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Facial Paralysis in Parotid Tumors: Diagnostic Value, Prognostic Value and Therapeutic Implications. A Review of the Literature

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Abstract | **Review Article**

Introduction. Facial paralysis (FP) is a rare but major sign in parotid gland tumors. ***Objective.*** To review its diagnostic value, its prognostic value and its therapeutic implications. ***Methods.*** Narrative review of the literature. ***Results.*** Preoperative FP strongly suggests a carcinoma with nerve invasion, but cases caused by benign tumors have been reported. In several series, it is associated with poorer disease-free survival. Guidelines recommend resection of the involved branches, with immediate repair whenever possible, and consideration of adjuvant radiotherapy. The absence of FP does not rule out nerve invasion, and nerve preservation remains the rule when a dissection plane exists. ***Conclusion.*** FP should be regarded as a diagnostic warning sign, a prognostic marker and a decisive element in surgical, oncologic and rehabilitation strategy.

Keywords: Parotid neoplasms; facial paralysis; facial nerve; carcinoma; prognosis; facial rehabilitation.

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1. INTRODUCTION

Approximately 80% of parotid gland tumors are benign, with pleomorphic adenoma being the most frequent histologic type [1]. Preoperative facial paralysis (FP) is exceptional in this setting, whereas it is present in 15% to 30% of patients with a primary parotid cancer [2,3]. It is therefore a major clinical sign, long considered almost pathognomonic of malignancy and nerve invasion. This view is nuanced, however, by cases of FP caused by benign tumors, through compression or a vascular mechanism [4], and by the difficulty of predicting nerve involvement in the absence of a deficit [5,6]. Beyond its role as a diagnostic warning sign, FP influences survival, surgical strategy (preservation or sacrifice of the nerve), the indication for adjuvant radiotherapy and the choice of facial rehabilitation. The aim of this narrative review is to take stock of the diagnostic value, the prognostic value and the therapeutic implications of FP in parotid tumors.

2. METHODS

This narrative review is based on a literature search in PubMed and Scopus, using the following search string: *("parotid neoplasms" [MeSH] OR "parotid tumor"* OR "parotid carcinoma") AND ("facial paralysis" [MeSH] OR "facial nerve palsy" OR "facial nerve involvement"). We included clinical series, systematic reviews, meta-analyses and practice guidelines addressing preoperative or postoperative FP in patients with parotid tumors. Isolated case reports were included only to illustrate benign etiologies. This is a qualitative synthesis, without quantitative analysis or formal assessment of the risk of bias.

3. Anatomic and Pathophysiologic Background

3.1. Relationship of the facial nerve with the parotid gland

After emerging from the stylomastoid foramen, the facial nerve enters the parotid gland and divides into two trunks, temporofacial and cervicofacial, which give rise to the terminal branches. It classically separates a superficial lobe from a deep lobe. This arrangement explains why any intraparotid tumor lies in close relationship with the nerve. In a retrospective series of 88 parotid carcinomas, postoperative facial deficit was observed in 88.1% of patients whose tumor involved the deep lobe, compared with 50% of those with a superficial tumor [7]. Anastomoses connect the intraparotid facial nerve with the auriculotemporal nerve, allowing perineural extension toward the V3 branch of the trigeminal nerve. The combination of signs of V and VII

involvement in a patient with a known cancer should raise suspicion of this route of spread [25].

3.2. Mechanisms of facial paralysis

Three main mechanisms have been reported. The first is direct or perineural invasion by a carcinoma: preoperative FP is considered the manifestation of malignant infiltration of the nerve [5], and it correlates with direct neural involvement [6]. The second is extrinsic compression of the nerve by a benign tumor, notably a pleomorphic adenoma [4]. The third is a vascular or ischemic mechanism, described in isolated cases associated with Warthin tumors or lipomas [4].

4. DIAGNOSTIC VALUE

4.1. FP as a warning sign of malignancy

In the Dutch cooperative group series of 324 parotid carcinomas, facial nerve function was normal before treatment in 77% of patients, partially impaired in 14% and completely impaired in 7% [3]. According to the French REFCOR network, preoperative FP accompanies 15% to 30% of primary parotid cancers, a situation in which most authors agree on resecting the nerve together with the tumor [2]. FP has thus been described as the only reliable preoperative indicator for planning total parotidectomy with nerve resection and facial reanimation [5].

