Complications after parotid gland surgery
Our experience

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AIM: *Complications after parotid surgery include deficit of the facial nerve, wound complications, as sialocele and salivary fistula, and Frey syndrome; the goal of this study was to evaluate the relationship between the type of parotid surgery performed and the incidence of each of these complications.*
MATERIAL OF STUDY: *A total of 184 patients were evaluated and 158 were included in the study. Four different kinds of intervention were made: extracapsular dissection, partial superficial parotidectomy; superficial parotidectomy and total parotidectomy. The incidence of each complication was studied and correlated to the type of surgery performed. Statistical analysis was done using the chi-square test of independence.*
RESULTS: *From all cases examined, 86 patients developed facial nerve complications with 59 minor asymmetry, 19 partial weakness and 8 complete weakness. Forty patients had wound complications, 28 sialocele and 12 salivary fistula. Sixteen patients developed Frey syndrome.*
DISCUSSION: *Facial nerve complications and Frey syndrome were significantly related to superficial or total parotidectomy, differently extracapsular dissection and partial superficial parotidectomy had more cases of wound complications.*
CONCLUSION: *The kind of complications that occur after parotid surgery depends on surgery performed. Chi-square test has a statistically significant result and confirms this kind of relationship (P <.0001).*

KEY WORDS: Facial nerve, Parotid glands, Parotidectomy

Introduction

The surgical treatment of tumors of the parotid gland was significantly modified in the last years. The enucleation technique was substituted by techniques which provided partial or total parotidectomy [1], but recently, techniques involving the resection of less than the full superficial parotid lobe have obtained popularity, because many authors agree that a resection margin of 1,5 to 2 cm in the parenchyma can be considered sufficient to reduce the risk of recurrence and constitutes an adequate oncologic margin [2]. Complications after parotidectomy include transient or permanent facial paresis, wound complications, as sialocele and salivary fistula, and Frey syndrome [3-5]. Parotid gland surgery always touch the facial nerve. In fact, identification of this nerve from the main trunk to the peripheral branches represents the most important part of the operation. Temporary facial nerve paresis, involving all or just one or two branches of the facial nerve, and permanent total paralysis have occurred, respectively, in 9.3% to 64.6% and in 0% to 8% of parotidectomies reported in the literature [6]. A sialocele is a saliva harvesting within the wound that occur after the surgery. Its incidence has been reported to be between 5% and 39%, considered to be caused

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by the continued leakage of saliva from the residual parotid gland[3]. Saliva may also drain through the wound to the skin, originating a salivary fistula, that has an incidence between 2% and 17% classically; fluid accumulation and leakage occurs during eating. Reasons for the wide variance in these reported incidences are unclear, but may relate to variation in types of surgery performed, variations in surgical technique. Frey syndrome is caused by an aberrant regeneration of sectioned parasympathetic secretomotor fibres of the auriculotemporal nerve with inappropriate innervation of the cutaneous facial sweat glands that are normally innervated by sympathetic cholinergic fibres. This disorder is characterized by unilateral sweating and flushing of the facial skin in the area of the parotid gland occurring during meals that becomes evident usually 1-12 months after surgery. The clinical incidence of Frey syndrome, after parotidectomy, has been reported, in various studies, to be as high as 50%, and severe in 15%. Gustatory sweating is generally evaluated by means of a post-operative iodine-starch test (Minor test) [12].

The purpose of the present study was to evaluate our incidence of facial nerve disease, wound complications and Frey syndrome after parotidectomy and to correlate those complications to the kind of surgery performed.

