Paradigm Shift in Surgery for Benign Parotid Tumors: 19 Years of Experience with Almost 3000 Cases

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**Objectives:** The aim of this study was to explore the changes in philosophy in the surgical therapy of benign parotid tumors over a period of 19 years.

**Methods:** The records of all patients treated for benign parotid tumors between 2000 and 2018 were evaluated. Data were analyzed with respect to the number of procedures carried out per year of the study according to each of the different surgical modalities and the incidence of postoperative complications. Statistical analysis was performed using the \( \chi^2 \) test. A \( P \) value of <.05 was considered statistically significant.

**Results:** A total of 2988 patients were included in this study. Our analysis showed that the increasing performance of extracapsular dissection was associated with a progressive reduction in the incidence of temporary facial nerve palsy and Frey’s syndrome, while the rate of permanent facial nerve palsy remained consistently low.

**Conclusion:** One of the most controversial issues in head and neck surgery is which therapeutic approach is best in patients with benign parotid tumors. Our analysis demonstrated that a change of strategy towards reducing invasiveness was possible, with exceptional functional results. Avoidance of facial nerve dissection is feasible in more than two-thirds of cases with benign tumors.

**Key Words:** Extracapsular dissection, superficial parotidectomy, complete parotidectomy, facial nerve, Frey’s syndrome.

**Level of Evidence:** 4b

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**INTRODUCTION**

Parotid gland tumors account for about 3% of tumors in the head and neck region, with benign tumors representing almost 80% of them. The most common pathology is the pleomorphic adenoma, which usually occurs in 65% of benign cases, followed by the cystadenolymphoma, accounting for 25%. At the beginning of the 20th century, benign parotid tumors were surgically managed by means of enucleation, ie, the capsule of the tumor was incised and the tumor was carved out. In the 1940s, McFarland et al. detected a high rate of tumor recurrences (up to 45%) in patients treated by this surgical modality. Bailey et al. assumed that the reason for this was the fact that enucleation left parts of the tumor capsule in place, and thus the tumor could not be removed completely. This perception led him to advocate a more radical procedure in terms of obligate dissection of the main trunk and branches of the facial nerve in all cases.

A change of philosophy at least led to superficial parotidectomy in all cases and was associated, by definition, with a higher risk of iatrogenic facial nerve palsy. Nevertheless, careful dissection of the facial nerve long remained the standard surgical method for treating benign lesions of the parotid gland, so that many working groups claimed that parotid surgery was the same as surgery of the facial nerve. It has been suggested that extracapsular dissection, in the form of removal of a tumor with a cuff of healthy gland parenchyma where possible, without intending to pre-identify the main trunk or branches of the facial nerve, as a minimally invasive procedure reduces postoperative morbidity and offers early recovery with an even better preservation of salivary function.

According to the philosophy of our department, minimal invasive surgery in the form of an extracapsular dissection (ECD) was indicated in cases of a single and mobile lesion with preoperative clinical and imaging signs of a benign tumor and located within the lateral lobe of the parotid gland as well as in cases of conglomerates of cystadenolymphomas in the caudal pole of the parotid gland. Furthermore, it was performed via an extended submandibular incision in rare cases of tumors arising from the pharyngeal prolongation of the parotid gland, located within the deep parapharyngeal space and without broad contact to the lateral parotid flap, after sectioning of the posterior belly of the digastric muscle and the styloid process in most cases. Interestingly, a significant number of former literature reports, in particular, use the term “enucleation” in order to describe what could be regarded as a form of extracapsular dissection.

In the case of a suspected cystadenolymphoma, several literature reports even point towards a clear potential for...
further reducing surgical invasiveness in capsular dissection or towards a “wait-and-see” strategy in the case of certain surgical contraindications. The aim of this study was to explore the changes of philosophy and investigate single-institution experience in the surgical therapy of benign tumors of the parotid gland over a period of 19 years (2000–2018) in almost 3000 patients.

