18 Zwetyenga N, Audion M, Gardet H, et al. Quality of life after primary parotidectomy for benign tumor. *Rev Stomatol Chir Maxillofac Chir Orale* 2015;116:18-22. <https://doi.org/10.1016/j.revsto.2014.04.006>
- 19 Bulut OC, Hohenberger R, Oladokun D, et al. Long-term quality of life and sensory impact of great auricular nerve preservation in parotid surgery as measured with the Parotidectomy Outcome Inventory-8. *Clin Otolaryngol* 2019;44:743-748. <https://doi.org/10.1111/coa.13366>
- 20 Koch M, Zenk J, Iro H. Long-term results of morbidity after parotid gland surgery in benign disease. *Laryngoscope* 2010;120:724-730. <https://doi.org/10.1002/lary.20822>
- 21 Grosheva M, Shabli S, Volk GF, et al. Sensation loss after superficial parotidectomy: a prospective controlled multicenter trial. *Head Neck* 2017;39:520-526. <https://doi.org/10.1002/hed.24647>
- 22 Yan F, Desiato VM, Nguyen SA, et al. Impact of greater auricular nerve sacrifice during parotidectomy on quality of life. *Head Neck* 2021;43:70-78. <https://doi.org/10.1002/hed.26452>
- 23 Porter MJ, Wood SJ. Preservation of the great auricular nerve during parotidectomy. *Clin Otolaryngol Allied Sci* 1997;22:251-253. <https://doi.org/10.1046/j.1365-2273.1997.00030.x>
- 24 Ryan WR, Fee WE. Long-term great auricular nerve morbidity after sacrifice during parotidectomy. *Laryngoscope* 2009;119:1140-1146. <https://doi.org/10.1002/lary.20246>
- 25 Marchese-Ragona R, De Filippis C, Marioni G, et al. Treatment of complications of parotid gland surgery. *Acta Otorhinolaryngol Ital* 2005;25:174-178.