Materials and Methods

At the Department of Maxillo-Facial Surgery of University Hospital of Naples ''Federico II'', between February 2014 and December 2015, 184 patients were evaluated after parotid surgery for the occurrence of one of the following complications: deficit of the facial nerve, wound complications (sialocele or salivary fistula), and Frey syndrome. Cases requiring flap reconstruction after skin resection for malignant tumors and patients who underwent sacrifice of the main facial nerve trunk or underwent sacrifice of a facial nerve's branch were excluded from the analysis. The skin incision started from the pre-auricular region and extended around the ear lobe insertion, touched the anterior margin of the mastoid, and ends in the lower scalp (like face-lift incision). (Figs. 1, 2) The superficial muscular aponeurotic system (SMAS) was elevated in the cases of benign tumors (Fig. 3), or removed with the gland in malignant and superficial tumors. The greater auricular nerve was identified and preserved when possible. The common trunk of the facial nerve was identified, isolated, and controlled by facial nerve monitoring with a neurostimulator (Fig. 4). After removal of the tumor, hemostasis was ensured using bipolar coagulation, and the facial planes and skin were closed. The types of operations performed were classified as one of the following: extracapsular dissection (removal of a superficial tumor using dissection around its capsule) (Fig. 5); partial superficial parotidectomy (resection of part of the superficial lobe, with identification of the main trunk of facial nerve, and generally with dissection of the branches of either the lower or upper division); superficial parotidectomy (removal of most or all of the superficial lobe with dissection of branches of both upper and lower divisions of facial nerve); and total parotidectomy (removal of most or all parotid gland). We compared the effects of the surgical

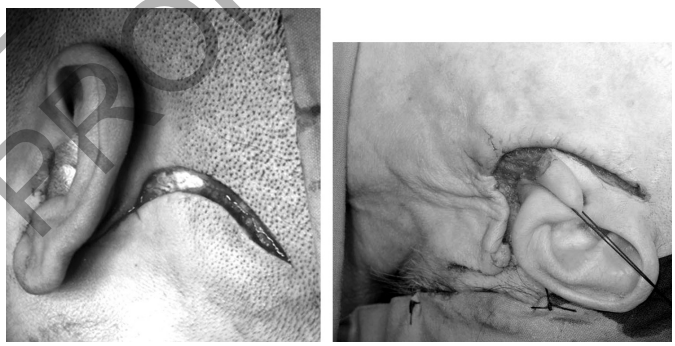


Fig. 2: Skin incision.

Fig. 1: Cutaneous engraving drawing.

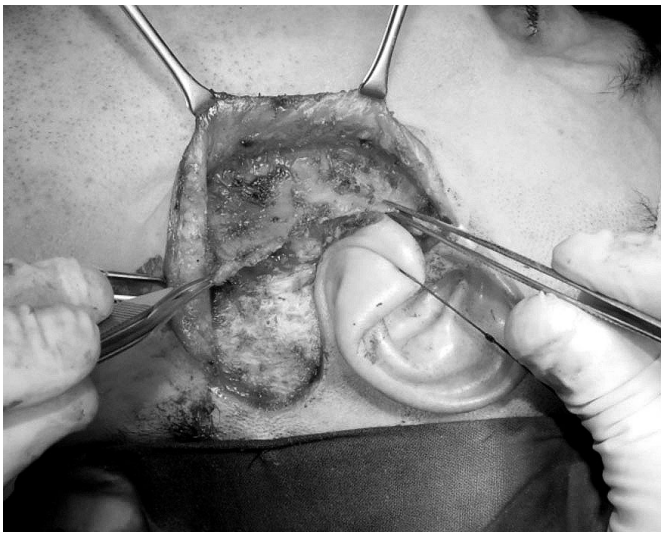


Fig. 3: Dissection of SMAS.

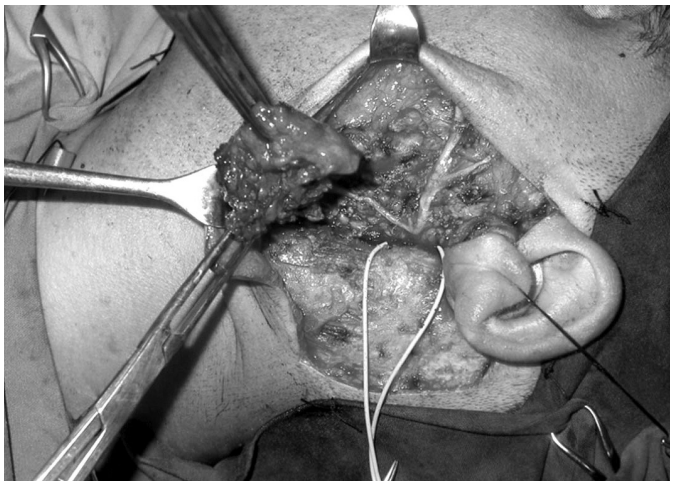


Fig. 4: Superficial parotidectomy. You can see the main trunk of the facial nerve and its three branches.

