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Pattern of facial nerve palsy during parotidectomy: a single-center experience

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Abstract

Objective: This study was performed to report and analyze the prevalence of permanent facial nerve paralysis following parotidectomy for various benign and malignant lesions in a single center.

Methods: This single-center retrospective study included all patients who underwent parotidectomy (total and superficial) for benign and malignant tumors and chronic inflammatory diseases during a 6-year period. Patients who had previously undergone an operation of the parotid gland and those with preoperative facial weakness were excluded.

Results: The study included 127 patients ranging in age from 14 to 83 years (median, 45.89 years). Most patients were female (n = 83, 65.4%). The most prevalent procedure was superficial parotidectomy (n = 117, 92.1%), followed by total parotidectomy (n = 6, 4.7%). The average operative duration was 138 minutes (range, 80–400 minutes). Histopathology revealed that 109 (85.8%) patients had benign tumors, 14 (11.0%) had malignant tumors, and 4 (3.1%) had chronic sialadenitis. Only two patients sustained an injury to the cervical branch of the facial nerve.

Conclusion: In this single-center experience of parotid surgery, the rates of transient and permanent facial paralysis were acceptably low at 9.0% and 1.6%, respectively, for all pathologies.

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Introduction

The parotid glands are the largest paired clusters of salivary tissue in the body. They have a basic glandular structure from which they generate and secrete serous saliva.[1] Parotid gland tumors represent approximately 2% of all head and neck tumors and approximately 80% of all salivary gland tumors, and 75% of such tumors are benign.[2,3] Parotidectomy is a common surgical procedure used to treat parotid gland tumors.[4] Despite recent advances in surgical techniques, surgery for parotid tumors is associated with a high prevalence of complications, the most common of which is transient facial nerve paralysis.[2] Frey's syndrome, salivary fistula, postoperative infection, hematoma/hemorrhage, and sialocele are other possible complications of parotidectomy.[2] Parotid gland surgery necessitates appropriate tumor excision and, whenever possible, preservation of the anatomical and functional integrity of the facial nerve.[4] Facial nerve paralysis is a frightening complication of parotidectomy that has received considerable attention. Because parotid gland tumors are located very close to the facial nerve, this nerve is one of the most critical structures encountered during surgical excision.[5] Facial nerve injury can result in cosmetic and functional morbidity, ocular problems, decreased quality of life, and medical malpractice litigation.[6] The impairment of nerve function can be total (paralysis) or partial (paresis) and can result from damage to the main trunk or specific branches. According to statistics from the international literature, up to 46.1% of patients experience postoperative temporary facial nerve dysfunction.[7] Permanent facial nerve paralysis is less frequent, occurring in 2.5% to 5.0% of cases.[8]

The current study was performed to report the prevalence of permanent facial nerve paralysis following parotidectomy for various benign and malignant lesions in a single center of head and neck surgery.

Methods

This retrospective study focused on patient outcomes following parotidectomy at a single private center from 2015 to 2021. All patients provided written consent before surgery. The data acquired from the center's medical records included the patients' age, sex, details of the presentation, preoperative examination findings, fine needle aspiration cytology results, type of parotidectomy, final pathology, and postoperative sequelae. The study was approved by the Ethical and Scientific Committee of the College of Medicine, University of Sulaimani.

Inclusion criteria

This study included all patients who underwent parotidectomy (total or superficial) for benign tumors, malignant tumors, and chronic inflammatory diseases and had a normally functioning facial nerve preoperatively.

Exclusion criteria

Patients who had previously undergone an operation of the parotid gland and those

who had preoperative facial weakness were excluded.

Preoperative assessment

All patients underwent a clinical evaluation including ultrasound-based estimation of the parotid gland size and morphology, fine needle aspiration cytology (if indicated), and assessment for facial nerve integrity.

Surgical procedure

All patients underwent general anesthesia with endotracheal intubation. The neck was extended and the head turned to the unaffected side. Skin preparation was performed using povidone disinfectant, and the site of the lazy S incision was marked with a specific skin marker. The incision was then made using local anesthetic infiltration. The skin flap was elevated until just the hair follicles became visible. In most patients, the greater auricular nerve, especially the posterior branch, was identified and preserved. Using familiar landmarks, the facial nerve trunk was identified and tracked, and its branches were conserved. The anterior surface of the gland was dissected intracapsularly, whereas the posterior surface was dissected extracapsularly. In this way, superficial parotidectomy was accomplished. In certain cases, the tumor was positioned in the deep portion of the parotid gland, necessitating total parotidectomy.

