



Incidence of facial nerve sacrifice in parotidectomy for primary and metastatic malignancies



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ABSTRACT

Introduction: The parotid gland may become involved by primary parotid malignancies and secondarily by metastases from other primary sites. Surgical resection of these tumors can be technically challenging due to the intimate relationship of the parotid gland and the facial nerve. The primary aim of this project was to determine the incidence of facial nerve sacrifice in parotidectomy for primary and secondary malignancies of the parotid.

Methods: A retrospective chart review of was performed. Patients who received parotidectomy with final pathology consistent with a malignant neoplasm were included. The primary outcome studied was necessity for facial nerve sacrifice. Co-variables included preoperative facial nerve function, preoperative pain, superficial versus total parotidectomy and pathologic diagnosis. Univariate analysis was performed using student *t*-test to determine odds ratios.

Results: We identified 75 patients who had a parotidectomy for a malignant process in our review. 30 patients had facial nerve sacrifice: 14 total and 16 partial sacrifices. Patients were more likely to require facial nerve sacrifice when they presented with preoperative facial nerve dysfunction [100% vs 19.6%, $p = 0.0006$, OR 154.3, CI (8.66–2750.9)], pre-op pain [76.5% vs. 29.3%, $p = 0.001$, OR 7.84, CI (2.23–27.50)], and required excision of both superficial and deep lobes of the parotid gland [64.9% vs 15.8%, $p = 0.0001$, OR 9.85, CI (3.27–29.66)].

Conclusion: Our data illustrates that many patients with normal facial nerve function, even in the setting of malignancy, can have their facial nerve preserved. Pain, deep lobe involvement and preoperative facial nerve dysfunction are associated with an increased risk of needing at least partial facial nerve sacrifice in the setting of parotid gland malignancies.

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Introduction

Parotidectomy is frequently indicated in the management of benign and malignant neoplasms of the parotid gland as well as metastasis to the gland. The facial nerve passes through the parenchyma of the parotid gland, classically dividing it into superficial and deep lobe. Iatrogenic facial nerve paresis and paralysis are well-known risks of parotidectomy, and should be discussed with every patient preoperatively. In the setting of malignant parotid neoplasms facial nerve sacrifice is occasionally required to achieve sound oncologic results. Patients who will likely require nerve sacrifice and complex reconstructive techniques benefit from preoperative planning and discussion of their expected outcome.

While there is no pre-operative test that can conclusively determine facial nerve involvement by tumor, there are several pieces of information that can suggest it. Pre-operative facial nerve function is of importance, especially if the suspicion of malignancy is high. Facial nerve dysfunction often indicates tumor invasion and malignancy. Certain pathologies, notably squamous cell carcinoma and adenoid cystic carcinoma, have a propensity for spread along the perineurium [1,2]. It is theorized that tumor invades and compresses a nerve's blood supply, ultimately causing localized infarction and clinical dysfunction [2]. However, many patients with malignant neoplasms have normal facial nerve function at the time of diagnosis, yet some will require facial nerve sacrifice at the time of surgery. For this reason, a better understanding of predictive factors for nerve sacrifice beyond preoperative motor asymmetry are of great importance. Management of the facial nerve is determined intraoperatively based on direct assessment of cancer extension. At our institution, every effort is made to preserve a functioning facial

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nerve during resection of parotid neoplasms, and nerve sacrifice is reserved only for those cases where gross invasion has occurred.

Resections of parotid neoplasms can be complicated by facial nerve dysfunction due to the intimate relationship between the facial nerve and the parotid gland. The rate of facial nerve dysfunction immediately following nerve-preserving parotidectomy for both benign and malignant tumors ranges from 29 to 42% [3–5]. The most commonly affected nerve branch is the marginal mandibular, followed by buccal [5]. However, this is almost always temporary with complete resolution by 6 months in 95–100% [3–5], with rates of limited (1 or more branches) sacrifice of the nerve reaching up to 9.25% [3].

Partial or total facial nerve sacrifice leads to significant cosmetic and functional morbidity. Facial nerve dysfunction following surgery is distressing for patients as it causes psychological distress, anxiety and depression [6], and patients with permanent facial nerve dysfunction experienced anxiety and depression at rates of 32.7 and 31.3% respectively [7]. Optimal pre-operative counseling, including discussion of facial nerve reanimation when appropriate, can help maximize post-operative expectations and results. The ability to provide an adequate risk assessment for facial nerve sacrifice would undoubtedly be useful in counseling these patients.