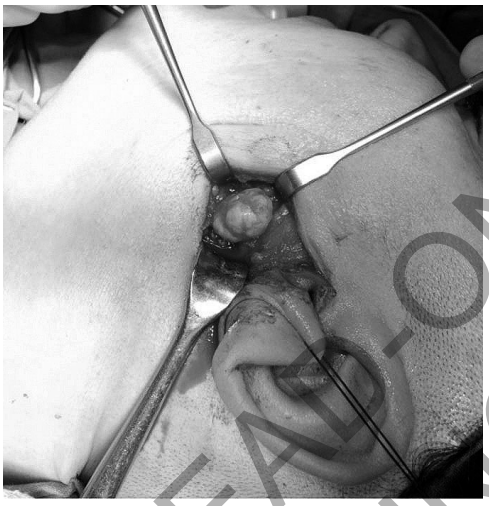


Fig. 5: Extracapsular dissection.

procedures on postoperative onset of function of the facial nerve, wound complications, and Frey syndrome. Statistical analysis was done using the χ^2 test of independence.

Results

From all cases examined, 158 were included for analysis. There were 88 male and 70 female patients, with a mean age of 53 years (range, 25-81 years). Types of surgery performed were: 45 extracapsular dissection (28.481%); 42 partial superficial parotidectomy (26.58%); 48 superficial parotidectomy (30.379%), 23 total parotidectomy (14.557%) (Table I).

TABLE I - *Types of surgery and number of treatments.*

Types of Surgery	Number of treatments
Extracapsular dissection	45
Partial superficial parotidectomy	42
Superficial parotidectomy	48
Total parotidectomy	23

TABLE II - *Types of diagnosis and number of patients.*

Types of Diagnosis	Number of patients
Pleomorphic adenoma	59
Warthin's tumor	46
Other benign salivary neoplasm	26
Metastatic squamous cell carcinoma	12
Acinic cell carcinoma	4
Metastatic malignant melanoma	5
Chronic parotitis	6

TABLE III - *Post-operative function of facial nerve.*

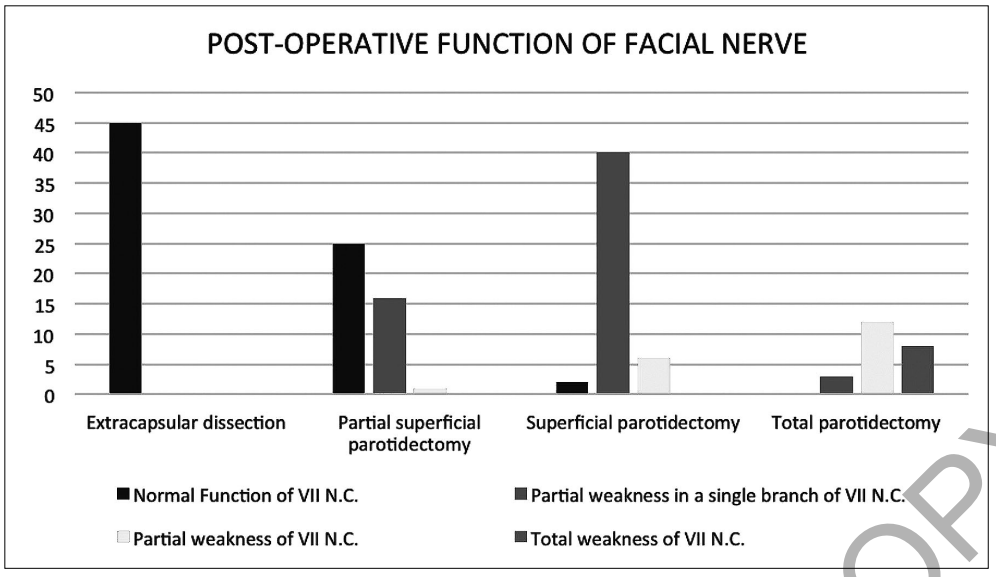
Post-Operative function of facial nerve (VII N.C.)	
Normal Function of VII N.C.	72 (45.56%)
Partial weakness in a single branch of VII N.C.	59 (37.34 %)
Partial weakness of VII N.C.	19 (12.02 %)
Total weakness of VII N.C.	8 (5.06 %)