Follow-up

The median duration of follow-up was 3 years (range, 1–6 years). The patients were discharged home on the first or second postoperative day and returned to the clinic 10 days later. They were subsequently followed up by telephone every month during the first 3 months and every year thereafter.

Statistical analysis

The collected data were entered into an Excel sheet and then into IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics including the mean, standard deviation, percentage, and p-value were calculated. The data are presented in tables, and analyses were performed for comparison of the data.

Results

In total, 127 patients underwent parotidectomy from 2015 to 2021. They ranged in age from 14 to 83 years, (median, 45.89 years). Most of the patients were female (n = 83, 65.4%). Overall, 86 patients (67.7%) were nonsmokers. The most prevalent procedure was superficial parotidectomy (n = 117, 92.1%), followed by total parotidectomy (n = 6, 4.7%). The average operative duration was 138 minutes (range, 80–400 minutes). Histopathology revealed that 109 (85.8%) patients had benign tumors, 14 (11.0%) had malignant tumors, and 4 (3.1%) had chronic sialadenitis. Benign tumors included pleomorphic adenoma (n = 89), Warthin tumor (n = 15), lipoma (n = 2), simple epithelial cyst (n = 1), giant cell tumor of the parotid (n = 1), and canalicular adenoma (n = 1). Malignant lesions included mucoepidermoid carcinoma (n = 4), acinic cell carcinoma (n = 3), squamous cell carcinoma (n = 3), metastatic carcinoma (n = 3), and giant cell tumor (n = 3). Only two patients sustained an injury to the cervical branch of the facial nerve.

Both patients with nerve injury were female and <65 years old, and the differences between them were statistically insignificant. One patient had a malignant tumor. Superficial parotidectomy was performed in both patients and completed within 180 minutes.

The patients' demographic and clinical characteristics are shown in Table 1, and the frequency of facial nerve palsy in relation to patient variables is shown in Table 2.

Table 1. Demographic data and clinical characteristics.

Variables	Total patients (n = 127)
Sex	
Male	44 (34.6)
Female	83 (65.4)
Age, years	45.89 (14–83)
Marital state	
Married	107 (84.3)
Single	20 (15.7)
Occupation	
Employee	16 (12.5)
Housewife	66 (52.0)
Worker	17 (13.4)
Student	8 (6.3)
Other	20 (15.7)
Smoker	
No	86 (67.7)
Yes	19 (15.0)
Passive	21 (16.5)
Past	1 (0.8)
Chief complaint	
Swelling	113 (89.0)
Pain	9 (7.1)
Incidental finding	5 (3.9)
Side	
Left	61 (48.0)
Right	64 (50.4)
Both	2 (1.6)
Type of lesion	
Benign	113 (89.0)
Malignant	14 (11.0)
Type of operation	
Superficial	117 (92.1)
Total	6 (4.7)
Partial superficial	4 (3.1)
Temporary facial weakness	
Present	12 (9.4)
Absent	117 (90.6)
Facial nerve damage	
Present	2 (1.6)
Absent	125 (98.4)

Data are presented as n (%) or median (range).

Discussion

Parotidectomy remains one of the most significant and critical procedures for the treatment of salivary gland tumors in the field of head and neck surgery.[9] Postoperative facial paralysis is a common consequence of parotid surgery for parotid lesions, and it is a considerable concern for both the patient and the surgeon.[10] Thus, accurate detection and preservation of the facial nerve are required to avoid facial nerve dysfunction.[11] There are two ways to recognize the facial nerve trunk during parotidectomy: standard antegrade dissection and retrograde dissection.[12] Various anatomical landmarks for early identification of the facial nerve have been documented. The tympanomastoid suture, the cartilaginous section of the external auditory canal, and the posterior belly of the digastric muscle are considered to be three critical markers for identifying the main trunk of the facial nerve.[13] Several approaches, including preoperative imaging and intraoperative facial nerve monitoring, have been used to decrease facial nerve problems after parotidectomy. With the exception of a few trials, however, the surgical results of these procedures have not been well examined.[14] In the current study, the facial nerve was identified by identifying the facial nerve trunk and then conserving its branches. Facial nerve monitoring was not used.