MATERIALS AND METHODS
This retrospective study was conducted at an academic tertiary referral center specializing in salivary gland pathologies (Department of Otorhinolaryngology, Head and Neck Surgery, University of Erlangen-Nuremberg, Erlangen, Germany). The records of all patients treated for benign tumors of the parotid gland between 2000 and 2018 were evaluated. Patients with histologic findings other than a benign tumor of the parotid gland or surgical revisions of external surgeries were excluded from this study. All patients were evaluated preoperatively by clinical examination, ultrasonography of the head and neck region and, in some cases, computed tomography or magnetic resonance imaging. Preoperatively, the function of the facial nerve was assessed using the House-Brackmann grading system and by electromyography of the facial nerve in all cases, for detection of fine tumor-related facial nerve involvement. Postoperatively, all patients were followed up for a minimum of 12 months for controlling for facial function in cases with facial nerve dysfunction or Frey’s syndrome. Data were collected and analyzed with respect to the number of procedures carried out per year of the study according to each of the different surgical modalities and the incidence of postoperative complications. For study purposes, temporary facial nerve paresis was defined as a facial weakness which recovered completely within a period of 12 months. Persistence of the facial nerve palsy over 12 months was defined as permanent facial nerve paralysis. Statistical analysis was performed using the $x^2$ test with 95% confidence intervals (CIs). The software SPSS version 21 for Windows (SPSS, Inc., Chicago, IL, USA) was used for the analysis. A $P$ value of $<.05$ was considered statistically significant.

Surgical therapy for benign tumors of the parotid gland has been classified as follows: firstly, an ECD is defined as the removal of a tumor from the parotid gland with a cuff of healthy gland parenchyma where it is possible, without intending to pre-identify the main trunk of the facial nerve or its branches. If it is intended to expose the facial nerve, the procedure is termed a partial superficial parotidectomy (PSP), since parts of the superficial lobe of the gland will remain in place. Once the entire superficial lobe of the gland is resected, the procedure is designated as a lateral (or superficial) parotidectomy (LP). As soon as the total gland parenchyma is removed, the surgical modality is called complete parotidectomy (CP). Lastly, radical parotidectomy (RP) is defined as a complete removal of the parotid gland and the main trunk or branches of the facial nerve. In all cases, intraoperative monitoring of the facial nerve by means of electromyography was performed to protect the main trunk or the branches of the facial nerve.

RESULTS
A total of 2988 patients were included in this study (1586 men, 1402 women; male/female ratio: 1.13:1). The mean age was 55 (range 1–94 years). Information on the tumor histopathology can be seen in Table I. The most frequent histologic entities were the cystadenolymphoma (n = 1150) and the pleomorphic adenoma (n = 1047), accounting for 73.5% of our study cases. The distribution of the different surgical modalities over the years 2000 until 2018 is shown graphically in Figure 1. It can be easily detected that extracapsular dissection showed an impressive increase, whereas the remaining surgical modalities remained stable over the years. Figure 2 demonstrates the percentage performance of extracapsular dissection as well as the incidence of temporary or permanent facial palsy and Frey’s syndrome over the years of the study. Our descriptive analysis showed that the increasing performance of extracapsular dissection over the years was associated with a progressive reduction in the incidence of temporary facial nerve palsy and Frey’s syndrome, whereas the rate of permanent facial nerve palsy remained remarkably and consistently low over the years. A statistical analysis of the influence of the surgical modality on the complication rate is seen in Table II.

DISCUSSION
In our department, all patients with parotid gland tumors are evaluated preoperatively by clinical examination and imaging (primarily by means of ultrasonography). In contrast to a great number of salivary gland centers still performing fine needle aspiration cytology (FNAC) in all cases with exemption, needle biopsies (preferably in the form of core needle biopsy, as FNAC displays only moderate sensitivity values) are performed in our department for specific reasons in selected cases only, in order to avoid surgery in cases in which surgical treatment poses a high risk to the patient’s health, eg, with a suspicion of Warthin’s tumor in elderly multimorbital patients, or in order to optimize counseling and planning of surgery in cases with a suspicion of malignancy.