Fifteen patients underwent concomitant selective or modified radical neck dissection. Drains were used in all and were left in for the prescribed minimum time of 48 hours in all patients. The median length of time drains were left in situ was 3 days.

Final histological diagnosis was 59 pleomorphic adenoma (37.34%); 46 Warthin's tumor (29.11%); 26 other benign salivary neoplasm (16.45%); 12 metastatic squamous cell carcinoma (7.59%); 4 acinic cell carcinoma (2.53%); 5 metastatic malignant melanoma (3.16%); and 6 chronic parotitis (3.79%) (Table II).

Postoperative facial function was assessed in all patients. It was perfect in 72 (45,56%). Fifty-nine patients (38.7%) had minor asymmetry (partial weakness or some perceptible facial asymmetry on movement in a single branch). Nineteen patients had partial weakness (12.02%), and 8 (5.06%) had complete weakness (Table III).

All patients with postoperative weakness fully regained normal facial function within 5-6 months. Patients undergoing superficial or total parotidectomy had a significantly higher percentage of postoperative facial nerve complications (Graphic I).

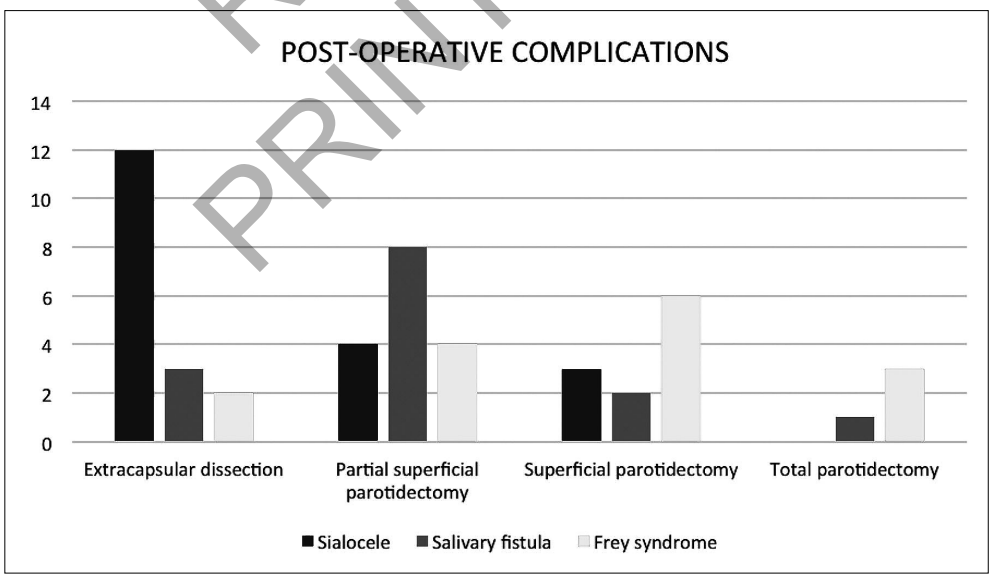


Graphic I: Post-operative function of facial nerve.

TABLE IV - *Post-operative complications after parotide surgery.*

Post-Operative Complications		Numbers of patients
EARLY	Sialocele	28
	Salivary fistula	12
LATE	Frey syndrome	16