Despite preservation measures, large institutional series have revealed temporary facial nerve impairment in up to 65% of patients undergoing parotidectomy and life-long facial nerve paralysis in 4% to 7% of patients.[15] Jin et al.[14] observed a similar tendency in a series of 794 parotidectomy surgeries for both benign and malignant disease, with overall temporary and long-term paresis rates of 9.2% and 5.4%, respectively. Witt[16] performed a meta-analysis and found that transitory and persistent facial nerve

Table 2. Frequency of facial nerve palsy in relation to patient variables.

Variables	All patients	Patients with facial nerve damage	p-value
Age, years			
≤65	117 (92.3)	2 (1.6)	0.677
>65	10 (7.9)	0 (0.0)	
Sex			
Male	44 (34.6)	0 (0.0)	0.299
Female	83 (65.4)	2 (1.6)	
Side			
Left	61 (48.0)	2 (1.6)	0.333
Right	64 (50.4)	0 (0.0)	
Both	2 (1.6)	0 (0.0)	
Type of lesion			
Benign	113 (89.0)	1 (0.8)	0.979
Malignant	14 (11.0)	1 (0.8)	
Type of operation			
Superficial	116 (91.3)	2 (1.6)	0.979
Total	6 (4.7)	0 (0.0)	
Partial superficial	4 (3.1)	0 (0.0)	
Duration of operation, minutes			
≤180	124 (97.6)	2 (1.6)	0.001
>180	3 (2.4)	0 (0.0)	

Data are presented as n (%).

dysfunction occurred in 59.8% and 4.0% of patients undergoing total parotidectomy and in 17.9% and 0.2% of patients undergoing partial superficial parotidectomy, respectively. Guntinas-Lichius et al.[17] reported permanent fascial paralysis in 6% of cases. The marginal branch of the facial nerve was the most frequently involved branch.[18] In the current series, the prevalence of temporary facial nerve paresis was 9.0%, and permanent facial nerve damage occurred only in two (1.6%) patients. In both patients, only the cervical branch was damaged. According to reports in the literature, paresis or paralysis of the cervical branch is not clinically significant.[7] This variability can be partly explained by the differences in the operative procedures and the timing of examination in relation to surgery.

The pathophysiological reasons for temporary, reversible post-parotidectomy facial paralysis remain unknown. The most likely mechanical component is short-term segmental distortion of the myelin sheaths caused by mild stretching of the prepared nerve branch. The induced edema most likely impedes the nerve's microcirculation and results in an electric deblocking of the nerve, regardless of the fact that the nerve fibers are mostly intact.[19] Crushing peripheral nerves with surgical forceps consistently results in mechanical distortion of myelin sheaths, leading to segmental demyelination; however, this appears to be an uncommon occurrence in patients who have undergone meticulous parotidectomy.[20]

Previously recognized risk factors for postoperative facial nerve dysfunction include the type of surgery, malignant tumors, tumor size, inflammatory diseases, age, recent parotid surgery, and operative duration.[6] The exact importance of these findings is questionable because some studies verified some of these variables whereas

others did not.[21] Guntinas-Lichius et al.[19] assessed 610 patients and found that an age of >70 years and an operative duration of >260 minutes were risk factors for transitory weakness. Similarly, Ruohoalho et al.[2] found that age and a longer operative duration were strongly associated with postoperative facial nerve dysfunction. However, Albosaily et al.[22] did not find that age was significantly associated. In contrast to prior studies, both cases of facial nerve injury in the current study occurred in patients aged <65 years and an operative duration of <180 minutes.

The depth of surgical resection has been shown to be associated with the incidence of transitory or permanent facial palsy. One study showed that when compared with partial superficial parotidectomy, more extensive procedures such as total parotidectomy or superficial parotidectomy were associated with 2.7-times higher risk of facial nerve paralysis.[23] Witt[16] found a three-times higher incidence of permanent facial nerve dysfunction and a two-times higher incidence of temporary facial nerve dysfunction after total parotidectomy than after partial superficial parotidectomy. Albosaily et al.[22] reported that facial weakness was more common in patients who had undergone superficial parotidectomy than in those who had undergone partial superficial parotidectomy or extracapsular dissection, although the difference was not statistically significant. Another study showed that for all lesions, complete parotidectomy (12.8%) and revision parotidectomy (19.0%) had substantially higher rates of short-term weakness than partial/superficial parotidectomy (3.6%).[9] In the current study, both cases of permanent facial nerve injury occurred during superficial parotidectomy. Furthermore, there was no correlation between weakness and the direction of facial nerve dissection.[24] Scarred or inflammatory tissue (as in chronic or recurring illness) and revision surgery increase the risk of nerve injury during parotid gland dissection.[8] The risk of nerve stretching may be increased in revision parotidectomy.[17] Patients who underwent revision surgery were excluded from the current study.