The converse is not true: when facial function is intact, there is no precise preoperative criterion that predicts nerve involvement [6]. A prospective study nevertheless suggests that facial pain, paresthesia and rapid growth of the mass are clinical signs suggestive of malignancy [6].

4.2. FP and benign tumors

Several large series reported FP only in patients with malignant tumors. Cases of FP caused by benign tumors have nevertheless been described [4]. An instructive example is that of a pleomorphic adenoma responsible for an FP present for 4 years, initially labeled Bell's palsy, in which imaging and frozen section suggested a facial nerve schwannoma [4]. This case is a reminder that FP in the presence of a parotid mass is not always synonymous with malignancy.

4.3. Differential diagnosis

In the presence of FP associated with a tumor, the differential diagnosis includes a primary facial nerve tumor, a parotid cancer, a metastasis from a skin cancer, or a temporal bone tumor such as a glomus jugulare [4]. The diagnostic delay caused by a paralysis initially attributed to Bell's palsy illustrates the value of imaging in any atypical FP, that is, one with a progressive or recurrent course or without recovery.

4.4. Contribution of imaging

An older series emphasized that ultrasonography, CT and MRI did not allow visualization of the facial nerve structure with sufficient resolution [5]. More recent data are more favorable for MRI in detecting perineural extension. A meta-analysis of 11 retrospective studies (319 nerve samples from 245 patients) concluded that MRI performs well for cranial nerves, the most frequent signs being nerve thickening and enhancement, but on scarce and heterogeneous evidence [9]. An anatomic-radiologic correlation study showed a sensitivity of 95% for detecting perineural spread, but of 63% for mapping its full extent, because MRI may miss microscopic foci [10]. In a series of 58 patients who underwent sacrifice of the intratemporal segment of the facial nerve, the sensitivity and specificity of MRI for involvement of the mastoid segment were 72.7% and 87.8%, respectively [11]. Facial nerve tractography is being explored as a complementary tool [9].

4.5. Contribution of cytology

Fine-needle aspiration cytology is the reference technique for the preoperative evaluation of a parotid mass, and the Milan System allows results to be reported in categories associated with a risk of malignancy (ROM) [12]. Published ROM values vary from one series to another (Table 1). The sensitivity of cytology is higher in dedicated head and neck centers [12], and the risk of malignancy is higher for deep lobe lesions, including in the "benign neoplasm" category (7.3% versus 1.0% for the superficial lobe) [15].

Table 1: Risk of malignancy (%) by Milan System category in two series

Category	Series [13]	Series [14]
I – Nondiagnostic	37.5	—
II – Nonneoplastic	9.0	—
III – Atypia of undetermined significance	50.0	12.5
IVa – Benign neoplasm	4.7	3.2
IVb – Neoplasm of uncertain malignant potential	50.0	72.7
V – Suspicious for malignancy	100	100 (grouped with VI)
VI – Malignant	71.0	100 (grouped with V)

An indeterminate cytology result should not alone justify a decision with major consequences such as resection of the facial nerve [20].

5. Prognostic Value

Several series show that facial nerve function before treatment is a major prognostic factor in parotid carcinomas. In the Dutch series of 324 patients, disease-free survival was 69%, 37% and 13% depending on

whether preoperative facial function was normal, partially impaired or completely impaired. Impaired facial nerve function was an independent factor for disease-free survival, and regional, but not local, control was significantly reduced in the case of complete FP [3]. A Korean series of 80 parotid carcinomas found preoperative FP and extraparenchymal invasion to be independent factors for poorer disease-free survival [16]. A German series of 231 patients confirmed that initial FP is a negative prognostic factor for disease-free survival, alongside pT and pN stage and the presence of distant metastases [17]. Other work concludes that intact facial function at presentation is a very strong prognostic factor [5], and facial nerve invasion was an independent prognostic factor in a Japanese series comparing two surgical strategies [18]. The British guidelines list preoperative facial weakness among the adverse prognostic elements, together with stage, positive margins, perineural invasion and extracapsular spread [19].

These results are not unanimous, however. In a small prospective study, 4-year survival did not differ according to whether the nerve had been sacrificed or not, or according to macroscopic invasion of the nerve [6]. Regarding postoperative FP, the literature reports a highly variable prevalence after parotidectomy for malignant tumors, from 9.09% to 100% depending on the study [8]. Its determinants include tumor size greater than 4 cm, deep location and nerve involvement [7], as well as the extent of surgery: after nerve preservation, total parotidectomy is associated with more transient deficits (41% versus 26%) than more limited procedures [21].