Table I shows that a general increase in the number of surgeries over the years was detectable, from 70 in 2000 to 252 in 2018, which could be attributed to the higher number of patients referred to our department. A further observation points to the remarkable upward shift of less invasive procedures in our study sample: In the year 2000 more than
the half of benign cases were managed by CP (40/70, 57.1%), ECD on the other hand was performed in only 9/70 cases (12.8%). This changed, however, in 2004, when for the first time the performance of ECD overtook that of the nerve-dissecting modalities (PSP, LP, CP), so that ECD was performed in the year 2018 in 182/252 cases (72.2%), but CP only in 44/252 cases (17.7%). There was a sharp increase in the performance of ECD until 2008, with a doubling of the percentage in the period 2001–2004 (25.6% to 50.4%), mirroring the enthusiasm for the philosophy of reducing
invasiveness in parotid surgery. Later on, this increasing tendency slowed down, with an increase of up to 71.6% in the year 2010, and has since then achieved a high level remaining consistently over 70%. This element supports the statement that extracapsular dissection can successfully manage more than two-thirds of benign parotid tumors. Our analysis demonstrated that facial nerve-dissecting modalities, in absolute numbers, remained relatively stable over the 19 years of our study: the number of PSPs increased from six to 16 cases, LP cases decreased slightly (from 15 to 10), and the number of CPs remained mostly the same (from 40 to 44). This observation points to the fact that dissection of the facial nerve retains its position and is strongly indicated in parotid surgery (diffuse unilateral multilocular cystadenolymphomas, lesions of the deep lobe, parapharyngeal lesions with close contact to the facial nerve). It could also be seen that the rapid increase in the total number of parotidectomies (from 70 to 252) could be almost directly attributed to the increase in the number of extracapsular dissections (from 9 to 182).

Undoubtedly, one of the most severe surgical complications after parotidectomy is postoperative facial palsy, with a severe negative impact on postoperative quality of life. In our department, all cases with parotid gland tumors managed after 2000 are being examined preoperatively by means of electromyography, as this method is more sensitive in detecting nerve involvement and thus suspicion for malignancy preoperatively. Our analysis showed that dissection of the facial nerve brings an almost 6.5 times higher risk of the development of permanent facial palsy in comparison to ECD. Reasonably, this significant difference could be mostly attributed to the high number of the, per definition, high-risk complete parotidectomies in the group of facial nerve-dissecting modalities (648/1064, 60.9%). Frey's syndrome was assessed by means of questionnaire in our department. In cases with a suspicion of Frey's syndrome, confirmatory testing was done with a Minor starch-iodine test. With respect to it, ECD had an 11.2 times lower risk of the development of this complication in comparison to the remaining modalities. If we look at the course of incidence of this complication over time, we can see that the change of philosophy and an increasing avoidance of nerve dissection whenever possible led to a significant reduction in temporary facial nerve palsy and Frey's syndrome, whereas the incidence of permanent facial nerve palsy remained low from the very beginning and showed an only slight tendency to decrease over the years. The latter clearly points to the fact that the vast majority of temporary palsies after nerve-dissecting modalities (PSP, LP, CP) recovers over time, and this was encouragingly verified by our analysis: a high tendency for recovery of the nerve palsy to normal facial nerve function (House-Brackmann I) was shown in both patient groups (89.5% for ECD and 87.3% for the remaining modalities).