Previous studies have shown that malignancy and recurring tumors are common risk factors for postoperative facial paralysis.[15] In one study, the prevalence of transient paresis was significantly higher after surgery for malignant than benign disease.[9] Diabetes has also been linked to facial palsy after parotidectomy.[21] Diabetes has been associated with wound complications following head and neck surgery.[25] Neurologically, patients with diabetes have lower motor nerve conduction velocity and amplitude than patients without diabetes. Schwann cells and the myelin sheaths of nerves are substantially more vulnerable to injury in patients with than without diabetes.[21] In a study of 162 patients, Nouraei et al.[26] discovered that sialadenitis greatly enhanced the risk of postoperative weakness. In the current study, one patient had a malignant tumor, no patients were diabetic, and no patients had concomitant sialadenitis.

When the tumor is greater than 4 cm in diameter, the risk and duration of facial nerve stretching are enhanced. In one study, facial palsy was observed in 95.5% of patients with tumor invasion of the facial nerve and in 51.3% of patients without tumor invasion.[20] Another study showed that tumors larger than 70 cm^3 were associated with a high likelihood of facial weakness.[19] However, Yuan et al.[21] stated that the size of the lesion was not a major determinant in the development of facial nerve dysfunction. This finding might have been attributed to the confusing association between the tumor site and facial nerve.[20] Gaillard et al.[4] also revealed that the size of the lesion was not a major determinant in the development of facial nerve

dysfunction. Another study showed that larger tumors were more likely to be associated with permanent than transient facial nerve dysfunction.[27] In the current study, the size of the tumor was not significantly associated with facial nerve injury. However, the location of the tumor has been shown to be a major risk factor for facial paralysis.[28] Gaillard et al.[4] discovered a significant relationship between postoperative facial nerve palsy and close contact of the tumor with the nerve. Tumors in the upper and/or anterior portions and in the deep lobe of the parotid gland also have a high rate of temporary facial nerve dysfunction.[29]

In recent reports, several authors have strongly suggested the performance of partial superficial parotidectomy for benign parotid illness because of the lower rate of complications associated with this procedure.[21] Multiple articles during the last decade have demonstrated that restricted parotidectomy procedures, such as extracapsular dissection and partial superficial parotidectomy, do not result in greater recurrence rates while lowering the incidence of postoperative facial weakness associated with total and superficial parotidectomy.[30] The importance of regular electromyographic monitoring in preventing postoperative facial nerve weakening remains debatable.[4] For parotid surgery, 60% of practicing head and neck surgeons use intraoperative facial nerve monitoring, with the remaining 40% relying on anatomical landmarks or visually monitoring the facial muscles for twitching.[15] In contrast, one meta-analysis showed that intraoperative facial nerve monitoring did not reduce the risk of permanent facial paralysis in patients undergoing primary parotidectomy.[15] Permanent paralysis frequently necessitates further surgical treatments to obtain a functional and acceptable aesthetic result, which entails additional risks for the patient.[31]

This study had several crucial limitations. The sample size was small, it was a single-center experience, and the data collection was retrospective, increasing the risk of important biases.

In conclusion, in this single-center experience of parotid surgery, the rates of transient and permanent facial paralysis were acceptably low at 9.0% and 1.6%, respectively, for all pathologies. Overall, this series has demonstrated acceptably low rates of facial nerve paralysis for parotid surgery without the routine use of continuous facial nerve monitoring.

Author contributions

Abdulwahid M. Salih, Hiwa O. Baba, Yadgar A. Saeed, Aso S. Muhialdeen: majorly contributed to the study conception, performed the operations, followed up the patients, and provided final approval of the manuscript.
Fahmi H. Kakamad, Shvan H. Mohammed, Zuhair D. Hammood, Karzan M. Salih, Rawezh Q. Salih, Dahat A. Hussein, Hunar A. Hassan: performed the literature review, wrote the manuscript, and provided final approval of the manuscript.

Declaration of conflict of interest

The authors declare no conflict of interest in preparing this article.

Data availability statement

The data are available upon request of the corresponding author.

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