6. Therapeutic Implications

6.1. Surgical strategy and management of the facial nerve

The ASCO guidelines recommend preserving the facial nerve in patients with intact preoperative function when a dissection plane can be created between the tumor and the nerve, and resecting involved branches in the case of a preoperative deficit or when they are encased or grossly involved by a confirmed malignancy. They specify that a decision as consequential as nerve resection should not rest on an indeterminate preoperative or intraoperative diagnosis. A partial superficial parotidectomy may be proposed for superficial low-grade T1-T2 tumors, and an ipsilateral selective neck dissection for elective management of the neck [20]. The British guidelines point in the same direction: every effort should be made to preserve facial function if it is normal before surgery, and immediate microsurgical repair with an interposition graft should be considered if the nerve is divided [19].

The question of a nerve in contact with the tumor, in the absence of FP, remains debated. In the multicenter REFCOR study, which included 207 patients (93 of whom, or 45%, underwent nerve resection), nerve resection was not associated with better survival after propensity score matching [2]. This retrospective result argues for preserving the nerve when it can be dissected free from the tumor.

6.2. Adjuvant radiotherapy

The British guidelines recommend a low threshold for adjuvant radiotherapy when a malignant tumor is in contact with the facial nerve [19]. In one series in which the presence of FP was studied, all paralyzed patients received adjuvant radiotherapy [5]. After nerve repair, a systematic review of 12 studies found no significant difference in facial function between irradiated and non-irradiated patients, with reservations related to small sample sizes and heterogeneous methods [23].

6.3. Repair and rehabilitation

When the nerve must be sacrificed, immediate reconstruction with an interposition graft is indicated whenever possible. In decreasing order of effectiveness, techniques include cable nerve grafts, anastomoses with the hypoglossal or masseteric nerve or with the contralateral facial nerve (cross-face), dynamic musculofascial transpositions (temporalis, gracilis), static transpositions, and then static procedures such as the eyelid chain or canthoplasty. The greater auricular nerve is the main donor for cable grafts [22].

Functional results vary. In the Korean series, after nerve sacrifice, subtotal recovery (House-Brackmann grades I-II) was obtained in 35.9% of patients, partial recovery (grades III-IV) in 33.3% and no recovery (grade V) in 30.8% [16]. In a small series of patients treated with radical parotidectomy and subtotal petrosectomy, all reached grade III-IV within two years [24]. A multicenter series of 28 patients showed that preoperative FP was a risk factor for poorer functional outcome after cable grafting, and that the key to the best outcome was the combination of technically correct reconstruction and targeted facial rehabilitation [22].

7. DISCUSSION

The literature converges on three points. Preoperative FP is a strong warning sign of malignancy and nerve invasion [3,5,6]. It is associated in several series with poorer disease-free survival [3,16,17]. According to the guidelines, it leads to resection of the involved branches with immediate repair whenever possible [19,20].

Several points remain controversial. First, the value of FP as a sign of malignancy is not absolute, since benign tumors can cause it [4]. Second, the independence of its prognostic value is debated: the data suggest that FP is above all a marker of tumor aggressiveness (advanced stage, extraparenchymal invasion, perineural invasion) rather than a causal factor of poor prognosis, which only multivariable analyses adjusted for these parameters can settle [3,16,17]. Finally, the management

of a nerve in contact with the tumor without FP rests on retrospective data [2], and the impact of radiotherapy on function after repair has been studied in small samples [23].

The limitations of the literature are substantial. Salivary gland tumors are rare and histologically heterogeneous, which makes it difficult to generate high-level evidence [19]. Studies are mostly retrospective, often single-center, with variable definitions of FP and variable assessment scales (House-Brackmann, Sunnybrook) [22], which explains the wide range of reported prevalences [8]. Perspectives include improved preoperative detection of perineural involvement by MRI and tractography [9], standardization of functional assessment, and the creation of prospective multicenter registries.

8. CONCLUSION

Facial paralysis in a parotid tumor is a major warning sign of malignancy, an unfavorable prognostic marker in carcinomas and a determining element in therapeutic decisions. It should not, however, lead to overlooking the rare benign tumors that can cause it, and its absence does not rule out nerve invasion. Its management rests on rigorous preoperative clinical, radiologic and cytologic evaluation, on nerve preservation when oncologically feasible, on resection with immediate repair when the nerve is invaded, and on appropriate facial rehabilitation.

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