Previous studies have sought to investigate pre-operative factors that could predict immediate post-operative facial nerve dysfunction, but the incidence of facial nerve sacrifice in the setting of parotid malignancies is currently unknown. When looking at parotidectomies for all pathologies, excluding cases in which the facial nerve was sacrificed, an increased incidence of post-operative facial nerve weakness has been linked to malignant parotid tumors [8], tumors >4 cm, facial nerve dysfunction [9], involvement of deep parotid lobe [9,10], and tumors located in the upper, anterior and deep regions of the parotid [11]. Malignant parotid lesions were also associated with slower rates of improvement after initial dysfunction, albeit with similar final resolution of facial nerve function [8].

However, these studies addressed post-operative facial weakness in the setting of complete facial nerve preservation. To our knowledge, no study has looked at the incidence of facial nerve sacrifice (partial or total) in the setting a malignant parotid neoplasm and the pre-operative predictive factors specific to facial nerve sacrifice in these patients.

Methods

Patient selection

After University Hospitals Cleveland Medical Center IRB approval, a retrospective review of electronic medical records was performed. Current procedural terminology (CPT) codes were used to identify patients who received excision of parotid gland lesions at University Hospitals Cleveland Medical Center from 2003 to 2012, which identified a total of 585 patients. International statistical classification of diseases (ICD-9) codes were then used to identify those with diagnosis of malignancy, either from primary parotid tumors or secondary metastasis from another primary site. 150 patients were identified using this method. Complete records detailing preoperative characteristics were available for 75 patients and their charts were included in our analysis.

Outcomes examined

The primary goal of this study was to determine the incidence of partial and complete facial nerve sacrifice in patients undergoing parotidectomy for malignant process with a secondary aim looking for any predictive factors for facial nerve sacrifice in this popula-

tion of patients. To this end, electronic and paper medical records were examined and data points were collected. Patients were divided into 2 main groups based on the presence or absence of eventual facial nerve sacrifice, which was determined from operative reports and final pathology reports. The co-variables analyzed were age at diagnosis, gender, length of duration of mass, pre-operative facial nerve function using House-Brackman staging, location of mass, pre-operative pain, presence of metastasis, grade, positive nodal status, drinking history and smoking history.

Statistical analysis

Univariate analysis of the co-variables was performed with respect to the primary outcome. Odds ratios were calculated to determine statistical significance between groups, with p -values < 0.05 considered significant.

Results

Pre-operative patient demographics

Demographic analysis of our patient cohort is shown in Table 1. Average age was 69.1 years with standard deviation of 15.3 years. 43 (57.3%) patients were female. Parotid masses had been present for 8.5 months on average with a standard deviation of 15.6 months. 17 patients (22.6%) presented with pre-operative facial pain. Pre-operative facial nerve function was normal in 56 (74.7%) patients. 37 (49.3%) were current or former smokers. At initial presentation, and 52 (69.3%) had stage IV disease.

Operative and post-operative patient demographics

All patients had at least a superficial parotidectomy, and 37 (49.3%) also required excision of the deep parotid lobe. 56 (74.7%) patients received lymph node dissection at the time of surgery. The facial nerve was completely sacrificed in 14 (18.7%) cases, and partial sacrifice was performed in an additional 16 (21.3%) cases. The most common tumor pathology was regionally metastatic squamous cell carcinoma in 33 (44.0%) cases, followed by melanoma in 12 (16.0%).

Incidence of facial nerve sacrifice and preoperative predictive factors

When analyzing all patients with parotidectomy performed for malignant process, 60% had complete preservation of the facial nerve. In 19.6% of those with initial House-Brackman scores of 1 [$p = 0.0006$, OR 154.3, CI (8.66–2750.9)] some degree of sacrifice was necessary, but as expected 100% of those with a House-Brackman scores of 2 or greater on presentation required some degree of nerve sacrifice. A presentation of pre-operative pain in the parotid region also correlated with facial nerve sacrifice. 76.5% of those with pre-operative pain received some degree of facial nerve sacrifice, compared to only 29.3% of those without pain [$p = 0.001$, OR 7.84, CI (2.23–27.50)]. Additionally, 64.9% of those requiring resections of both superficial and deep lobes of the parotid gland also had facial nerve sacrifice, compared to only 15.8% of those with resection of only the superficial lobe [$p = 0.0001$, OR 9.85, CI (3.27–29.66)] (Table 2).

While all patients in our cohort had final pathology of malignancy, only 48 patients had a preoperative tissue diagnosis of malignancy from fine needle aspiration (FNA) or incisional/excisional biopsy. In these patients, the facial nerve was completely preserved in 27 patients (56.3%), and total nerve sacrifice was only required in 8 patients (16.7%) (Table 3). In the setting of preoperative malignant tissue diagnosis, 75% of patients with normal facial

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