Twenty eight patients developed a sialocele (18%) and 12 developed a salivary fistula (8%). Sixteen patients (10%) developed Frey syndrome (Table IV).
The incidence of sialocele or fistula was significantly greater for patients who performed extracapsular dissection o partial superficial parotidectomy (27 of 97 patients, 31%) compared to those with superficial or total parotidectomy (6 of 71 patients, 9%) (Graphic II). Concomitant neck dissection, location of the tumor within the deep lobe, and malignant histology, did not have any impact on risk of wound complications. We successfully managed our patients who developed sialocele with aspiration of the accumulated fluid and salivary fistula by compressive medicament for a mean time of two week.
After a Minor' s test, the whole area was divided into 1.5 cm squares. They were treated with two units of BTX-A (Botox, Allergan) injected, subcutaneously, into each square to achieve a diffuse, homogeneous effect. The total amount of drug used for treatment depends on the surface area of sweating. Patients with a large hyperhidrotic area required more injections and larger dosages. In all patients the symptoms regressed on average after a week of treatment. The individual BTX dosage can range from 10 to 175 U. The mean dose is



Graphic II: Post-operative complications.

30-50 U. BTX treatment has always been well tolerated without needing anaesthesia. The gustatory sweating usually stopped in the treated area, within 48-72 hours.

Discussion and Comments

Complications after parotid surgery can be classified like early complications, including transient or permanent paresis or paralysis of the facial nerve or its branches, bleeding, hematoma, and numbness, intermediate-length complication, like sialocele and salivary fistula, and late complications that include tumor recurrence, cosmetic deformity and Frey syndrome [3]. Post-operative facial nerve dysfunction involving some or all of the branches of the nerve is the most frequent early complication of parotid gland surgery. The incidence of temporary facial dysfunction after parotidectomy ranges between 23% and 66% [7], with lower incidences reported among cases performed using the extracapsular dissection [8,10]. The cases of transient facial nerve paresis generally resolved within 6 months, with 90% within 1 month [9]. The incidence of facial nerve paralysis is higher with total, than with superficial parotidectomy, which may be related to stretch injury or as result of surgical interference with the vasa nervorum [11]. The branch of the facial nerve most at risk for injury during parotidectomy is the marginal mandibular branch. Temporary facial nerve weakness is a cosmetic problem, and patients should be told their appearance will return to normal [12]. However, eye protection must be ensured. Different therapies have been proposed for the treatment of facial nerve deficits, as electrostimulation, biofeedback, proprioceptive neuromuscular facilitation, but mime therapy could be able to improve functional results in patients with facial palsy. It includes self-massage, relaxation exercises, and breathing combined with exercise sessions based on the performance of coordinated movements of the face, functional movements, pronunciation of letters, and words, and it includes a daily home exercise program. In our study patients undergoing less extensive parotid resection (partial superficial parotidectomy or extracapsular dissection) demonstrated clear benefit with only 30 patients (26%) who developed slight asymmetry over patients undergoing superficial parotidectomy or more extensive parotid surgery. Patients with postoperative weakness, supported by mime therapy fully regained normal facial function within 5-6 months. This is in agreement with the findings of authors who have also reported partial superficial parotidectomy to be associated with a lower risk of postoperative facial palsy than superficial parotidectomy or more extensive parotidectomies [13,14]. However, our findings, and those of others, would suggest that optimum facial functional outcome is achieved when facial nerve dissection is limited to the minimum possible. Sialocele and salivary fistula are common complications after parotidectomy. There is a wide variability in the reported incidences of these complications, 5% to 39% for sialocele [3,15] 2% to 17% for salivary fistula [16]. This variability probably reflects both differences in surgical techniques and differences in follow-up during the weeks after hospitalization. The cause of sialocele and salivary fistula is the continued secretion of saliva from remaining parotid gland tissue after the surgery. When saliva collects in the wound, it causes a sialocele. In other cases, the saliva filtrates through the wound, don't collect and leads to a salivary fistula. Both the collection and the leakage occur during eating. A sialocele and salivary fistula can occur after the first week after surgery. It appears as a nontender, nonerythematous fluctuance at the angle of the mandible. Subjective discomfort from a sialocele can range from no complaint to a moderate pressure sensation. Most cases are self-limiting and even without active treatment most resolve over a period of weeks. There is no agreement in the literature between different authors on incidence of wound complications and their correlation with the extent of parotidectomy. Some of them [3] found partial superficial parotidectomy to be associated with increased risk of sialocele compared to total parotidectomy. Others did not find a correlation between the extent of surgery and the onset of salivary fistula [16]. In our study, we found that extracapsular dissection and partial superficial parotidectomy are associated with a high incidence of sialocele or salivary fistula, and this was significantly higher than the incidence of these complications in patients operated with full superficial parotidectomy or more extensive surgery (Table I). Many surgical and non-surgical attempts have been made to prevent the clinical appearance of Frey's syndrome. The application of various anticholinergic agents (scopolamine, glycopyrrolate) and the use of stellate ganglion blockade have been unsuccessful. Surgical treatment has included cervical sympathectomy, tympanic neurectomy, sternocleidomastoid transfer and dermis-fat grafts and the use of various materials, as interpositional barriers [17]. Better results have been reported with some prophylactic measures, including the use of the superficial musculoaponeurotic system (SMAS) [18]. These techniques aim to create a physical barrier between the divided fibres of the auriculotemporal nerve and the sweat glands in the facial skin. The first-choice for symptomatic treatment of Frey's syndrome is currently botulinum toxin (BT) type A (BT-A) injected intracutaneously [19,20]. BT is a powerful neurotoxin, which acts by blocking acetylcholine release at the neuromuscular junction. Between the seven known serologically distinct types of BT, designated A to G, The serotype BT-A, was effective to stop gustative sweating [21]. We found a 'much higher incidence of the Frey syndrome in patients who have a total parotidectomy than the other types of intervention. However good results have been obtained with the 'use of botulinum toxin that has determined in all cases remission, at least temporarily, of the symptomatology.