As mentioned above, all cases with malignancy were excluded from the study cohort. Previous publications have shown that the majority of cases with presumably benign tumors have either benign or low-grade malignant cases. In a previous literature report, our working group could show that, in the case of lack of suspicion of malignancy, primary less invasive locally limited R0 resection was not associated with an unfavorable oncologic and functional outcome. This could be explained by the fact that the vast majority (>90%) of these lesions were less aggressive, low-grade subtypes (mucoepidermoid carcinoma, acinic cell carcinoma) with a low potential for occult metastases and a favorable biologic behavior. Another relevant analysis showed very encouraging preliminary results following primary extracapsular dissection as the sole surgical therapy for carefully selected low-stage, low-grade, inferiorly located lesions in patients with high compliance. Finally, another report of the same working group did not detect any medium-term oncologic benefit through completion surgery (completion parotidectomy with ipsilateral neck dissection) in these very cases. As mentioned before, for comparability reasons, these cases (n = 51) were excluded from our study cohort.

It should be underlined that this single-institutional retrospective analysis has certain limitations, which should be considered in the interpretation of the study results. Investigation of the facial nerve palsy rate and Frey's syndrome among several surgical modalities should be treated with caution because of the fact that ECD was chosen, at least in the first few years of our study, in easier cases with solitary, mobile, and caudally located tumors. Thus, the comparison of ECD to other facial nerve-dissecting modalities is prone to a certain selection bias. As mentioned above, Frey's syndrome was assessed primarily by means of questionnaire. Beginning with the subjective testing for
this complication may lead to an underestimation of its true occurrence.\textsuperscript{29} A further limitation lies in the surgeons’ preferences, at least in the first few years of the study. However, with time, the same minimal-invasive surgical philosophy was adopted by all 33 surgeons involved in parotid surgery in our department in the 19 years of the study and no significant differences in the indicating process were present. Another limitation lies in the fact that no sufficient data were available regarding the cosmetic result (scar formation) or postoperative pain. However, it seems that our department’s philosophy allows adaptation of the skin incision and flap size to the size and location of the tumor, allowing for a significantly smaller incision in many cases managed by means of ECD.\textsuperscript{30} Concerning the incidence of salivary fistula, the reliability of our results is limited by the fact that more and more cases have been managed prophylactically using scopolamine for the prevention of this complication with outstanding results.\textsuperscript{30} Last but not least, it has to be mentioned that the “hot topic” of comparison of the tumor recurrence rates after several surgical modalities was beyond the scope of our analysis, as this has already been investigated in several literature reports showing that properly indicated ECD is not associated with a higher need for revision surgery\textsuperscript{31} or higher long-term recurrence rates in pleomorphic adenomas.\textsuperscript{32}

It should be noted, that these results will almost certainly not be reproducible by the novice or low-volume surgeon, who lacks the experience to select appropriate cases for less invasive techniques. In any case, the change of philosophy and the management of more demanding cases by means of ECD are justified by the lower complication rates associated with this modality. It is important to emphasize that patient counseling is of major importance. On the day the indication for parotid surgery is determined, patients are counseled about general complications (postoperative hemorrhage with a need for transfusion of blood products or emergent intubation, pain, scar formation) as well as surgery-specific complications: temporary facial nerve palsy (12%), permanent facial nerve palsy (1.5%), Frey’s syndrome (8%), and salivary fistula (7%).

CONCLUSION
One of the most controversial issues in head and neck surgery is which therapeutic approach is best in patients with benign tumors of the parotid gland. The analysis of almost 3000 cases over a period of 19 years in a single institution demonstrated that a change in strategy towards reducing invasiveness was possible, with exceptional functional results. It could also be shown that an avoidance of dissection of the facial nerve is feasible in more than two-thirds of cases with benign tumors. Extracapsular dissection, (i.e., the removal of a tumor with a cuff of macroscopically healthy tissue without intending to pre-identify the main trunk or branches of the facial nerve) should by all means be distinguished from the tumor enucleation that is nowadays not acceptable (capsule of the tumor incised and the tumor carved out). Facial nerve-dissecting modalities retain their well-established status in certain indications; the fact of the matter is that a general tendency is slowly pointing away from the old rule that “parotid surgery is synonymous with surgery of the facial nerve” and can be summarized in the phrase: “the nerve should not be seen, if possible.”

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