Conclusions

Therefore, we can conclude that the onset of the different complications after surgery of the parotid gland depend on surgery performed. Our data confirm us there is a tight relationship between type of surgery performed and type of complication. Chi-square test has a statistically significant result and confirms this kind of relationship (Table II). We can evaluate how 66 patients (about 77% of cases) who developed a facial nerve complication are those who performed a superficial or a total-parotidectomy; while 32 patients over 40 (80%) who developed a wound complications are those who underwent an extracapsular dissection or a partial-parotidectomy. Lastly we can observe that the majority of patiens (9 over 16 patiens, 56%) experienced a frey syndrome came from a total parotidectomy. Therefore extracapsular dissection and partial superficial parotidectomy associate at increased percentage of sialocele and salivary fistula, while a more invasive surgery can result in a deficit of facial nerve. Our experience leads us to consider always, when we approach the parotid surgery, the nature of the disease and the localization in the context of the gland and it is this more than anything else that determines the surgical choice, preferring whenever possible, less invasive.

Riassunto

L'obiettivo del nostro lavoro mira a definire le maggiori complicanze in seguito a chirurgia parotidea, in particolare ci siamo soffermati su un'attenta analisi sulla correlazione tra i diversi tipi di chirurgia: asportazione della neoformazione, parotidectomia superficiale parziale, parotidectomia superficiale e parotidectomia totale in relazione con deficit del VII nervo cranico ed altre complicanze quali il sialocele, le fistole salivari, e la sindrome di Frey.

Sono stati selezionati 184 pazienti e di questi solo 158 sono stati inclusi nella nostra analisi. E' stato osservato che 86 pazienti hanno sviluppato complicanze a carico del nervo facciale, tra questi 59 hanno presentato asimmetrie minori risoltesi in breve tempo, 19 una parziale sofferenza risoltesi in un tempo più lungo e 8 una sofferenza completa con deficit totale del nervo. Le altre complicanze sono comparse in 40 pazienti: 28 hanno sviluppato un sialocele, in 16 si è presentata la Sindrome di Frey, e in 12 hanno presentato una fistola salivare.

La correlazione tra il tipo di intervento chirurgico e le complicanze comparse nei pazienti hanno evidenziato che la parotidectomia superficiale e totale ha comportato la maggior comparsa di complicanze a carico del nervo facciale e la comparsa di Sindrome di Frey.

L'enucleoresezione d una neoformazione parotidea e la parotidectomia superficiale parziale sono connesse a minori complicanze.

Dalla nostra esperienza è emersa una stretta correlazione statisticamente significativa (P value < 0.001) tra tipologia di intervento parotidea e complicanze connesse.

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